Dynamic Inconsistency, Tradeoffs and Delegation in a Developing Economy

Ashima Goyal

February 17, 2000

Indira Gandhi Institute of Development Research
Gen. Vaidya Marg, Goregaon (E)
Mumbai 400 065, India
e-mail: ashima@igidr.ac.in
http://www.igidr.ac.in/ ashima/index.html
Tel.: (022) 8400920 (EPABX), Fax: (022) 8402752

Acknowledgement

This is a revised version of the paper presented at the IGIDR conference on Money and Finance, Dec. 1999. I thank Ashok Nag, P.J. Nayak, Veena Mishra, S.L. Shetty, and A. Vasudevan for useful comments; other conference participants for stimulating questions; Mridul Saggar and Anurag Sharma for the information used in Table 2.

ABSTRACT

Strategic interaction between the government and economic agents can lead to the creation of more inflation than is socially optimal. The tradeoffs through which this occurs normally are the Phillips curve and the government debt. A major tradeoff, important for a populous democracy with a large number of poor, is that between redistribution and growth. This has not received much analytical attention. We model this tradeoff and show that (i) a Nash equilibrium will occur with a redistribution level that is higher than the optimal, (ii) define a natural rate of growth, (iii) specify the conditions on which the results depend, (iv) discuss stabilisation possibilities, and (v) show that optimal delegation is to a pro-growth central banker and a conservative fiscal authority. This would lower inflation and raise growth. Last, the model and its results are shown to be consistent with Indian macroeconomic performance.

KEY WORDS: growth, redistribution, tradeoffs, dynamic inconsistency, delegation

1 Introduction

Recent macroeconomic literature has explored the implications of strategic interaction between the government and economic agents. Where the government acts after private agents, it can move to push them in socially desirable directions. But, over time, as agents come to anticipate these actions, they take steps to counter the government actions, so that the latter do not succeed. Moreover, distortions are created that reduce social welfare. Well researched examples are the creation of more inflation than is socially optimal in an attempt to reduce unemployment or government debt. The tradeoff through which this occurs normally is the Phillips Curve[1] which gives an opportunity for the government to lower unemployment by reducing real wages through unanticipated inflation. A rise in the latt er also reduces real government debt [2]. A major tradeoff, important for a populous democracy with a large number of poor, is that between redistribution and growth. This has not received the analytical attention it deserves. It also involves strategic interactions over time, between the government and private agents, with potential welfare loss. In this paper we formalise and systematically explore these effects.

If costs outweigh the benefits from it, redistribution is in excess of the social optimal. These costs arise from the distorting effects of administered

[1]The seminal paper was Kydland and Prescott (1977). This led to a huge literature. Key papers are collected in Person and Tabellini (1994), and the material is well surveyed in Walsh (1998).

[2]This is more relevant for developing economies with dualistic labour markets, where the Phillips Curve does not clearly hold. Calvo analysed this, for Latin America, in a series of papers (collected in Calvo 1996).

prices, controls, subsidies, and low user costs. Unanticipated re-distributions work only in the short-term since agents take defensive actions such as reducing effort or tuning to the black economy[3]. Well-known results of the dynamic inconsistency literature are reproduced in this new context. We show that a Nash equilibrium will occur with populist consumption that is higher than the optimal, define a natural rate of growth, specify the conditions causing higher welfare loss in the Nash Equilibrium, and discuss stabilisation possibilities in the presence of supply shocks.

The welfare losses that occur in this class of problems are due to a lack of a credible government commitment device. For example, in the story with government debt, because private agents expect the government to inflate they set high interest rates that force the government to inflate because the cost of servicing debt rises steeply. A commitment technology that has been much discussed is delegation of key policy decisions to agents with different preferences. For example, the anti-inflation policy of a conservative central banker will be credible and welfare will rise. But we discover that the meaning of conservative has to be carefully defined in the presence of the new tradeoffs.

The major new insight of this paper is that optimal delegation is to a fiscal authority with a lower weight on growth and a pro-growth monetary authority. This would raise growth and lower inflation. What is the reason? In this paper the focus is only on dynamic inconsistency based on the dominant trade-off in the economy. It abstracts from other causes of inflation. With the Phillips Curve trade-off, unanticipated inflation lowers unemploy-

[3]Goyal(1999a, b) documents details of such instances, derives microfoundations for the tradeoff, and tests it empirically.

ment; but a conservative central banker would not create surprise inflation since he places less weight on unemployment. In our model a surprise fall in inflation can raise growth by causing an unanticipated rise in re-distribution. A fall in inflation benefits the poor. Therefore it is a central banker who places more weight on growth who would lower inflation. Last, the model and its results are shown to be consistent with, and help to understand, Indian macroeconomic performance.

