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Interest Groups or Incentives: The Political Economy of Fiscal Decay

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Abstract

One view is that concessions demanded by and granted to interests groups are responsible for steady fiscal decline, and delay in reforms. We argue that negative supply shocks combined with the political objective of protecting the poor can build in incentives leading to these results. Pricing rules for government services, generated in such circumstances, would be equivalent to a fixed price contract that left the government with negative rent. A decline in investment in and quality of government services would follow, since price controls in the presence of cost shocks would lead to systematic incentives to lower quality and investment. Tax capacity and the ability to reduce poverty in the future would fall. The framework helps to understand the Indian experience. Time series based tests of causality support the causal priority of positive cost shocks. If it is accepted that incentives, and not only interest groups are responsible for fiscal decay, a concerted attempt to rationalize user charges and improve quality may be politically feasible.

Key Words: Cost shocks, user charges, political economy, cross-subsidization, interest groups, fiscal decay, incentives

JEL Classification nos.: O11, P16, E62, C32

I. Introduction

The reforms of the nineties, and the resistance they encountered, have re-kindled interest in political economy[1]. Recent literature analyzes the role of strategic interaction among interest groups in explaining delay in adopting and successfully completing reforms. Concessions given to appease powerful interest groups have been seen as responsible for the decay in government finances (Bardhan 1984). We argue that the government of a poor populous democracy may choose populist pricing policies in the face of cost shocks. But this sets in place incentive mechanisms that corrode the ability of the Government to provide essential infrastructure, lower the quality of government services, and harm every group in the long run. These disincentives are, however, easier to correct than competitive pressure from interest groups.

We demonstrate the incentives at work in a stylized theoretical framework, show how it applies to the Indian case, and test it with time series data. We model the government as contracting out its activities to a large multi-product public service provider[2] (PSP). The Government is democratically elected. Since the poor have the largest votes, incumbents want to provide government services at low prices. This leads to cross-subsidization both in the provision of specific products and across government functions. Maximizing social welfare subject to a budget constraint derives optimal cross-subsidization. This is the Ramsey-Boiteux rule. It implies that prices should differ from marginal cost but the gap should be inversely proportional to elasticities of demand. For example, if the poor buy a good whose elasticity of demand is relatively lower, margins charged on it should be relatively higher. The rule can take account of other objectives in social welfare such as redistribution and correcting incentives under asymmetric information, and has been generalized into the theory of optimal non-linear tariffs.

[1] Rodrick (1996) offers a survey. Alesina and Drazen (1991) and Drazen (1996) examine the role of interest groups in delaying reform, and therefore worsening government finances.

[2] In India the provision of government services is put under three heads: general administration, departmental, and non-departmental enterprises. The latter two charge for their products, while the costs of the first have largely to be covered by taxation. All these government agencies can be regarded as a PSP.

A growing budget deficit implies that the budget constraint has been violated; relative prices have not been derived from first principles. This can happen if user charges on goods consumed by the poor are kept frozen after a cost shock. Moreover if, because of cross subsidization, the price in any sub-market exceeds cost, or if new technology lowers cost or breaks a natural monopoly, competitive entry occurs. Government revenues from these sub-sectors fall further.

If the budget is not balanced the PSP is left with negative rent. There are two natural extremes in pricing rules that have opposite effects on the incentives of the PSP to lower cost or improve quality. The first, a price cap, offers high-powered incentives since the residual profit share (rent) lies with the PSP. In the second, rate of return regulation, incentives are low powered. The cost of the service is reimbursed and profits from improvements do not stay with the PSP, so there is no motivation to decrease costs. In designing an incentive scheme there is always a trade-off between rent extraction and providing incentives for additional effort. A price cap if low enough extracts all rent, but can still motivate a decrease in costs. But it reduces incentives to invest and improve quality. Low-powered incentives are required for the provision of quality, since costs rise with the latter. Similarly there is a disincentive to invest in the presence of price caps because investment costs sunk may be expropriated. When the poor form the major vote banks, raising prices of the services they consume is an unpopular decision politically. Then if net cost shocks are positive over a period, price caps can become low enough to leave the PSP with negative rent.

Indian experience illustrates these theories. Bardhan (1984) had hypothesized that powerful vested interests, each getting concessions such as employment, subsidies, free loans, and cheap public goods, were responsible for the decay in Indian government finances. Farmers, traders, industrialists, bureaucrats, and unionized workers each benefited. If this were the whole cause, government consumption as a ratio of the Gross Domestic Product should have risen steadily. But it was almost the same in the mid-nineties as it was in the mid-seventies. It is true the ratio could have fallen, but why should the let up in interest group pressure, that allowed it to remain constant, coincide with the period after the oil shocks? The component of current expenditure that did rise is interest payments (see, Goyal, 1999). The other feature interest group theories cannot explain is the pervasive decline in the quality of government services.

An alternative view of the political forces that impinged on budget making provides a better explanation of these stylized facts. The political necessity of populism, in the presence of net positive cost shocks, initiated the decay in government finances. Oil prices rose and agricultural output fell in the seventies. It was difficult to raise user charges for public goods. The result was increasing cross-subsidization, where industry and the well off were to pay for provision of services to the poor. This is in itself a valid social objective (apart from catering to dominant vote banks). But since it violated the budget constraint it built-in incentives for a fall in quality and investment. Since capacity constraints soon appeared, poor quality, time delays, and controls were used as rationing devices. It became advantageous for the rich to opt out of the system. Private alternatives appeared to service them. The government lost revenue, and the poor suffered non-monetary costs. A humane society requires cross-subsidization, but that is viable over the longer term only if the revenue budget is balanced and other economic criteria met. The cross-subsidization chosen was unsustainable. Interest payments on borrowing made to meet shortfalls in revenue began adding on to deficits. Perverse incentives got entrenched when relative prices were not allowed to adjust, and harmed the quality of provision of public services and the revenue raising capability of the government. Less corroding policies are available to protect the poor[3]. Once concessions become the norm, it is difficult for any one political party to remove them alone. A change in the status quo is seen as targeting a particular group. But as the welfare losses become obvious, a common political platform across parties and a critical mass supporting the required restructuring, can arise. Or law could implement the changes.

It is difficult to go against powerful vested interests. But if the benefits are only short-term or strategic, it is possible to educate interest groups. For example, the user charges required to improve the revenue deficit will be more acceptable if the adverse effects of pricing distortions in the face of cost shocks are recognized. Poor quality is

[3] Goyal (1999) lists some of these. In general they are the policy set that enhance earning power of the poor. Transfers should be tightly targeted and eventually give way to a negative income tax.

as much a cost to the poor as high prices. There is evidence that the poor are willing to pay higher prices for better quality[4].

