FISCAL AND OTHER DETERMINANTS OF THE INDIAN INFLATION RATE

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A critical macroeconomic objective, both when stabilizing the economy and laying the foundations for sustained growth, is to contain the inflation rate at moderate levels (preferably low single digits on an annual basis). Obviously, achieving this objective requires an understanding of the principal determinants of domestic price inflation, which in turn would guide the selection and application of appropriate policies over both the short- and longer-run. It is widely believed that by reducing the rate of growth of the money supply, which in most cases, and certainly in the Indian case, would require cutting the fiscal deficit, the inflation rate would be brought down. However, while the quantity theory of money's proportionate relationship between money growth relative to growth and inflation is well established as a longer-run proposition, there does not appear to be any systematic shorter-run relationship, say annually, between the inflation rate and rates of growth of the money supply and/or the size of the fiscal deficit or its monetary financed component as the principal source of monetary creation. Over the short-run, variables other than the inflation rate are also affected by increases in stock of money, especially output, which in turn influences the inflation outcome.

In the Indian context, Rangarajan (1995, p6) has noted that "Year-to-year correspondence between changes in money supply...and price level, is...a simplistic approach to the problem. The absence of such a relationship does not disprove the existence of an essential link between money supply, income and prices. What really matters is whether the relationship holds reasonably well over a period of time." Rakshit (1991) reviews the experience of the 1980's and finds that there is no systematic relationship between fiscal deficits and the annual rate of inflation, even though the fiscal deficit has been the preponderant source of monetary creation. Such findings are not unique to India. Reviewing a broader sample of countries, Blanchard and Fischer (1989, p513) conclude "...the data rarely show a strong positive association between the budget deficit and the inflation rate."

Clearly, it is important to get the longer-run relationships right as Rangaranjan states. Nonetheless, the widespread failure to relate the short-run behavior of the inflation rate to determinants such as the money supply and the fiscal deficit is disappointing. Aside from casting doubt on the economist's own understanding of the relationships between key variables, scant comfort is provided to policymakers for whom the short-run is politically important, while being advised to pursue policies with uncertain shorter-run effects.

1/ This paper was prepared by the author during his tenure as a visiting professor at the National Institute of Public Finance and Policy, New Delhi, while on a sabbatical leave of absence from the International Monetary Fund. Any views expressed in this paper are the author's and should not be attributed to the International Monetary Fund. The author is deeply indebted to Partho Shome for his encouragement, comments and suggestions, and for the conducive environment that he, together with the staff of the NIPFP, provided. The author thanks Hiranya Mukhopadhyay and Sunil Ashra for helpful suggestions, and the latter for his dedicated and efficient research assistance. He wishes to thank the participants of a NIPFP seminar for their contributions, in particular, Messrs. Bagchi, Balakrishnan, Kurian, and Pronab Sen, and also Indira Rajaraman. Any remaining errors are the responsibility of the author's.

Rather than conclude that there is something intrinsic about the short-run that prevents an adequate explanation of inflation, this paper seeks to respecify the inflation equation. The objective, using Indian data, is to estimate an annual inflation equation, with particular reference to India that exhibits systematic and predictable relationships between key macroeconomic aggregates, the central policy instruments, and the inflation outcome.

Drawing on the relationship that is developed, a related objective is to provide an assessment of how policy measures, including critical fiscal ones, can be deployed so as to improve the inflation outcome. An important issue concerns the appropriate measure to use to represent fiscal actions for the purpose of assessing their inflationary impact.

The next section proceeds with a brief review of traditional approaches, and especially the widely employed monetary approach, to determining the rate of inflation, focussing on some reasons why they have not yielded the desired short-run inflation equation. Section 3 develops the approach adopted in the paper to estimating inflation in the Indian context and presents some empirical results. Section 4 examines the scope for policy to influence the inflation outcome, and also the issue of the appropriate measure of fiscal actions. Concluding comments are offered in Section 5.

2. A traditional approach

a. Friedman's missing equation

To determine the price level or its rate of change, the two traditional basic approaches have either employed a variant of the quantity theory of money or some version of Keynesian mark-up pricing together with ancillary equations to determine movements in key input prices such as wages. Although alternative theories of inflation have been advanced, there is some consensus that inflation is best viewed as a monetary phenomenon. There may be different, even non-monetary, triggers of inflationary episodes, but the persistence of inflation requires the excess creation of money. The remainder of this section will focus on the monetary approach, with a passing mention of other approaches.