The structure of the paper is as follows: section 2 describes the tradeoff between growth and re-distribution. Section 2.1 presents the formal model and section 2.2 derives the main results. Section 3 brings in supply shocks and therefore analyses the role of stabilisation policies. Section 4 examines the role that delegation can play in resolving the inefficiencies. Section 5 finds some initial empirical support for the hypotheses of the paper, from Indian experience. Section 6 concludes.

2 The tradeoff

In a populous democracy, the Phillips curve tradeoff between inflation and unemployment, affects, if at all, only the relatively small organised sector. The more pervasive conflict is that between growth and re-distribution. Incumbent governments want to please the large mass of poor voters in order to maximise vote-banks. Therefore there is a temptation to raise populist consumption. But this tends to lower growth because of the inefficiencies and distortions that arise. The reason for the latter is that productive agents can take neutralising actions, lawful and unlawful. Examples are black-markets,

flight of capital, labour migration, fall in effort, the rich switch to higher quality private service-providers from public sector providers. Since the latter lose revenue, they decay further. Re-distribution does fulfil an essential social purpose, but there exists an optimal level above which costs become too high, although it may be possible to lower costs with better designed policies. Here we focus on the dynamic consequences of the sequence of moves.

If the government makes its decision after that of the private agents, it has an incentive to trick the latter. In any one period, if redistribution is higher than anticipated, growth is not harmed since private agents have taken their decisions. But over a number of periods as agents adjust their expectations, the result will be redistribution higher than the social optimal, while growth remains at the natural rate. We demonstrate this algebraically, in the sections to follow.

2.1 The model

The max potential level of growth is $\overline{g}$, the actual is g, so that $G = \overline{g} - g$ measures growth foregone. We postulate that there is a maximum level of socially desirable redistribution, or populist consumption, $\overline{p}$. Actual populist consumption is p, so that $P = p - \overline{p}$ measures the excess of populist consumption over the desired value.

The government chooses a $P \subset S$. There is a continuum of private agents. The expected value of P is P^e. The average value of P^e is P^a. The one period payoff of a private agent is:

$$V(P^e, P^a, P) = -0.5((P - P^e)^2 + P^2) \tag{1}$$

Agents maximise their payoffs if $P^e = P$, that is, if they make an accurate forecast of P, so that the government cannot trick them[4]. Since all agents have the identical problem $P^a = P^e$. Therefore P^a is also an element of set S. Assume S to be a compact subset of the real line.

The government's one period payoff or objective function is:

$$U = -\frac{b}{2}G^2 - \frac{1}{2}P^2 \tag{2}$$

That is, returns to the government fall as growth falls below its maximum potential value, and subsidies etc. rise above their socially optimal value. The tradeoff that links foregone growth to redistribution is given by:

$$G = G^* - \alpha(P - P^a) \tag{3}$$

Where $\alpha > 0$, and G^* gives the sustainable level of G. If a supply shock or populist pressures force P to become positive, foregone growth can be made up only by an unexpected rise in P. If P is fully expected, avoiding action would be taken by agents. But if private agents undertake their action first and then the government moves, in each period the government has an incentive to raise P above P^a.

Substituting Eq. 3 into Eq. 2 gives the government's payoff as a reaction function, Eq.4. This takes account of private actions as embodied in the

[4]Since $\overline{p}$ measures the socially optimal level of re-distribution a positive P lowers the the utility of private agents. Although such expenditure upto the limit of $\overline{p}$ increases welfare, the productive aspects of redistribution are exhausted after $\overline{p}$. An unanticipated rise in P, also lowers welfare since agents cannot take the compensating actions they would have taken, if P was correctly anticipated.

tradeoff, Eq. 3, that is, decides the government's response to individual actions, given the government's preferences.

$$r(P, P^a) = -\frac{b}{2}(G^* - \alpha(P - P^a))^2 - \frac{1}{2}P^2 \tag{4}$$

The government's best response, Eq. 5, is therefore that which maximises its reaction function with respect to its decision variable P.

$$B(P^a) = argmax_P \; r(P, P^a) \tag{5}$$

This is the decision rule for setting P given the public's expectation P^a. Two kinds of equilibria[5] are possible, and since the public solve a forecasting problem, so that they cannot be continuously fooled, both the equilibria satisfy rational expectations.

A *rational expectations equilibrium (RE)* is a triple (U, P, P^a), satisfying the tradeoff Eq. 3, and $P = P^a$.