Our hypotheses impose a causal ordering on time series of the government budget and price variables. Cost shocks, which cause inflation, should raise the revenue deficit, as revenues continuously fall short of expenditures. Only if there is automatic monetization, would the money supply then rise. If interest groups are able to independently wrest concessions from the Government then it is the revenue deficit that should raise money supply and inflation. Time series tests we conduct support the causal role of cost shocks and incentives mechanisms, in initiating the decay in government finances. The tests also imply that although the Indian central bank was not formally independent in the period, there was no automatic monetization of the revenue deficit. Rather cost shocks raised Government borrowing and interest payments.

The paper is organized as follows. Section 2 presents a model of the provision of two kinds of government services and draws out the implications of budget balance and cross-subsidization. Section 3 uses the model to examine the effects of a cost shock, when prices are administered, on the incentives to invest and provide quality services. Section 4 tests the model with Indian data. Section 5 concludes.

2 The Model

A Public Service Provider (*PSP*) provides two kinds of service (or goods, q_R and q_L) of value S for the public. The poor consume q_L and the rich q_R. The cost function of the *PSP* is

$$C = C(\beta, e, \mathbf{q}) \tag{1}$$

Where β is a technological parameter ($C_\beta > 0$),

e is its manager's cost-reducing effort ($C_e < 0$)

$\boldsymbol{q} \equiv (q_R, q_L)$ is the *PSP*'s output vector ($C_{qk} > 0$)

[4] Farmers are given free or highly subsidized but unreliable electricity in many Indian States. In the course of reform farmers have often said they were willing to pay for better quality. It is interesting to note that in UP where the quality of supply is very bad farmers were willing to pay, but in MP where the supply is better, they were not. In experimental reforms in Rajasthan farmers were willing to pay four to five times the usual tariff for assured quality. As an informal targeting and cost saving device very poor quality foodgrains are sold in India's public distribution scheme. Many low-income households' prefer to pay more and buy from the free market. An interviewee reported that apart from other higher transaction costs, it took too long to clean stones from the ration shop rice.

Bold letters denotes vectors. To refer to any of the two goods, subscript k is used. Subscripts other than those indexing goods (that is, k, L, and R) denote partial derivatives.

We make the accounting convention that the revenue[5] $R(q)$ (if any) generated by the sale of outputs is transferred to the general budget; the government pays the cost of production and then pays a net transfer to the *PSP*. Therefore the *PSP* would want to maximize the latter.

This arrangement can be understood as a contract written between the Government and the *PSP*. The class of linear contracts where the transfer equals $a - bC$, $0 < b < 1$, are known as incentive contracts[6]. The power of the incentive scheme is b. A low powered cost plus contract occurs if $b = 0$ since the *PSP* does not bear any of the cost. A high-powered fixed price contract occurs if $b = 1$, since the government does not reimburse any of the costs. The *PSP* has high incentives to improve efficiency since it would retain any cost savings[7]. Clearly, the accounting convention can also be understood as the *PSP* paying for its costs, with the government reimbursing a fraction $1 - b$ of the cost and giving a fee a.

Although β will be relatively lower in the production of q_L, we can assume without loss of generality that β and e are the same in the production of the two goods, are known to the *PSP* and to the Government. This simple framework will allow us to derive optimality conditions and their implications for the relationship between cost and prices across the two goods.

2.1 Model solutions

Let t denote the net monetary transfer from the Government to the *PSP*, $\psi(\cdot)$ the disutility of effort, then the *PSP*'s objective function is

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[5] Our broad definition of the *PSP* implies that revenue includes taxes, which are regarded as the price of administrative services.

[6] See Laffont and Tirole (1993) for the general theory of incentive contracts, under asymmetric information, in the context of regulation, and Joskow (1998) for applications to developing countries. Our treatment follows Laffont and Tirole.

[7] The contract between the government and the PSP is an artifice to bring out the incentive effects of pricing policies following cost shocks. The PSP and the government are identical. Although Dixit (1996) examines incentives in government structures, he does not examine effects of pricing government services.

$$U = t - \psi(e) \tag{2}$$

And its participation constraint is

$$U \geq 0 \tag{3}$$

$$\psi' > 0,\ \psi'' > 0,\ \psi(0) = 0$$

The social value *V* (**q**), associated with the production of vector ***q*,** is the sum of two items. First, net consumer surplus {*S* (**q**) – *R* (**q**)} (gross consumer surplus minus revenue). Second, social value of tax savings for taxpayers generated by the sale of the goods, (1+λ) *R* (**q**) (where λ is the shadow cost of public funds as Re 1 inflicts disutility of Re 1+λ on taxpayers). That is,

$$V(\mathbf{q})=S(\mathbf{q})+\lambda R(\mathbf{q})=S(\mathbf{q})+\lambda \Sigma_k p_\kappa q_\kappa \tag{4}$$

The partial derivative of *S* with respect to q_κ, $p_\kappa = S'_\kappa(q)$, defines the demand function $q_\kappa(p)$, with cross elasticities $\eta_{RL} \equiv (\delta q_R / \delta p_L)\ (p_L / q_R)$ and own elasticity

$$\eta_k \equiv -\ (\delta q_k / \delta p_k)\ (p_k / q_k)$$

The utilitarian social welfare function is the sum of consumer welfare and the PSP's welfare.

$$W=[V(\mathbf{q})-(1+\lambda)(t+C(\beta,e,\mathbf{q}))]+U \tag{5}$$

Substituting Eq. 2,

$$W=S(\mathbf{q}) +\lambda R(\mathbf{q})-(1+\lambda)(\psi(e)+C(\beta,e,\mathbf{q}))-\lambda U \tag{6}$$

That is *W* consists of three terms. The social value *V* of outputs, the total cost $\psi + C$ of operating the *PSP* times the shadow price of this cost, and the social cost λU of leaving a rent to the *PSP*.