The monetary approach is based on the fundamental money exchange identity - a tautology which simply states that the money value of transactions over a given time period always equals the average stock of money times the speed or velocity with which it circulates during that time interval. Assuming that there is a stable demand for money to which the money stock is equated converts this identity into a theory that generates testable propositions. In its Cambridge version, the demand for money takes the form

$$M = kPQ = kY \tag{1}$$

where M is the money stock, k is the inverse of the income velocity of money v, P is the price level, Q is the annual flow of real output, and Y is nominal output.

On equating the demand for money, assumed to be a stable function of nominal income (i.e k is stable) to its given supply M, equation 1 solves for the product term PQ = Y, or nominal output. An excess supply of money, for example, is eliminated by a rise in nominal income. As was emphasized by Friedman (1971), this macroeconomic model, which is based on the monetarist assumption of a stable velocity, yields a fundamental indeterminacy - it can solve for nominal income but not for the price or output components separately. The nominal income solution takes primacy because transactions are generally executed in monetary terms, with the circulation of money determining nominal values, even though the objects of supply or demand may be physical goods.

Moving to an alternative Keynesian version that is based on the assumption of a stable multiplier in place of a stable velocity does not improve matters. As Friedman notes, an excess demand for goods will, through the multiplier process, cause nominal income to rise so as to eliminate the excess demand. Friedman regards this issue of the indeterminacy of the price and output components as "...so important that it deserves to be stated explicitly and separately. Neither theoretical model has anything to say about the factors that determine the proportions in which a change in nominal income will, in the short run, be divided between price change and output change." (1971,p222). 2/

To solve for the rates of inflation or output growth separately, both theories have to bring in a deus ex machina that is not part of the model. 3/

This the monetarist approach does by assuming that output is given at its full employment or secular trend level so that the model solves for the inflation rate. The Keynesian approach instead assumes that prices are inflexible, which enables the model to generate an output solution. Rather than make these arbitrary assumptions, Friedman attempted to sketch a theory that would determine the division of nominal income growth between the inflation rate and the output growth rate. Unfortunately, while instructive his attempt was not sufficiently developed, nor does it appear to have been subsequently advanced, at least to my knowledge. 4/

Indeed, the profession appears to have paid scant regard to Friedman's concerns, and the belief remains widespread that the problem of the missing equation is readily resolved by simply estimating separate inflation and output growth equations. The apparent lack of success of these estimated equations in explaining the behavior of prices and output in the short-run could be attributed to a failure to take adequate account of Friedman's concerns. Specifically, these estimated equations do not observe the consistency requirement that Friedman indicated should be met. Because the general macroeconomic model solves for nominal output Y, obtaining a separate solution for P, by estimating a separate equation for it, requires that the equation determining Q also be consistent with the underlying solution for Y. Under the consistency requirement, solutions that are generated for any two of the three variables determine the solution for the third variable.

It might be noted that the standard monetary approach assumption that output is exogenously given at its trend level, automatically ensures the required consistency of the price level solution with the nominal income solution. This is because the last, as derived from equation 1, is the starting point for determining the solution of the selected endogenous variable. The assumption of full employment or trend output is imposed on the nominal income solution that equation 1 generates, which takes precedence. Likewise, the Keynesian assumption that prices are predetermined, insofar as it is imposed on the nominal income solution of that model, automatically ensures consistency of the output solution with that for nominal income. However, the practice of estimating separate price and output equations, but not the prior solution of nominal income, as is widely done in econometric models, does

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2/ The failure to derive the needed relationship has been attributed to the so-called "missing equation problem" (Friedman, 1971), which prevents the proper attribution of a change in money demand to real and nominal effects.

3/ Unless otherwise noted, the argument that is presented here applies equally to levels of variables such as the price and output levels and their rates of growth.

4/ McCallum (1973) provided a suggestive application on the lines set out by Friedman.

not automatically ensure that the consistency requirement is met thus giving rise to misspecification.

b. Some initial empiricism

It is useful to consider first whether any simple relationships exist between key macroeconomic aggregates and inflation in India. Chart 1 portrays for the period 1972-1994 annual movements in the rate of growth of the money supply (M3) and in the inflation rate (GDP deflator). As is evident from the chart there is no discernible relationship between the two series. This is confirmed by regressing the inflation rate on the money supply growth series, allowing for varying lags. An estimated equation with M3 growth lagged three years for the period 1974-1993 failed to yield any significant coefficients.