An *optimal equilibrium (OE)* is the value of P that maximises $r(P, P^a)$.

If the timing protocol is such that the government chooses first, the OE results.

A *Nash equilibrium (NE)* is a pair (P, P^a), satisfying $P = P^a$ and $P = B(P^a)$.

If the government decides after private agent's set their expectations, NE results. With these building blocks, we next explore the different equilibria, and their welfare implications.

[5]Sargent(1999) has a clear treatment of the different equilibria, which we follow

2.2 Results

Result 1: G^* is the natural rate of growth (NRG).

Proof: Substituting $P = P^a$ in the tradeoff eq. 3, and taking expectations shows that $G = G^*$, in any RE. Therefore, over the long-term, no other G would be sustainable.

The government's best response function, is obtained by differentiating the reaction function Eq.4, with respect to P, and solving for P, the government's decision variable:

$$P = B(P^a) = \frac{\alpha b}{\alpha^2 b + 1} G^* + \frac{\alpha^2 b}{\alpha^2 b + 1} P^a \tag{6}$$

Result 2: In the NE, $P_N = {P^a}_N = \alpha b G$, $G = G^*$, and $r(P_N, {P^a}_N) = -\frac{b}{2} G^{*2}(1 + \alpha^2 b)$

Proof: The first, second and third results come by respectively substituting $P_N = {P^a}_N$ in the government's best response Eq. 6, the tradeoff Eq. 3, and the government's reaction function, Eq. 4.

Result 3: In the OE, $P_O = {P^a}_O = 0$, $G = G^*$, and $r(P_O, {P^a}_O) = -\frac{b}{2} G^{*2}$

Proof: The value of P that maximises $r(P, P)$ is zero. The second and third results follow by respectively substituting $P_O = {P^a}_O = 0$ in the tradeoff Eq. 3, and the government's reaction function, Eq. 4.

Result 4: The welfare loss in the NE compared to the OE, is $\frac{1}{2(\alpha b G^*)^2}$.

Proof: $r(P_O, {P^a}_O) - r(P_N, {P^a}_N)$ gives $\frac{1}{2(\alpha b G^*)^2}$, which is the loss in the government's objective function if OE changes to NE.