Maximizing social welfare, *W*, w.r.t. to *e, U* and outputs q_k gives the first order conditions. First:

$$\psi'(e) = -C_e \tag{7}$$

That is, the marginal disutility of effort is equated to marginal cost savings made by increasing effort. While the cost plus contract induces $\psi'(e) = 0$, the fixed price contract induces $\psi'(e) = -\ C_e$, and is therefore efficient. Under a fixed price contract $t(C) = a - (C-C^*)$ with $a \equiv \psi(e^*)$ and $C^* = \beta - e^*$ the PSP as the residual claimant of its cost savings, would chose *e* to maximize $(a - (\beta - e - C^*) - \psi(e)$. The first order condition, then gives e = e*, or optimal effort. Second, with utility $U = 0$, all rent is extracted[8], but the participation constraint is satisfied.

The third FOC is,

$$V_{q_k} = (1+\lambda)C_{q_k} \tag{8}$$

That is, each good is produced to the point where marginal generalized gross surplus is equated to marginal social cost of production. Doing the derivation with respect to q_R, Eq. 8 becomes,

$$p_R + \lambda\left(p_R + \frac{\partial p_R}{\partial q_R}q_R + \frac{\partial p_L}{\partial q_R}q_L\right) - (1+\lambda)C_{qR} = 0 \qquad (8)'$$

$$\text{or} \quad L_R = R_R \tag{9}$$

$$\text{where,} \quad L_R = \frac{p_R - C_{q_R}}{p_R} \tag{10}$$

L_R is good *R*'s Lerner index.

$$R_R = -\frac{\lambda}{1+\lambda}\left(\sum_k \frac{\partial p_k}{\partial q_R}\frac{q_k}{p_R}\right) \tag{11}$$

R_R is good ≥'s Ramsey index.

For independent demands

$$R_R = \frac{\lambda}{1+\lambda}\frac{1}{\eta_R} \tag{12}$$

So that the price-marginal cost ratio is inversely proportional to the elasticity of demand for the good, subject to λ the economy-wide cost of funds. Symmetric conditions can be derived for q_L.

If the maximization of social welfare is undertaken by adding a redistribution constraint *D* with shadow cost μ, *Eq*. 12 is changed to:

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[8] In the class of linear contracts, t = a – bC, in general, da/db = C. If efficiency is uniform $b = 1$, under the fixed price contract, and the contract offered is t(C) = a - C. If efficiency varies, and there is asymmetric information, the most efficient *PSP* will prefer a fixed price contract where $b = 1$, since it is then the residual claimant for its cost savings. Other types will be intermediate to the cost plus contract which corresponds to $b = 0$.

$$R_R = \frac{\lambda}{1+\lambda}\frac{1}{\eta_R} + D_{q_R} \qquad (12)'$$

And for q_L the Ramsey index now becomes:

$$R_L = \frac{\lambda}{1+\lambda}\frac{1}{\eta_L} - D_{q_L}$$

Since redistribution to the poor raises social welfare, the price-cost margins on q_R would now be relatively raised.

From (9), (10), and (12)', for good R

$$\frac{P_R - C_{qR}}{P_R} = \frac{\lambda}{1+\lambda}\frac{1}{\eta_R} + D_{q_R}$$

and for good L

$$\frac{P_L - C_{qL}}{P_L} = \frac{\lambda}{1+\lambda}\frac{1}{\eta_L} - D_{q_L}$$

These two equations, if D is ignored and $\eta_R > \eta_L$

$$\Rightarrow \quad p_R - C_{qR} < p_L - C_{qL} \qquad (13)$$

That is, if the demand elasticity of q_R exceeds that of q_L, then the margin of price over cost should be lower for q_R compared to q_L. The rich consume q_R and the poor consume q_L; therefore unlike our simplifying assumption if β is higher for q_R, $p_R > p_L$ is consistent with condition 13. Moreover, the re-distribution constraint D lowers the price cost margin on goods consumed by the poor and therefore the gap between the two price-cost margins shrinks.

Maximizing welfare subject to an explicit constraint for budget balance across the activities of the *PSP*,

$$\sum_k p_k(q_k)q_k \geq C(q_R, q_L) \qquad (14)$$

endogenously generates λ as the shadow price of the constraint, (14)[9]. If Eq. 14 holds with equality it implies budget balance or zero revenue deficits and a positive λ. A higher value of λ would require higher price cost margins from equation 12. As long

[9] This was the way the equation 8 was first derived by Boiteux (1960), on the lines of Ramsey's earlier analysis of the optimal tax problem. Therefore the formulae (9) for optimal prices are known as

as constraint (14) is met, the price cost margins have to be such that the budget is balanced.

We assume the Government follows a *populist pricing rule* (PPR)**,** which is,

PPR: Hold p_L constant and raise p_R to cover costs.

3 Results

The framework derived gives interesting implications for the effect of cost shocks and their impact on incentives of the *PSP* managers.

R1: A positive cost shock leads to cross-subsidization

If constraint 14 is met and then a positive cost shock occurs. If the *PPR* is followed so that the price of q_L is held constant and p_R is raised, given that $\eta_R > \eta_L$, Eq. 14 must be violated, because the fall in revenue from the sale of q_L will not be compensated by the rise in q_R. The *PSP* will begin running a deficit. *A revenue deficit occurs and will have to be financed either by borrowing or printing money*. Cross-subsidization is now occurring across the two goods, with proceeds from sale of q_R subsidizing losses from the provision of q_L. But if $p_R q_R > C(q_R)$, for some kinds of services[10], conditions are ripe for the entry of private competitors, and the price structure may not be sustainable[11], since further revenue losses occur as more customers of q_R are lost.

R2: Fall in Incentives to invest

Since the rise in p_R is not sufficient to compensate for the constancy of p_L, and the budget deficit rises, the *PPR* functions as a price cap. But it is a price cap that over-extracts the rent, and leaves the *PSP* with a negative rent. The *PSP*'s participation constraint (3) is violated. Its response is to cut back on investment, effort or the quality of its output.

Ramsey formulas. Boiteux had a more complete framework since he derived Hicksian compensated demand in a general equilibrium framework.

[10] Faulhaber (1975) defines the absence of cross-subsidization as $p_R q_R \leq C(q_R)$ where $C(q) \leq C(q_L) + C(q_R)$. That is, no one good by itself yields a profit to the *PSP*, when the cost of producing both goods together is less than that of producing any one alone. If this condition holds, then competitive entry in the production of any one of the goods would not occur, and the price structure would be sustainable.

[11] Goyal (1999) outlines the problems that have arisen due to adverse incentives, in the provision of a number of public services. Examples of the adverse effects of cross subsidization are the widespread

A price cap has better incentive properties compared to a cost of service or rate of return contract. Under a price cap the *PSP* is the residual claimant, there is an incentive to lower costs, so as to raise own share of returns. But if *a* falls below ψ (e*), when prices are not changed after a cost shock that raises *β*, the surplus of the *PSP* is negative, or $U < 0$. In the short-term optimal effort *e**, will continue to be induced with the fixed price contract. But if there are limits to running a revenue deficit the only feasible ways to lower expenditure are to cut investment, lower effort or lower the quality of output.