Growth in the money supply is a function of domestic credit operations and the accumulation of foreign assets. Over the period under review, the money supply series in India has been almost entirely dominated by the need to finance the fiscal deficit (Rangaranjan, 1995). Chart 2 relates the fiscal deficit, defined to equal gross additions to domestic and foreign public debts, to the inflation rate series and confirms the lack of any relationship. The situation is unchanged when the deficit financing measure, defined as RBI purchases of government securities less any increase in government deposits with the RBI, is used (Chart 3).

Empirical estimations in India appear to be largely in terms of the price level, which is often derived from inverting the money demand functions and relating the price level term to the discrepancy between nominal money supply and demand, using a partial adjustment mechanism (for example, Rangaranjan and Arif, 1990, and Yadav, 1994). 5/ These equations are in the central monetary tradition and subject to a number of problems. Inverting the money demand function of Equation 1, the price level is readily solved as

(2) $$P = M/kQ$$

Running a regression of P on M and Q will typically result in estimated equations exhibiting very good fits, as has been observed in many countries. However, these are likely to be spurious as the relationship will be influenced by any trends underlying the movement in the three variables so that what is in effect being captured is the relationship between trends. The variables themselves may be drifting off without any tendency to move to an equilibrium level. A pointer that they may not be stationary is provided by a diagnostic check on their Durbin-Watson statistics, which tend to be low as against a very high R-square. Ideally the time series on price level and nominal output should be rendered stationary. A simple way of doing so would be to take first differences, repeated if needed, and then testing for the presence of unit roots.

5/ The considerable body of work on estimating price equations for individual sectors has been well surveyed by Yadav (1994). In such work the overall price level is approached from its components. However, while individual sectoral estimation is needed to determine relative price movements and associated allocational and distributive effects, they are not required for estimating the overall price level. The reason, of course, is the fundamental dichotomy of money and value theory, whereby relative prices can be determined by reference to a general equilibrium system without money, but the scalar that applies a nominal magnitude to the relative prices is determined by money.

The predictive powers of equations that are derived from inverting the price level appear limited. For the equation estimated by Rangaranjan and Arif (1990) for the period 1975-1984, the mean absolute percentage error is found to be about 4 for static forecasts and 7.3 for dynamic forecasts. In terms of movements in the price level this might not appear large, but if translated into inflation rate terms, the implied range of errors is very large. Given an average annual inflation rate of 8.4 percent over this period, the estimated mean absolute errors would range from roughly one-half of the underlying inflation rate in the case of static forecasts, to more than three-fourths for dynamic forecasts, which allow for the cumulative build-up in forecasting errors. The model estimated by Yadav (1994) for the period 1970-1971 shows even larger root mean square percentage errors of 6.4 percent for the static simulation and 13 percent for the dynamic simulation, respectively.

In sum, simple empiricism does not reveal any relationship between key variables such as the rate of growth of the money supply or alternative fiscal deficit measures and the rate of inflation. This suggests that the relationship between these variables, if it exists, is more circuitous. Furthermore, estimated equations of the price level based on the monetary approach do not appear suitable for forecasting the annual inflation rate, even though they might exhibit extremely high R-squares, as the concerned series are unlikely to be stationary, leaving aside the issue of their consistency with Friedman's criteria.

3. An inflation equation for India

a. Deriving the equation

The approach to building a more satisfactory equation of inflation is to start from some general considerations about the inflation process that have been advanced over the years, many of which will be familiar (see, for example, Gordon, 1985). The rate at which the price level is changed reflects a variety of influences. On the one hand, there are pressures from the cost of supply side. Here factors such as the rise in intermediate input prices, the nature of imported influences, domestic exogenous shocks and their effect on raw material prices, the efficiency of input use determine how strong the pressures are on producers and other price setters for raising prices. While different price setters will, of course, be subject to different mixes of influences and their desired responses will vary, a reasonable approximation at an aggregate level for all such influences from the cost of supply side is to use the previous period's rate of inflation to represent the build up in price pressures. A separate term should be introduced to capture the effect of administered price changes.

Use of the previous period's rate of inflation, the first term of the inflation equation set out in 4 below, is based on the widespread observation that the inflation process contains an inertial element. By this is meant the tendency for an ongoing inflation rate to perpetuate itself. The underlying process is circular - the increase in the prices of yesterday's production contributes to the increase in prices of today's production, directly when yesterday's outputs are today's inputs, or, less directly, when increases are induced in the prices of key inputs for today's production. The most important input is usually labour, which will attempt to ensure that its real wages are not eroded, although whether it succeeds will depend on how well organized and powerful it is. While the process described so far is essentially dominated by recent past developments, expectations of the likely future course of inflation could also influence current price-setting behaviour. For example, the desired rate of increase in wages could be influenced by expected future inflation, in addition to the experienced rate of inflation.