Figure 1 shows both the OE and the NE, and also explains why, if the

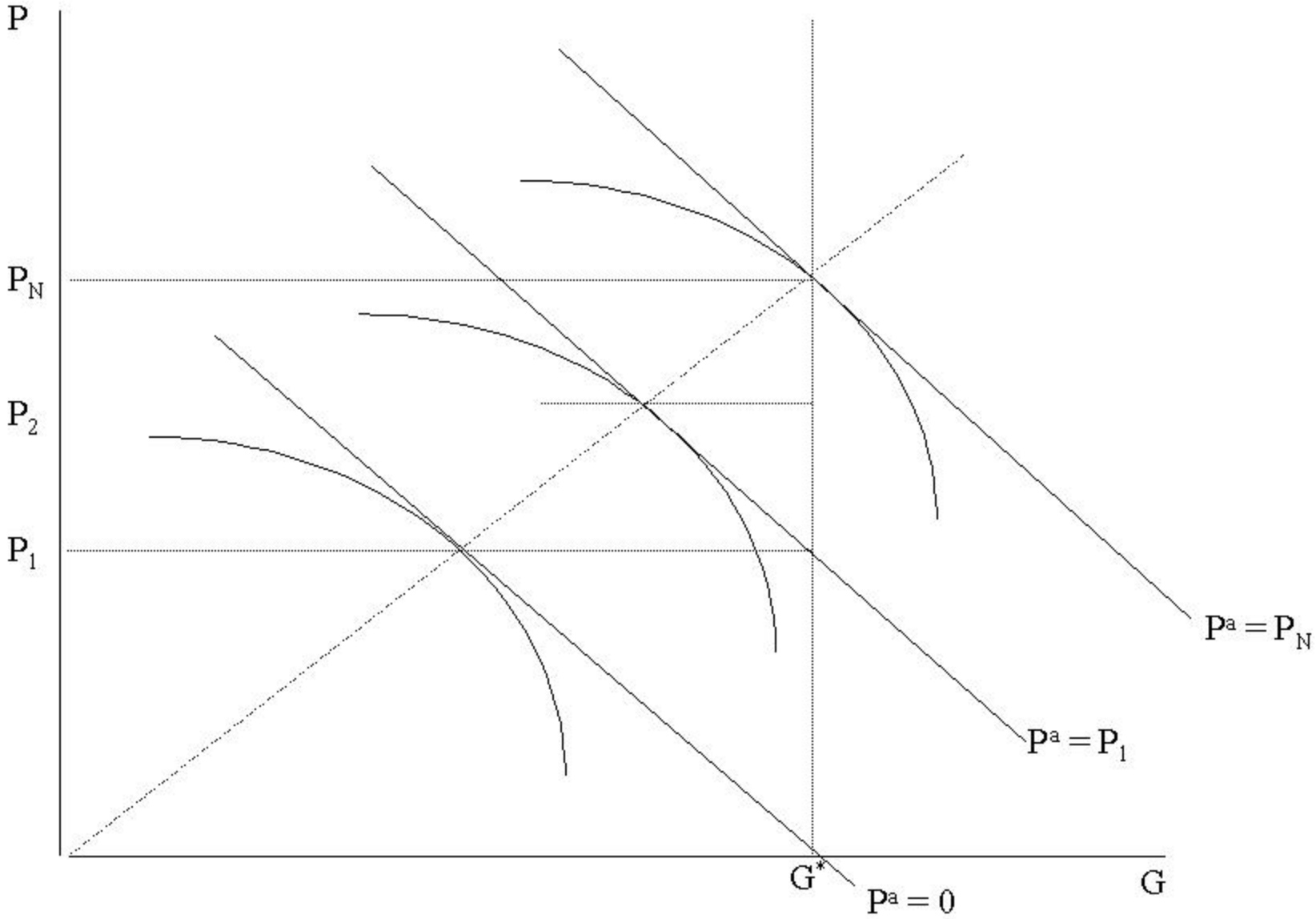

Figure 1: The Optimal and Nash equilibrium and the approach to the Nash equilibrium

government moves second, dynamic adjustment will lead to the NE. The downward sloping lines are the tradeoff eq. 3, drawn for different values of $P^a = 0, P_1, P_N$, and slope $\alpha = -1$. Tangency points with the indifference curves based on the government's one-period payoff or objective function Eq. 2, lie on the government's reaction function, and give the government's best response in setting P for a given P^a. Since both rising G and P lower welfare, the indifference curves are downward sloping: a rise in P needs to be compensated by falling G. A higher indifference curve has both higher and therefore shows a lower welfare level.

The optimal equilibrium has $(G^*, 0)$. The NE has (G^*, P_N). Although the NE lies on a lower indifference curve, the government's best response will inevitably lead to it. Raising P and lowering G along the same tradeoff, brings the economy closer to $\overline{g}$, and raises the government's payoff, if P^a, is unchanged. Thus, in Figure 1, even at the OE, with $P^a = 0$, the government would set $P = P_1$, in order to move to its point of tangency. The public responds with $P^a = P_1$, the government raises P again and the process continues until $P = P^a = B(P^a)$ at the NE. The dynamics are $P_t = B(P_{t-1})$, with the government seting P in each period as the best response to the last period's P, until the process converges to the NE.

Result 5: The payoff to the government from raising P rises in α and b.

Proof: At the NE, $P_N = \alpha b G$. The higher is b, the greater is the payoff to the government from a fall in G. The higher is α, the greater is the fall in G, from an unanticipated rise in P, in the tradeoff Eq. 3.

Some way of credibly committing the government to $P = 0$ is necessary to sustain an OE. Delegation is a well-known commitment technology. For

example, in the context of a tradeoff between inflation and unemployment, delegation should be to a conservative central banker, who has a stronger aversion to inflation, as compared to the government. In section 4 we analyze the effect of such delegation in our context. But first we examine the role of stabilisation policy in the presence of supply shocks.

3 Supply shocks and stabilisation policy

We now introduce a random independently distributed supply shock affecting the tradeoff eq. 3. The shock ϵ_t, has zero mean and variance ${\sigma_\epsilon}^2$. Therefore:

$$G_t = G^* - \alpha(P_t - {P^a}_t) + \epsilon_t \tag{7}$$

Substituting this in the government's objective function, differentiating this reaction function to get the government's best response or first order condition with respect to P_t, and solving for rational expectations at the NE by the method of undetermined coefficients (see appendix), we get:

$$P_t = \alpha b G^* + \frac{\alpha b}{\alpha^2 b + 1}\epsilon_t \tag{8}$$

$${P_t}^a = \alpha b G^* \tag{9}$$

$$G_t = G^* + \frac{1}{\alpha^2 b + 1}\epsilon_t \tag{10}$$

The sequence of events now is that first private agents expectations are set, then the shock occurs and is observed, finally P_t is chosen by the government. Since $\overline{g} - G^* > 0$, the government always has an incentive to try to increase the growth rate. But now it also has an incentive for stabilisation, since it responds more quickly to shocks than private agents can. Moreover, the demand for populist expenditures rises in the presence of supply shocks.