Investment, *I*, increases efficiency as it lowers costs, *β*. Assume the *PSP* has an investment plan that would lower *β* in the next period. Since cost reimbursed now includes current and investment cost, the *PSP* will cover current costs, but choose an investment level less than the socially optimal.

To see this let investment determine a probability distribution $F(\beta/I)$ for $\beta \in [\underline{\beta}, \overline{\beta}]$, with first order stochastic dominance that is, $F_I \equiv \partial F/\partial I > 0$ for $\beta \in (\underline{\beta}, \overline{\beta})$. There are decreasing returns to investment or $F_{II} < 0$.

The optimal investment level I* minimizes the sum of investment cost and the ex post cost $C = \beta - e$. That is

I* minimizes $\left\{ I + \int_{\underline{\beta}}^{\overline{\beta}} \beta \, dF(\beta / I) \right\}$

After integrating by parts, the objective function becomes

I* minimizes $\left\{ I - \int_{\underline{\beta}}^{\overline{\beta}} F(\beta / I) d\beta + \overline{\beta} \right\}$

The socially optimal effort level is given by $\psi'(e^*) = 1$ and the socially optimum rent $U(\beta) = 0$ for all *β*.

If the government cannot observe *I* and it offers a cost reimbursement $C \prod t\,(C + I)$, the *PSP* can now put in optimal effort *e** reaching *C**, but under invest, so that $I < I^*$.

use of private generators for electricity, the shifting of goods traffic from rail to road, and of

The problem arises because costs are fungible[12]. Alternatively both $e < e^*$ and $I < I^*$ may occur. Over time this will result in a high cost operation. Another way to evade a binding price cap is by an unverifiable cut in quality.

R3: Fall in Incentives to maintain quality

To see this, assume quality (*x*) and price (*p*) are close substitutes for both the consumer and the *PSP*. The *PSP* then maximizes profits over *p*, *x*, with output given at $\bar{q}$:

$$\max_{\{p,x\}} \left\{ pD(p,x) - \frac{p\bar{q}}{1+\lambda} - (\beta - e + x)D(p,x) \right\}$$

Where the cost function $C = (\beta - e + x)\, q$ now increases with quality, and the quantity purchased increases with *x* and decreases with *p* according to the demand function $D(p, x)$.

If price increases (decreases) and quality decreases (increases) are perfect substitutes for both the consumer and the *PSP*, demand can be written as:

$$D(p,x) = \tilde{D}(p - x)$$

And since cost is now $C = (\beta - e + x)\, q$ the *PSP* can decrease quality to compensate for an administered price which is different from its optimal price. Indeed, if the good is free, although the price is zero, the quality will decrease until it equals the virtual monopoly price.

To summarize, *price controls in the presence of net positive cost shocks lead to systematic incentives to lower quality and investment in the public sector. This reduces the capacity of the state to tax, invest and provide services in the future.*

If this analysis applies to the Indian case, cost shocks must be causally prior and affect other macroeconomic time series. We test for this in the next section.

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international telephone calls to private providers.

4. Empirical Tests

If the major causal factor for fiscal decay was a sustained pressure for transfers to interest groups, the ratio of government consumption to GDP would have gone up smoothly, raising the revenue deficit, money supply and inflation. But in India GC/GDP has been relatively constant but government interest payments rose steeply, as pricing policies after net positive cost shocks decreased revenues and forced it to borrow. The government began running revenue deficits, which cumulated over time. The causality therefore ran from cost shocks to the revenue deficit. This would explain why a steep fall in quality in the provision of Indian public services occurred after the oil shocks of the seventies. Therefore we test the following two hypotheses for the Indian economy.

In the post 1970's:

Hypothesis 1: Changes in revenue deficit raised money supply and caused inflation.

Or

Hypothesis 2: Net positive cost shocks proxied by inflation lead to proportionate changes in money supply and the revenue deficit.

Rate of change of the following variables were used in the empirical exercise:

a) Revenue deficit of central and state governments (denoted by *revdefr*).
b) M3 component of money supply (denoted by *m3r*).
c) The wholesale price index, WPI (denoted by *infln*).

There are 25 observations[13], from 1970-71 to 1994-95. Tables and graphs are presented in the appendix.

Insert Table 1

Table 1 shows the results of Phillips-Perron[14] unit root tests for each series. The null is the presence of unit roots, based upon the following regression:

[12] For example, Bajaj (1999) reports that in 1996-97, 52.46 percent of the provision made in the UP State Government for maintenance expenditures on the canal system was spent for payment of wages and salaries.

[13] The data sources were the Central Statistical Organisation (CSO), and the Economic and Political Weekly, Research Foundation (EPWRF) (1996).

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \varepsilon_t \qquad (1)$$

MacKinnon's critical values are used here at 5% level of significance. The results show that the null of unit root could not be accepted for any of these variables. The variables are stationary.

We are interested in the structure of causality amongst these variables. In a systems estimation of Vector Autoregressions (VAR)[15] each variable can be explained by the lagged values of every other variable including itself. Such estimations can therefore discover the direction of causality amongst variables, without imposing any such a priori restriction. We estimate the following general augmented VAR model:

$$z_t = a_0 + a_1 t + \sum_{i=1}^{p} \Phi_i z_{t-1} + \Psi w_t + u_t \,, \qquad t = 1,2,........n\,. \qquad (2)$$

Where z_t is a $m \times 1$ vector of jointly determined dependent variables and w_t is a $q \times 1$ vector of deterministic or exogenous variables like dummies etc. Now let $z_t = \left(z_{1t}^{/}, z_{2t}^{/}\right)^{/}$ where z_{1t} and z_{2t} are $n_1 \times 1$ and $n_2 \times 1$ subsets of z_t, and $m = n_1 + n_2$.