The second term of the inflation equation takes account of administered price increases. These would comprise adjustments in indirect taxes, subsidies, administered

prices (some 15 percent of the GDP deflator in India covering items such as petroleum, steel and cement).

Whether suppliers will succeed in pushing forward their escalating costs or not will depend on the demand for their output. The influences on demand are many, extending from government demands to those of exporters (foreign import demand), with the demands representing different purposes such as consumption or investment. The individual price-setter will, of course, focus on the input and output prices it is likely to face. Such information will enable it to charge appropriate prices, taking account of the strength of demand for its own products, the demand interrelations with other goods, and the behaviour of competitors. Rather than be simply guided, as under static expectations, by the observed past rates of inflation, experience of a varying inflation rate would make it more profitable for the producer to take better account of the future course of inflation. The period for which the forecast is needed would depend on which aspect of production is of concern, whether the annual production plan or a long lasting investment project, multi-year wage contracts, and so on. In general, forming expectations about the future course of inflation would be an important ingredient in current pricing and production decisions.

An important distinction needs to be drawn between the expectations behaviour of the individual price-setter and that of price-setters as a group. The individual unit is more concerned with relative price movements that relate to its own production. Because movements in these relative prices are superimposed over the general trend of price increases, the individual must project the overall rate of inflation so as to be able to determine the relative price component. 6/ Rational behaviour would require that the individual learn the process by which the overall inflation rate is determined, in addition to those processes that determine relative price movements of concern to it. In this regard, the individual needs to appreciate that the relative price aspects of concern to it and other individuals disappear on aggregation, and that what matters to the determination of the overall rate of inflation is the balance between aggregate demand and supply, rather than the individual commodity excess demands or supplies.

If the aggregate ex ante demand matches ex ante supply, suppliers as a group will just be able to pass on their rising costs. Inflation will then be driven by the inertial element and the received or underlying inflation rate will tend to be perpetuated. This, of course, assumes that the required monetary accommodation is taking place, otherwise ex ante demand would be constrained to decline. In the event of aggregate excess demand, the price level will be bid even higher than that implied by the inertial component and the inflation rate will worsen.

These demand and supply considerations are captured in the inflation equation by including a term to represent the net excess demand. Upto this point the specification of

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6/ Lucas (1973) has made much of the distinction between relative price shifts and the general rate of inflation and the potential for the individual producer to confuse the two, as the foundation for his theory of aggregate supply. Deviations in output or supply around its trend, full capacity utilization path, are the result of such confusion which causes individuals to either over- or under-produce, with capacity production prevailing when the confusion is eventually eliminated. It is noteworthy that this approach preempts any role for demand factors as an independent determinant of the fluctuation.

the inflation equation follows conventional lines (see Gordon, 1985). 7/ The principal point of difference is in the specification of the excess demand variable. A widespread approach is to use the deviation between actual output and its potential or full employment level to represent demand pressure on the economy. While such a construction might appear acceptable in an ad hoc, eclectic, theory of inflation, it begs the issue of inflation determination by implicitly assuming that output has already been determined. Instead, just as with inflation, output should be an outcome in the process of resolving the excess demand. Nor are matters improved by expressing the excess demand as a deviation of nominal GDP from its nominally valued trend level, or the corresponding expression in grwoth terms. The price level term common to both nominal GDP and its nominally valued trend counterpart can be factored where e is a stochastic error term. 8/

The approach here is to characterize aggregate excess demand in a manner that is consistent with the underlying macroeconomic model's determination of nominal income. Excess demand, which triggers the inflation rate adjustment, is defined as comprising two elements - a demand element y indicated by the solution of the underlying macroeconomic model for nominal income growth, which equals the sum of growth in aggregate demands, and a supply element that is also nominally valued. Formally,

(3) $ED = y - \{(1+p_{-1})(1+\hat{q}) - 1\}$,

where ^ denotes the potential rate of growth.