For example, under a is negative shock, such as an agricultural drought, hunger and want have to be alleviated. In addition to the populist bias $\alpha b G^*$ affecting P_t, similar to sections 2 and 3, there is now also a stabilisation term, $\frac{\alpha b}{\alpha^2 b+1}$. Taking expectations leads to:

$$E(P) = \alpha b G^* \tag{11}$$

$$E(G) = G^* \tag{12}$$

Average populist expenditures are higher than the desired level, without leading to any improvement in average growth over the NRG. This is the time inconsistency problem that arises without a government commitment technology. But calculating the variances:

$$var(P) = (\frac{\alpha b}{\alpha^2 b + 1})^2 \sigma^2{}_\epsilon \tag{13}$$

$$var(G) = \frac{1}{(\alpha^2 b + 1)^2} \sigma^2{}_\epsilon \tag{14}$$

There is a role for stabilisation policy, since the policy reduces the variance of growth, although it does imply a positive populist bias. Some of the shock's variance is stabilised. But if the variance of the shock is low in relation to the parameters influencing the populist bias, the loss to adopting a simple policy rule such as $P_t = 0$, will be low, although stabilisation will be given up completely. In such a case the rule should be preferred over discretion. But the rule is not credible, since the policy maker has an incentive, ex post, once expectations are formed, to deviate from the rule, and increase P_t to raise the growth rate. Even if it is written as a law there are problems of monitoring and implementing it.

Result 6: In the presence of supply shocks, some discretion specific to the shock can do better than a shock-invariant rule

Proof: If the government were to set optimal $P_t^* = \frac{\alpha b}{\alpha^2 b+1}\epsilon_t$, it would keep $E(P_t) = 0$, while the variance of growth would be unchanged at the lower level of Eq. 14. But if the shock-invariant policy rule $P_t = 0$ is chosen, there is no stabilisation of growth, since $var(G)$ remains at ${\sigma^2}_\epsilon$ which exceeds Equation 14.

Does delegation work as a credible commitment device? The nature of the tradeoffs in a developing country makes the issue more complex, as we see in the next section.

4 Delegation

If the government can delegate policy to an agent who places less weight on growth shortfalls than the government itself does, it should lead to a welfare improvement. The populist bias would be lower, but some of the benefits of stabilisation would be retained[6].

If the agent is independent in the sense that she cannot be dismissed ex post, after the shock has occurred and before the policy is chosen, the delegation is credible. The sequence now is that first the policymaker chooses an agent, second expectations are formed, third the shock is realised, and last the agent chooses policy. The policy maker can only change the agent in the next period, but then his optimal choice will be the same as it was in the first period.

Although the agent will choose the NE with the discretionary policy set 8,

[6]The seminal paper on this kind of delegation was Rogoff (1985). Alesina et. al. (1997) have a useful discussion of this.

it will be with her own preferences, with a weight on G in her payoff function given by $b^{\diamond}$, rather than b. The policymakers utility will now depend on his own preference weight b, and on the agent's preference parameter $b^{\diamond}$, because the latter will determine the policy the agent will follow, once appointed. Therefore the policy maker's objective function now is:

$$maxE(U(b,b^{\diamond}) = E(-\frac{1}{2}(\alpha b^{\diamond} G^{*} + \frac{\alpha b^{\diamond}}{\alpha^{2} b^{\diamond} + 1}\epsilon_{t})^{2} - \frac{b}{2}(G^{*} + \frac{1}{\alpha^{2} b^{\diamond} + 1}\epsilon_{t})^{2}) \quad (15)$$

Result 7: The utility of the policy maker and social welfare rises if policy is delegated to an independent agent who is less pro-growth and less populist than the policy maker herself.

Proof: Maximising expected utility Eq. 15 with respect to $b^{\diamond}$ and solving the FOC gives the result that $0 < b^{\diamond} < b$ (see appendix). Since the agent's disutility from a growth shortfall is less than the government's, his utility from a rise in growth is less. The independent agent should place relatively less weight on deviations from maximum growth and more on deviations form the optimal populist expenditure than the policy maker himself.

Such an agent would be less tempted to increase P_t in order to raise growth, and a credible discretionary equilibrium with lower P_t plus stabilisation benefits would result.

The agent is conservative in the sense that she values growth less, and is averse to populism. In the literature, where the tradeoff analysed is that between growth and inflation, the conservative agent is more inflation averse. Therefore, appointing an independent conservative central banker is expected to result in a lower rate of inflation. But, in the context of our model:

Definition: A conservative central banker is less pro-growth than the government.