Consider the following block decomposition of (2):

$$z_{1t} = a_{10} + a_{11} t + \sum_{i=1}^{p} \Phi_{i,11} z_{1,t-i} + \sum_{i=1}^{p} \Phi_{i,12} z_{2,t-i} + \Psi_1 w_t + u_{1t}$$

$$z_{2t} = a_{20} + a_{21} t + \sum_{i=1}^{p} \Phi_{i,21} z_{1,t-i} + \sum_{i=1}^{p} \Phi_{i,22} z_{2,t-i} + \Psi_2 w_t + u_{2t}$$

The hypothesis that the subset z_{2t} do not 'Granger-cause' z_{1t} is defined by the following $n_1 n_2 p$ restrictions:

$$H_G : \Phi_{12} = 0$$

where $\Phi_{12} = \left(\Phi_{1,12}, \Phi_{2,12}, \Phi_{3,12}, ...\Phi_{p,12}\right)$. The log-likelihood ratio statistic for the test of these restrictions is computed as:

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[14] The Phillips-Perron method is suited to the short span of data as it uses a non-parametric correction for serial correlation, as an alternative to the inclusion of lag terms. We consider the growth rates of the variables, and take the model with constant and no trends.

[15] Since our variables are I(0) or stationary, we estimate a VAR. Toda and Phillips (1993) recommend the estimation of a co-integration VAR to conduct statistical inference including causality testing when variables are non stationary and integrated of order I(1). Tests methodologically similar to ours have been conducted by Nakajima, 1995, and Obben, 1996.

$$LR_G\left(\Phi_{12}=0\right)=2\left(\log\left|\tilde{\sum}_R\right|-\log\left|\tilde{\sum}\right|\right)$$

where $\tilde{\sum}$ is the ML estimator of variance covariance matrix for the unrestricted system (2) and $\tilde{\sum}_R$ is the ML estimator of the variance covariance matrix when the restrictions $\Phi_{12}=0$ are imposed. Under the null hypothesis, that $\Phi_{12}=0$, LR_G is asymptotically distributed as a chi-squared variable with $n_1 n_2 p$ degrees of freedom.

The direction of causality among these variables is examined in three steps. First we estimate a VAR. The OLS estimates of single equations in the unrestricted VAR provide prima facie evidence on the possible direction of causality. Second, block-Granger causality tests provide evidence on the ability or inability of the past values of a single or group of variables to predict the other variables. Third, impulse response[16] functions show the future dynamic responses of the system to shocks in specific variables.

We estimate a model of unrestricted VAR of order 1[17] with a constant, a trend and dummies for two fiscal years, to take care of outliers. They assume a value 1 for 1973-74 and 1983-84 and zero elsewhere. The oil shock of 1973, and severe droughts of 1972 and 1974 led to high inflation. The month to month average WPI shows that, inflation was at its highest between mid 1973 and September 1974, at 33%. In 1983-84 also there was a sharp increase in agricultural prices.

Insert Table 2

[16] Unlike the orthogonalized impulse response function advanced by Sims (1980, 1981) our diagrams depict the Generalized impulse response functions as proposed by Koop *et al.* (1996) and Pesaran and Shin (1997). The orthogonalized impulse response is not unique and in general depends upon the particular ordering of the variables in the VAR, if the covariance matrix of the shocks is not diagonal. The generalized impulse response function circumvents the problem of the dependence of the orthogonalized impulse responses on the ordering of the VAR.

[17] VAR of order 2 was estimated with a constant and trend but without the dummies. VAR of order 1 was selected based upon the AIC criterion.

Table 2 gives the OLS estimate of single equations in the unrestricted VAR. Figures within bracket under the independent variables are t-ratios for the respective coefficients, and those under diagnostic tests are the respective test statistics[18].

Observation 1: In the OLS estimate of single equations in the unrestricted VAR:

a. Past values of *infln* significantly explain *revdefr* and *m3r*.
b. *revdefr* is explained by its own past value beside the past value of *infln*.
c. Past values of neither *revdefr* nor *m3r* could significantly explain *infln.*

Source: Table 2.

Neither *m3r* nor *revdefr* can explain any of the other variables though *infln* explains both these variables in these single equation estimations. Failure of the past values of *m3r* to explain any other variable including itself and the inability of *revdefr* to explain any other variable except itself, though they both are being significantly explained by past values of *infln,* points to the possibility of them being non-causal in this systems estimation. This provides initial evidence that cost shocks proxied by *infln* are the exogenous variables causing or explaining the other two variables.

Insert Table 3 and 4

Table 4 provides the result of tests on block non-causality of variables[19]. The associated statistic is used for testing the null hypothesis that the coefficients of the lagged values of a variable or a group of variables in the block of equations explaining the remaining variables are zero.

Observation 2: Tests on block non-causality of variables show that:

a. The inability of past values of either *revdefr* or *m3r* to predict the remaining two variables could not be rejected.

The joint non-causality of *revdefr* and *m3r* in explaining *infln* could not be accepted.

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[18]Details of these test statistics are given at the base of the table.

[19] Before proceeding further with Granger non-causality tests, we check for the significance of the dummies, intercept and trend component in this systems estimation. Table 3 provides the result of these tests. Likelihood ratio test of exogenous variable deletion shows that none of them should be deleted from this estimation. Significance of the dummies shows the importance of shocks (for those particular years) to the Indian economy.

Source: Table 4.

Observation 2 shows cost shocks, proxied by *infln,* to be the basic driving force, causing and hence explaining *revdefr* and *m3r*. These results support hypothesis 2. Net positive cost shocks, manifest in inflation, explain proportionate changes in money supply and revenue deficit.

Impulse response functions provide further evidence on causality. These functions measure time profiles of the effect of present shocks on the future states of a dynamic system.

Insert Figure 1

Observation 3: Impulse response profiles support the direction of causality from *infln* and *m3r* to *revdefr* and not the other way round.
Source: In Figure 1, corresponding to the model without interest payments, a one standard error shock to the equation for *revdefr* does not affect the time profile of any other variable. However, a one standard error shock to equation for either *m3r* or *infln* does have an effect on the future time profile of *revdefr.*

Inability of shocks in *revdefr* to initiate changes in *m3r* provides suggestive evidence that automatic monetization of the revenue deficit was absent over the period of our analysis. The Indian central bank was not independent of the Government in this period, but in a poor populous democracy without widespread automatic indexation of wages, keeping inflation low is a major political objective. The Reserve Bank of India used special deposit and reserve requirement schemes, to partially neutralize the impact of monetization of government deficits.