The potential supply available to the economy could be determined in different ways, the simplest being to estimate the trend rate of production as is done here. 9/ How should this be valued? Given that our concern is with determining the current rate of inflation, this should not, of course, be used in valuing potentially available supply. The procedure adopted is to value current potential supply at the previous period's prices. The justification for using the inertial rate of inflation to value potential output growth is that this is what is potentially available at prices that cover the rise in costs. If this growth in nominal potential supply differs from the growth in nominal demand, the underlying or inertial rate of inflation would be modified. The rate of inflation thereby determined becomes the basis for splitting the growth in nominal income between its nominal and real components, which in turn depends on the structure, organization, and behaviour of the economy.

The steps noted above are summarized in equation 4,

(4) $p = ap_{-1} + bpa + cED$

7/ Gordon sets out what may be referred to as the "mainstream" or "eclectic" formulation in which inflation is influenced by the inertial element and the increase in wage costs. The latter are influenced by expectations and the state of excess demand in the economy. On substitution for the wage term in the inflation equation, an expression that has a resemblance to equation 5 here is obtained.

8/ Under rational expectations EX(p)=p, where p is as defined in 4. In a stochastic environment, unanticipated shocks will cause the actual inflation outcome to differ from its expected level. If administered price changes are not known in advance, these would feature as part of the error term that is identified ex post.

9/ Instead of fitting a linear trend, a Hodrick-Prescott method could be employed.

where p_{-1} refers to the previous period's rate of inflation as an indication of inertial inflation, pa denotes the inflation in administered prices, ED represents excess demand growth, and a,b, and c denote coefficient values.

Assuming that the preceding equation represents the correct model of the inflation process, rational transactors will anticipate this model. The inflation outcome would then equal its expected level plus an error term

(5) $\quad p = EX(p) + e$

where e is a stochastic error term. 10/

b. Interpreting the equation

The inflation equation derived here is compatible with any theory that determines nominal income growth. Perhaps the simplest such theory is the closed economy version of the quantity theory of money, where velocity is assumed constant, but no prior assumption is made that output is always equal to its potential level. The money supply is then determined as

(6) $\quad M = D$

where D denotes the credit extended by the monetary system.

Equating 6 to the demand for money in 1, generates the nominal income solution in terms of the determinants of the money stock. Expressed in incremental growth terms,

(7) $\quad y = v(dD)/Y_{-1}$

Using 7 to substitute for y in the excess demand term of equation 4 generates the following solution for the inflation rate,

(8) $\quad p = ap_{-1} + bpa + c[v(dD/D_{-1})d_{-1} - (p_{-1} + \hat{q})]$

where $d_{-1} = D_{-1}/Y_{-1}$ is the ratio of the previous period's credit extension to nominal GDP and, to save on terminology, the approximation $(p + \hat{q})$ has been used in place of the exact expression in 3 above.

Several features of the above equation are of interest. The rate of growth in nominal income is determined by the rate of growth in credit, the assumed control variable rather than the rate of growth in the money supply, which is the outcome of the credit operations. In equilibrium, the excess demand term, which drives the inflation process, will disappear

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10/ Under rational expectations EX(p)=p, where p is as defined in 4. In a stochastic environment, unanticipated shocks will cause the actual inflation outcome to differ from its expected level. If administered price changes are not known in advance, these would feature as part of the error term that is identified ex post.

and the rate of inflation will equal its lagged value. 11/ If now the rate of growth of credit is increased, an excess demand will emerge, which will drive up the inflation rate. Keeping the rate of credit growth at its new level, the inflation rate will continue to rise until the rate of growth in the nominal value of potential output equals the rate of growth of credit, at which point a new equilibrium is reached. This new equilibrium will be characterised by a higher rate of inflation and a higher rate of money growth. The inflation equation thus shows the transmission mechanism through which a monetary action impacts on the inflation rate and the process by which a new equilibrium is attained. The precise dynamics of the process will, of course, depend on the structure and institutions of the economy, including those governing price setting behaviour, and the conjunctural position of the economy.

If it is assumed in accordance with the standard quantity theory of money postulate that prices adjust to ensure that actual output growth is always equal to potential output growth, then the inflation rate can be inferred directly from equation 1 by inverting it and solving for the price term. 12/

A distinction could be drawn between a positive excess demand and a negative excess demand or net excess supply on the grounds that price setting behaviour between these two states could differ. A reason for the possible asymmetery in inflation responses is that in excess supply the willingness to accept a price reduction is constrained by the need to cover rising costs that the enterprise will be experiencing as a consequence of inertial inflation. While some of the excess supply could result in higher inventories there is now scope for reducing supply. Rather than accept a loss it might pay the enterprise to scale back production. In contrast, an excess demand can more readily be dissipated by price increases. Although some offset could be provided by reducing inventories, there is less scope for production increases beyond the potential supply level. Accordingly, excess supply would be characterized by a negative coefficient that is lower than the positive coefficient attached to the excess demand term.