Therefore, appointing a more conservative central banker results in higher inflation. The reason is that a lower rate of inflation raises the consumption of the poor, and the conservative banker will not want to lower inflation to raise unanticipated P, in order to raise G. Formally:

$$P_t = f(\pi_t) + \eta_t, \quad f' < 0, \quad E\eta_t = 0 \tag{16}$$

Therefore if an independent central banker values raising growth less, higher inflation will result. She will tolerate higher inflation, since she will not want to raise P_t as much. Being cautious about high growth will conflict with conservatism in the sense of being anti-inflation. A central banker who prefers low inflation may or may not prefer low growth, but a central banker who prefers low growth will allow higher inflation. If the Phillips Curve tradeoff is dominant, a central banker who places less weight on growth will be inflation averse. In the presence of the new tradeoffs, a central banker who is less pro-growth will be populism averse, but can be more pro-inflation.

Proposition 1 *In a developing country, if the more important tradeoffs are between growth and populism, delegating to a conservative central banker, who places less weight on growth than the policy maker, may result in higher inflation.*

Proof: Let the money supply, which directly affects inflation, be the major instrument of the central banker. Let inflation lower the real value of populist consumption. A central banker who places less weight on growth, will have

less preference for raising P in order to increase G. Therefore she will not actively lower inflation to raise P.

In a developing country, given the nature of the tradeoffs, the policymakers may do better by delegating to a populism averse finance minister, and a pro-growth central banker. This is particularly so, if the objective is to lower inflation, check wasteful populism, but raise growth.

Proposition 2 *Optimal delegation, in the circumstances, would be to a fiscal authority that is less pro-growth and a monetary authority that is more pro-growth than the government.*

Proof: Although independence relieves the central banker of populist pressures from the government, if she is pro-growth she would want to keep inflation low, as a means of raising P above P^a and thus stimulating growth. But she would also ensure adequate liquidity to finance growth. Therefore money supply would be balanced between the demands of raising growth and lowering inflation. A less pro-growth fiscal authority, would use less of unexpected populist give-aways to stimulate growth.

Therefore a less conservative central banker would deliver the best combination of high growth and low inflation. Here we are considering only the affect of P on G. In addition, if there are multiple equilibria so that G^* rises as development occurs, and this is stimulated by lower interest rates, a monetary authority that is pro-growth would aid this process. While it may push towards the Nash Equilibrium in our model, the fall in inflation will have other beneficial effects, and delegation of the fiscal authority should be used to keep P low.

It is the finance minister who should have the preference weight $b^{\diamond}$. But it may be difficult to delegate to a fiscal authority that is less pro-growth than the government, since the finance minister is an active party member. In a multi party framework, a law preventing fiscal populism, may be a useful alternative commitment device. Since all the parties would be bound by it, they would have less incentive to engage in competitive populism. If any one party is sure that no other is going to woo the electorate with unproductive give-aways, it will not do so either. Ideally, the law should protect productive government investment in infrastructure and education, which also raises G^*. A reduction in populist expenditures will make more funds available for this.

In the next section we test for broad consistency of Indian macroeconomic data with these theories.

5 Some evidence

A major test of delegation under dynamic inconsistency[7] is to regress inflation on measures of central bank independence. The coefficient is negative, showing that independence lowers inflation. But tests also show that the variation of output is not increased. This was to be expected if less pro-growth independent central bankers were not undertaking stabilisation. Therefore other mechanisms are involved than just a strong inflation aversion. It may be that some other factors lead to both independent central banks and low inflation.

[7]See Walsh (1998) for a survey of these tests. Many researchers have done these using cross country data for advanced countries.

Hardly any tests have been undertaken for developing countries. Here, as an initial step, we examine if Indian experience is consistent with the new trade-off. More thorough tests are a future research agenda.

First, if the Phillips Curve were the dominant trade-off, we would expect to see growth increase with inflation in the medium-term. But Table 1 shows an overall inverse relationship between inflation and growth.

Second, inflation was low by developing country standards. If inflation affects P, and the government gives greater weight to populism over growth, we would expect this. Inflation would be lowered, especially after cost shocks, to raise P above its expected level, and stimulate growth. The Indian Reserve Bank was not independent of the fiscal authorities. Only in the nineties have some measures been taken to put limits on automatic financing of budget deficits. Therefore central bankers largely followed the preferences of the elected governments, explaining the relatively low inflation. There were other instances of populism, on the fiscal side, in growing subsidies and administered prices.