Next we introduce another variable, the rate of change in interest payments on public debt (denoted as *intr*), as an additional proxy to capture costs. In periods of cost shocks, the Government borrows to meet increased expenditure and this cumulates as interest payments on debt. We again estimate a VAR of order 1[20] with constant, trend

[20] This was again based upon the AIC criterion as before.

and dummies for two more fiscal years 1972-73 and 1981-82 to take care of the outliers (shocks) in the observations for *intr*. Real value of interest payments is affected by the rate of inflation. The shooting up of inflation from 5.6% in 1971-72 to 10% in 1972-73 lowered the burden of government interest payments as nominal interest rates were administered. Similarly the sharp fall in overall inflation from 18% in 1980-81 to 9% in 1981-82 had an adverse impact on government interest payments. The dummies of 1972-73 and 1981-82 capture these shocks.

Insert Table 5

Table 5 provides the result on OLS estimation of single equations in the unrestricted VAR. It strengthens our previous finding in support of hypothesis 2. The lagged values of neither *m3r* nor *intr* can significantly predict any of the other variables including themselves. Though the past value of *revdef* is instrumental in explaining its present value, it fails to explain the present value of any other variable. *Infln* is not explained by lagged values of any other variable except itself, though its lagged value is significant in explaining the other variables considered in the VAR. This again indicates that *infln* is the major driving force (causal variable) in this system of variables. Values of adjusted $\overline{R}^2$ show *revdefr* to be the variable best explained, followed by *intr*. This implies that they are the explained variables in this systems estimation.

Insert Table 6

The likelihood ratio test for deletion of exogenous variables presented in Table 6 further shows that none of the exogenous variables could be deleted from this four variable equation system.

Insert Table 7

Results on block non-causality tests presented in Table 7 maintain the inability of lagged values of *revdefr* and *m3r* individually as well as jointly to explain the other variables. However, past values of *intr* and *infln* affect the rest of the variables in the systems estimation. This causal relationship is found to be significant. This again supports hypothesis 2 that past values of *intr* and *infln* explain *revdef* and *m3r*.

Insert Figure 2

The generalized impulse response functions of Figure 2 provide further support for hypothesis 2. A one standard error shock to *revdefr* does not affect rest of the variables to the extent it affects its own future values. However, shocks in the rest of the variables i.e., *intr*, *infln* and *m3r* have a much larger impact on *revdefr*. These results can be summed up as follows:

Observation 4: Repeating the tests using the rate of change in interest payments on public debt (denoted as *intr*), as an additional proxy to capture costs, again supports hypothesis 2.

In order to derive the direction of causality amongst cost shocks, proportionate changes in money supply and revenue deficit we probed into three aspects of a systems estimation of VAR. The single equation OLS estimates of unrestricted VAR provides us with a prima facie evidence of causality amongst variables considered in our analysis. Block-granger causality showed whether lagged values of a variable or a group of variables were able to predict the others. The impulse response function measured the time profile of present shocks to a variable on the future states of the dynamic system.

The single equation estimates show that past values of *infln* is able to significantly explain rest of the variables included in our analysis though it remains unexplained by all others including its own past value. Block Granger non-causality in the form of inability of past values of *m3r* and *revdefr* to predict other variables in the systems estimation both individually and taken together and when we include proportionate changes in interest payments is also observed. Such non-causality is however ruled out for the variable *infln* and *intr*. The impulse response functions however show that a current disturbance in any of the variables has a large impact on the future time profile of *revdefr*. All our tests provide suggestive evidence that cost shocks, with proportionate changes in interest payments and inflation as proxies, lead to proportionate changes in money supply and revenue deficit. Thus hypothesis 2 cannot be falsified for the Indian economy.

5 Conclusion

The general theory of cross-subsidization and incentives offers a useful framework to analyze aggregate government finances. It suggests a shift from emphasis on vested interests as responsible for fiscal decay, to the incentive structure set in place by the populist response to exogenous shocks. In the long run no group benefits from the policy. Maximizing short-run chances of re-election can explain why such incentive structures are adopted, and strategic aspects, or relative group positions, why they persist--this provides scope for future work. The analysis can be applied to analyze deterioration in the quality of developing economy public goods defined more broadly, for example to include the environment. Or narrowed down to focus on a specific public good. If asymmetric information, which has varying impact on different government services, is explicitly modeled, it can explain why some types of services show greater deterioration.

The analysis is illustrated and tested with the Indian case. In the face of the cost shocks of the seventies, and the social objective to protect the poor, the government functioned with low price caps for much of the products and services it provided. But where it had monopoly power and was servicing the rich, prices were raised much above costs of production. There was extensive cross-subsidization. The same principles were applied to tax collection. Large groups of people were exempt from income tax, for reasons of equity or cost of collection, and rates were raised steeply for the rest. Consequently the tax base is very low; moreover evasion became pervasive. The government's ability to collect taxes fell. As the rich found alternatives, the cross-subsidization was not sufficient to cover costs. General revenues did not even cover consumption. Budgetary support was insufficient to prevent the deterioration in quality, and fall in investment, that came with the price caps. Poor quality was an implicit price rise that lowered consumption demand; fall in investment harmed the provision of future services. These services or public goods included infrastructure, education, health, social capital and even the environment. The fiscal decay also encouraged corruption.

Causality analysis based on a VAR model supports the causal priority of cost shocks compared to pressure by interest groups, as the source of fiscal decay. The policy implications following from the analysis are that if the government lowers the revenue deficit by raising user charges and the tax base, investment in and the quality of provision of essential public services can improve. Privatization, used as a means of re-allocating public capital in more efficient directions, is another means of improving finances.

As the long-term welfare losses of short-term populism become obvious, the perverse incentives are understood, and non-distorting mechanisms adopted to protect the very poor in transition, the reform will be acceptable to a wide spectrum of interest groups. This will make it more feasible for the Government to restructure, privatize in some areas, improve the quality and quantity of other essential services, thus facilitating the development of human capital and human dignity.

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Table 1
ADF and Phillips Perron unit root tests

Variable	**Philllips Perron test statistic**
	Constant & No Trend
REVDEFR	12.002 *
M3R	7.1516 *
INTR	15.135 *
INFLN	6.14 *

MacKinnon's 5% critical value corresponding to the model of no trend is –2.99695.