Third, bankers have been normally conservative in the sense of being less pro-growth. Perhaps this was one reason why the rate of growth of the economy remained stuck at the "Hindu rate"[8] of about five per cent for much of the period. And, given the tradeoffs present in the economy, trend rates of inflation have crept up. But there was a widespread perception that the Indian economy was performing at much below its potential NRG, $G*$. Higher growth and lower inflation were feasible.

[8]The term was first used by the late Raj Krishna, a well known Indian economist.

Table 1: Annual Average Indian Growth and Inflation Rates

An Average	GDP Growth	Inflation(WPI)
1981-89	5.57	6.4
1989-93	4.54	10.36
1993-97	7.17	8.31
1996-97	7.5	6.36
1997-98	5.1	4.80
1998-99	6.8	6.90

Source: Government of India, Economic Survey, NAS, CSO.

Fourth, Table 2 shows that growth, inflation and monetary policy have differed in the tenures of various Reserve Bank governors. The overall direction has been dictated by the preferences of the elected government, but even though, for much of the period, the Reserve Bank was not autonomous the Governor has been able to make a difference. The averaging hides some of this, but the periods with a sharp rise in inflation have coincided with cost shocks, and have normally seen a steep cut in reserve money growth, followed by a fall in inflation below peak rates. Still, average inflation rates and monetary growth show an upward trend.

Interest rates are no longer administered and are available as additional instruments to the Reserve Bank. Legislation has given it more independence. Therefore governors will have even more impact in the future, and the question of their preferences acquires greater importance. While short-run sharp inflation has been caused by supply shocks and was soon controlled, the cost shocks led to cumulative fiscal decay. For example, user costs were

Table 1: Annual Average Macro Statistics in Tenures of Reserve Bank Governors

Governor	From	To	Tenure Period	Monetary Policy			Growth Rate
				Reserve Money	M3	Inflation	of real output
Shri H.V.R. Ienger	Mar-57	Feb-62	1957-58 to1961-62	6.11		3.52	3.76
Shri P.C. Bhattacharya	Mar-62	Jun-67	1962-63 to 1966-67	8.16		7.28	2.42
Shri L. K . Jha	Jul-67	May-70	1967-68 to 1969-70	7.97		8.58	5.73
Shri Jagannathan	Jun-70	May-75	1970-71 to 1974-75	12.93	15.44	12.67	2.3
Shri I G Patel	Dec-77	Sep-82	1977-78 to 1982-83	15.57	17.55	9.13	4.03
Shri Manmohan Singh	Sep-82	Jan-85	1983-84 to 1984-85	23.46	18.6	7[@]	6
Shri R N Malhotra	Feb-85	Dec-90	1985-86 to 1990-91	16.54	17.14	7.26	5.93
Shri S Venkatiramanan	Dec-90	Dec-92	1991-92 to 1992-93	12.34	17.04	11.9	3.05
Dr C Rangarajan	Dec-92	Nov-97	1993-94 to 1997-98	15.63	17.71	7.6	6.88*
Dr Bimal Jalan	Nov-97	current	1998-99	14.56	18.37	6.89	6.8

Source: For the period after 1970-71, Reserve Bank(1999), before that reserve money is from IMF, Financial Statistics, and inflation and output from NAS, CSO. [a]

[a]Note: The last four columns give growth rates. The output figures from * refer to the New Series of the CSO, with base 1993-94, prior to that the base was 1980-81. The inflation series are derived from the Wholesale Price Index, before @ the base is 70-71, and after it is 1981-82.

not increased after cost shocks, as a populist measure. The rising trend rate of inflation is due to this fiscal laxness, which monetary policy has largely accommodated. The trend rate of growth has remained below potential partly due to anti-growth conservatism.

We further illustrate the argument by referring to monetary/fiscal responses to specific shocks[9]. The drought and terms of trade shocks over 1965-67, led to a fiscal tightening, with a cut in budget deficits and public investment. Monetary policy was non-accommodating but not severe. Fiscal and monetary policies were closely linked, as the budget deficit was automatically financed. The oil price plus agricultural supply shock over 1973-75 lead to a similar response. In both cases there was an unnecessary loss of output. A greater reliance on food supply policies would have been more effective. The lesson was learnt by the 1979-80 crisis. There was no cut in public investment, no monetary tightening, no long-term adverse effects on output, and a rapid recovery. Money supply was decreased sharply in mid 1979 and in mid 1973, with especially severe measures unde rtaken in 1974. In both cases inflation was well under way. Although there was a steady rise in the fiscal deficit from the mid-seventies, the rise in money supply was much lower. This was helped by the long-term fall in the velocity of broad money as financial deepening took place. The populist fiscal response to supply shocks was having a cumulative effect on the budget.