TABLE 2
OLS estimation result of single equations in the Unrestricted VAR

							Diagnostics Tests						
							Serial Correlation[1]		Functional Form [2]		Normality[3]	Heteroscedasticity [4]	
Dependent Variable	Revdefr (-1)	m3(-1)	Infln (-1)	const	trend	$\overline{R}^2$	LM $\chi^2(1)$	F *F(1, 14)*	LM $\chi^2(1)$	F *F(1, 14)*	LM $\chi^2(2)$	LM $\chi^2(1)$	F *F(1, 20)*
Revdefr	0.34546 (6.8269)*	3.6155 (.8686)	-10.2965 (-5.095)*	-0.19 (-.22)	0.092 (5.4)*	0.960	(1.47)	(1.00)	(6.69)*	(6.12)*	(0.348)	(0.874)	(0.828)
m3r	0.0012 (0.484)	-.1834 (-0.85)	-0.314 (-3.03)*	0.235 (5.1)*	0.000 (0.30)	0.366	(1.23)	(0.83)	(.099)	(0.063)	(0.603)	(0.001)	(0.001)
infln	-0.009 (-1.573)	0.7116 (1.493)	0.328 (1.423)	-0.06 (-0.6)	0.000 (0.05)	0.309	(0.01)	(.006)	(1.304)	(0.882)	(0.5729)	(.0428)	(.039)

[1] Lagrange multiplier test of residual serial correlation. [2] Ramsey's RESET test using the square of the fitted values.
[3] Based on a test of skewness and kurtosis of residuals. [4] Based on the regression of squared residuals on squared fitted values. Tests are based on LM
and F versions.
*Significant at less than 5% level. The dummies dum745 and dum834 were significant only for the equation of revdefr

Table3
LR Test of Deletion of Deterministic/Exogenous Variables in the VAR

Variables	L R test of variable deletion
const	$\chi^2(3)$ = 23.6746*
tt	$\chi^2(3)$ = 31.7553*
dum745	$\chi^2(3)$ = 85.7070*
dum834	$\chi^2(3)$ = 58.1756

*Significance at less than 5% level.

Table 4
Block Granger Non-Causality in the VAR

Variables	L R Test of block non-causality.
revdefr	$\chi^2(2)$ = 3.6119
m3r	$\chi^2(2)$ = 3.0729
Infln	$\chi^2(2)$ = 26.5874*
revdefr & m3	$\chi^2(2)$ = 7.3549*

*Significance at less than 5% level.

TABLE 5

								Serial Correlation[1]		Functional Form [2]		Normality[3]	Heteroscedasticity [4]	
Dependent Variable	revdef(-1)	m3(-1)	Infln(-1)	intr	const	trend	$\overline{R}^2$	LM $\chi^2(1)$	F *F(1, 14)*	LM $\chi^2(1)$	F *F (1, 11)*	LM $\chi^2(2)$	LM $\chi^2(1)$	F *F (1, 20)*
revdefr	0.2651 (6.5466)*	-0.7415 (-0.245)	-9.017 (-3.596)*	-1.1731 (-1.243)	-0.087 (-0.12)	0.0715 (4.704)*	0.9809	(0.5987)	(0.3077)	(2.152)	(1.1932)	(2.5666)	(0.9482)	(0.9008)
m3r	0.00073 (-0.24527)	-0.1503 (-0.673)	-0.43674 (-2.355)*	-0.0982 (-1.408)	0.2599 (5.09)*	0.0006 (0.5388)	0.3616	(1.3884)	(0.7409)	(0.387)	(0.1969)	(0.42756)	(1.3756)	(1.3339)
infln	-0.00667 (-1.1109)	0.65175 (1.4560)	0.49852 (1.3399)	0.10966 (0.7833)	-0.115 (-1.13)	0.00124 (0.552)	0.4328	(0.0022)	(0.0011)	(0.509)	(0.2609)	(5.743)**	(0.4162)	(0.3857)
intr	-0.0086 (-0.8019)	-0.3389 (-0.422)	1.4544 (2.182)*	0.0979 (0.3906)	0.2947 (1.608)	-0.0064 (-1.598)	0.6995	(1.894)	(1.0363)	(0.056)	(0.0283)	(1.5911)	(0.1018)	(0.0930)

[1] Lagrange multiplier test of residual serial correlation. [2] Ramsey's RESET test using the square of the fitted values.
[3] Based on a test of skewness and kurtosis of residuals. [4] Based on the regression of squared residuals on squared fitted values. Tests are based on LM and F versions.
*Significant at less than or equal to 5% level. **Significant at 5.7% level.
For the revdefr equation, all the dummies except dum812 are significant. In the equations of m3r and infln, none of the dummies are significant. In the intr equation, only dum745 is significant.

Table6
LR Test of Deletion of Deterministic/Exogenous Variables in the VAR

Variables	L R test of variable deletion
const	$\chi^2(4) = 28.334$*
tt	$\chi^2(4) = 42.205$*
dum723	$\chi^2(4) = 11.7998$*
dum745	$\chi^2(4) = 94.726$*
Dum812	$\chi^2(4) = 14.0411$*
dum834	$\chi^2(4) = 84.266$*

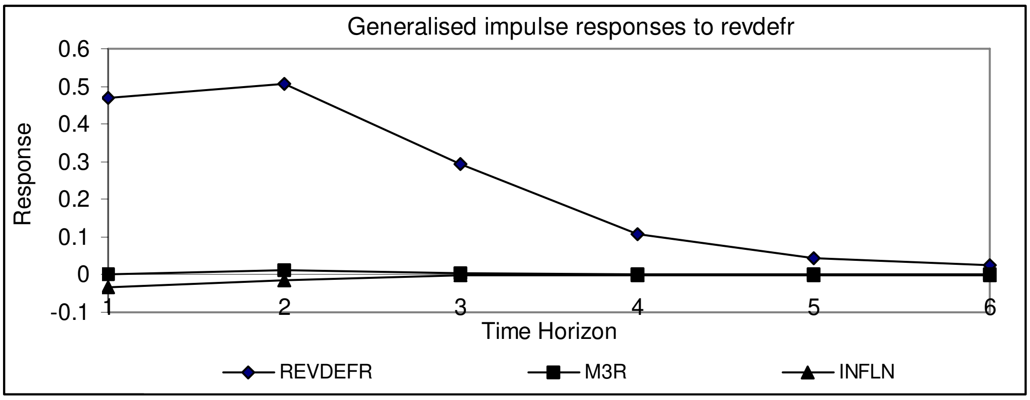
*Significance at less than 5% level.