The response to the early nineties balance of payments crisis included a cut in public investment, an artificial agricultural supply shock as procure-

[9]The reader is referred to Joshi and Little (1994), for more details of macro policies followed upto the early nineties.

ment prices for food grains were raised, and a monetary tightening to sterilize capital inflows in 1992-93. Growth revived in 1993-94, and monetary policy was accommodating, but exchange rate volatility in 1995 led to a monetary squeeze that precipitated a slowdown.

In the nineties structural changes associated with reform have been able to raise the trend rate of growth above five per cent. The Government of India is seriously considering adopting a fiscal responsibility act. This should protect investment while controlling populism. The Reserve Bank has been given more autonomy. A pro-growth central banker would complement the reforms. Understanding tradeoffs and preferences is necessary for design of effective institutions. If the latter were based on a non-existent inflation-unemployment tradeoff they would not be able to deliver.

6 Conclusion

The contribution of this paper is to develop and work out the consequences of strategic interaction between the government and private agents in the context of a tradeoff between growth and redistribution. This is the key tradeoff operating in a number of developing economies therefore it is very important to systematically think through its effects. The results mainly translate standard insights of the dynamic inconsistency literature to the new and more relevant tradeoffs, and are intuitive. But they lead to a startling reversal. One of the accepted conclusions in the literature is that delegation of monetary policy to a more conservative central banker will raise social welfare. A conservative central banker is defined as one who is less pro-

growth than the government. In the presence of the new tradeoffs it turns out that a central banker who is less pro-growth will turn out to be more pro-inflation. Optimal delegation, in these circumstances, would be to a less pro-growth fiscal a uthority and a more pro-growth monetary authority, compared to the government.

The theory and results are shown to be consistent with broad stylised features of Indian macroeconomic experience, but more systematic empirical tests need to be undertaken. The working of other commitment technologies, such as reputation and contracts, can also be explored in the new context.

Appendix

Method of undetermined coefficients to solve $B(P^a)$ for P_t in the presence of shocks

Assume the solution is of the form

$$P_t = \phi_0 + \phi_1 \epsilon_t \tag{17}$$

Then $P^a = \phi_0$.

Substituting for P_t and P^a in the government's best response function, $B(P^a)$, we get

$$\phi_0 + \phi_1 \epsilon_t = (\alpha b G^* + \alpha^2 b \phi_0 + \alpha b \epsilon_t) \frac{1}{\alpha^2 b + 1} \tag{18}$$

Therefore, it is necessary that

$$\phi_0 = (\alpha b G^* + \alpha^2 b \phi_0) \frac{1}{\alpha^2 b + 1} \tag{19}$$

$$\phi_1 = \frac{\alpha b}{\alpha^2 b + 1} \tag{20}$$

Solving for ϕ_0 and ϕ_1 directly gives the values of P_t and P^a, and G_t is obtained by substituting these values in the tradeoff Eq. 7.

Deriving the preference weights of the delegatee

Maximising

$$E(U(b,b^\diamond) = E(-\frac{1}{2}(\alpha b^\diamond G^* + \frac{\alpha b^\diamond}{\alpha^2 b^\diamond + 1}\epsilon_t)^2 - \frac{b}{2}(G^* + \frac{1}{\alpha^2 b^\diamond + 1}\epsilon_t)^2) \quad (21)$$

over $b^\diamond$, gives the first order condition[10]:

$$E(-(\alpha b^\diamond G^* + \frac{\alpha b^\diamond}{\alpha^2 b \ + 1}\epsilon_t)(\alpha G^* + \frac{\alpha}{(\alpha^2 b^\diamond + 1)^2}\epsilon_t) + b((G^* + \frac{1}{\alpha^2 b^\diamond + 1}\epsilon_t)(\frac{\alpha^2}{(\alpha^2 b^\diamond + 1)^2}\epsilon_t)) = 0 (22)$$

Simplifying and taking expectations leads to:

$$\alpha^2 b^\diamond G^{*2} = (b - b^\diamond)\frac{\alpha^2 {\sigma^2}_\epsilon}{(\alpha^2 b + 1)^3} \quad (23)$$

Therefore $b = b^\diamond$ cannot be a solution since it would imply that the RHS of the above equation is zero and the LHS positive–a contradiction. The solution must have $b > b^\diamond$ to match signs across the two sides of the equation.

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[10]The structure of the proof follows that in Alesina et. al. (1997)

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