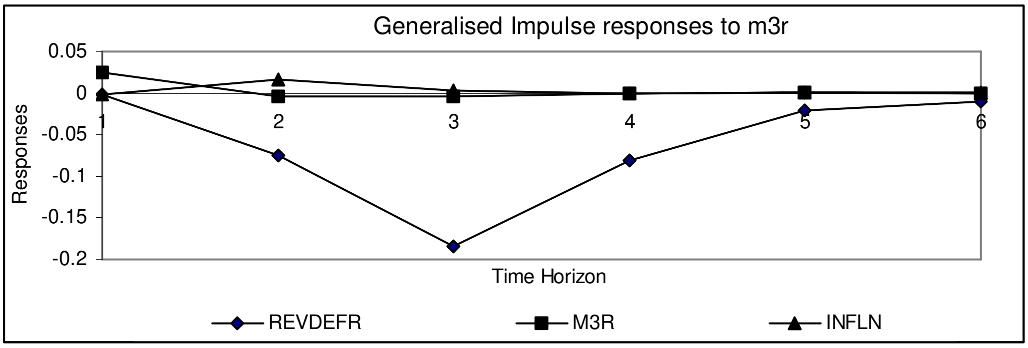
Table 7
Block Granger Non-Causality in the VAR

Variables	L R Test of block non-causality.
revdefr	$\chi^2(3)$ = 3.5532
m3r	$\chi^2(3)$ = 4.9978
Infln	$\chi^2(3)$ = 34.4027*
intr	$\chi^2(3)$ = 9.7432*
revdefr & m3r	$\chi^2(4)$ = 7.2349

*Significant at less than 5% level.

Impulses Responses in the model with *revdefr, m3r* & *infln*





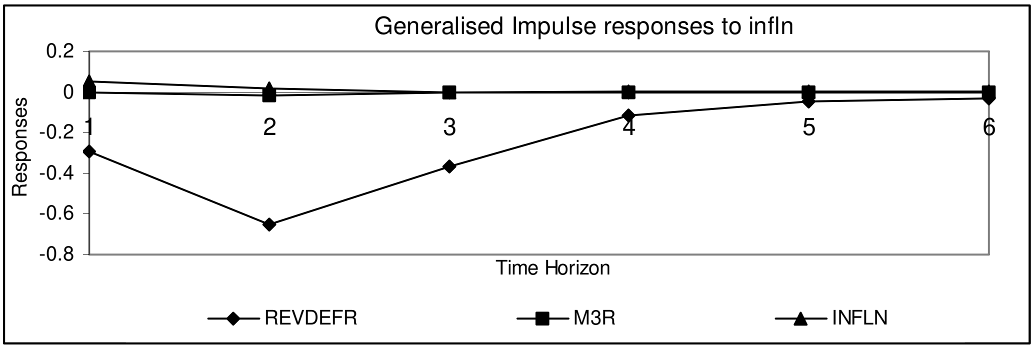


Figure 1

Impulses Responses in the model with ***revdefr, m3r, infln & intr***

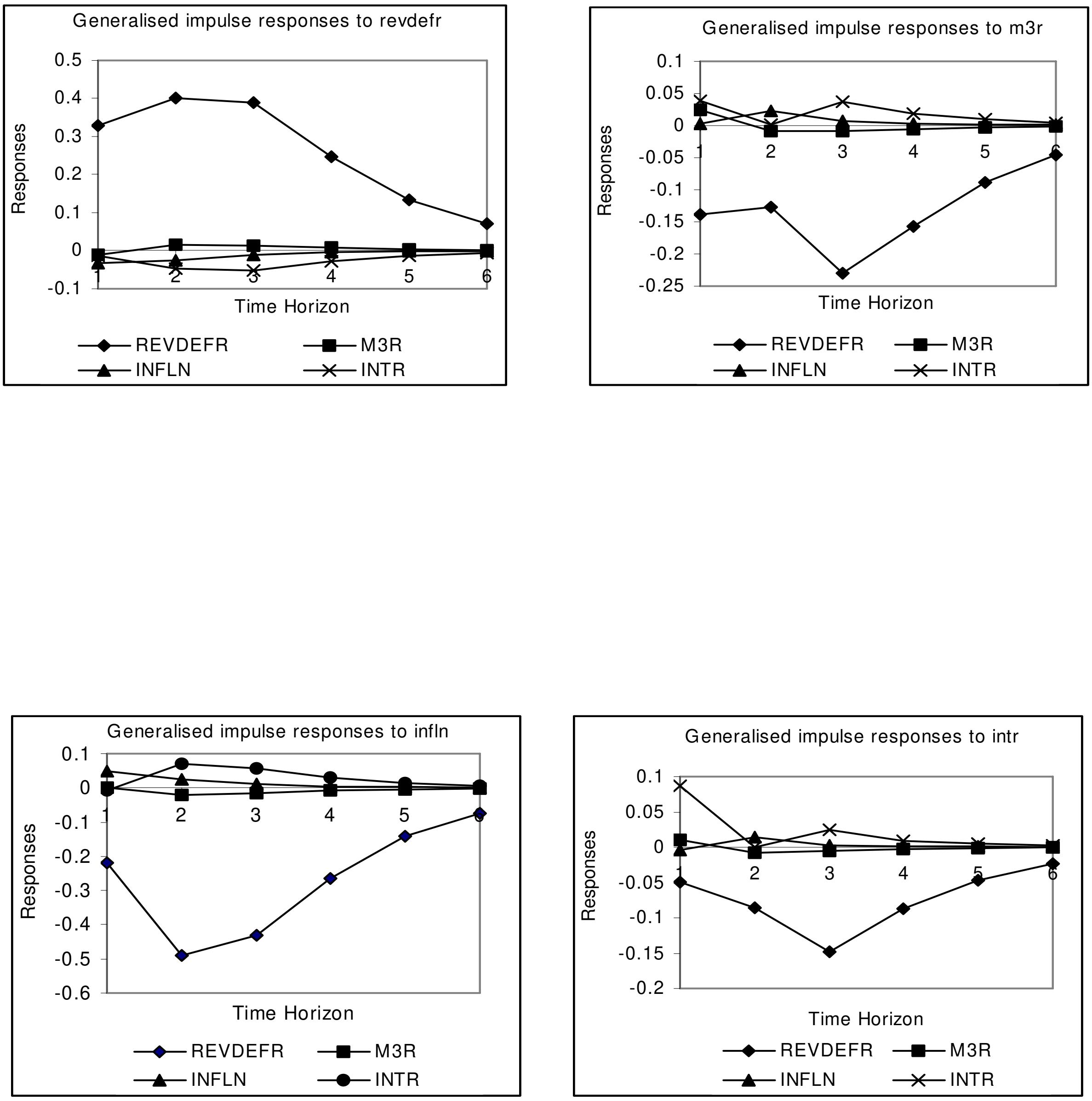


Figure 2