To capture the asymmetric response, two terms are introduced in a variant of equation 4 to represent excess demand or supply, respectively. In some years the situation will be one of excess demand, while in other years an excess supply could prevail. The inclusion of both terms in the equation requires that the data be made specific to each term. This is done by assigning the weight 0 to the excess demand series for those years in which an excess supply prevails. Similarly, the excess supply series will contain 0's for those years in which an excess demand prevails.

c. Estimates

The procedure adopted here is to estimate the inflation equation for the period 1973 - 1991, so that observations falling after 1991 (three observations comprising 1992-1994) can be used to test the forecasting ability of the selected equation. The GDP deflator is used as the measure of inflation. This is tracked closely by the wholesale price index, but at times deviates substantially from the consumer price index.

11/ The complication posed here by the presence of the administered price term is easily removed by assuming, at any rate for the long-term, that administered prices will rise at the same rate as the underlying rate of inflation so as to avoid any buildup in subsidies, etc.

12/ Equation 4 becomes redundant.

In determining the potential available supply from the trend rate of growth of output, allowance has to be made for the effect of supply shocks such as droughts or bumper crops, which can be especially important for a predominantly agricultural economy like India. The procedure adopted here is to take the fitted trend line and adjust it for any outliers, which are determined by imposing a statistical criterion involving a critical band around the trend line. Outliers were observed for five years over the period 1970-1994: 1972, 1979 and 1991, when adverse drought related supply shocks occurred, and 1975 and 1988, when weather conditions were highly favorable and bumper crops were recorded. Chart 4 shows the resulting growth trend line and the fluctuations of actual output growth around it. Observations that fall within the critical band but deviate from the trend line are presumed the result of stochastic factors and demand fluctuations, but not a supply shock.

Table 1 presents the results from estimating three variants. Each of these variants exhibits satisfactory statistical properties for the estimated regression line, both in terms of goodness-of-fit and serial correlation properties. A dummy term has been introduced to take account of the fundamental regime change that occured in 1991 when liberalization was launched. Common to all three of them the dummy term is not significant. However, for the reasons stated earlier regarding the regime change, this term is not dropped.

Table 1

India: Estimated Inflation Equations, 1972-1991

Independent Equation p	p_{-1}	p_{-2}	pa	EDI	ESI	ED	D^2/	$\bar{R}^2$	DW
Equation No.1/ (9)	0.83 (10.29)		0.14 (2.83)			0.94 (13.14)	0.01 (0.58)	0.87	2.26
(10) p^2 3/	-0.87 (4.07)							0.4	1.86
(11)	0.71 (7.18)	0.10 (1.59)	0.15 (3.24)			0.91 (12.78)	0.01 (0.74)	0.89	2.52
(12)	0.75 (8.92)		0.14 (3.13)	1.11 (9.91)	-0.79 (7.42)		0.01 (0.81)	0.89	2.42

Source: ***Author's calculations.***

1/. Items in parenthesis are estimated t-ratios.
2/. Assigned the value 0 for all prior years and 1 for 1991.
3/. Second difference of the price level; constant term (0.81 with t-ratio of 3.78) not shown.

In the first variant, equation 9, the excess demand and excess supply variables are combined into a single excess demand variable possessing a common coefficient. The results demonstrate the very high significance of the inertial term and of the excess demand variable and a significant coefficient for the administered price adjustment term. Results from testing for the stationarity of the inflation series are presented in equation 11 in the table, where p^2 represents the first difference of the inflation term or the second difference of the price level. These results confirm that the inflation series is stationary.

In the second variant, equation 11, it is hypothesized that the effect of inertial inflation is not exhausted by the previous period's inflation but that there are residual effects from the period prior to that. The second lag on the inertial inflation term is found not to be significant. This variable is dropped in the third variant, equation 12, which splits the excess demand variable into a positive excess demand and negative excess supply variable, in terms of their effects on inflation. The results show that the coefficients attached to both the excess supply and excess demand terms are significant, bear the expected signs, and the difference in the coefficient values is as hypothesized, with a higher positive value for the excess demand term and a lower negative value for the excess supply term. The last result would suggest that there is an asymmetry in the price response between an excess demand and an excess supply situation. However, the size of the standard errors surrounding these coefficient estimates do not preclude the possibility that the coefficients refer to the same sample, in which case there would be no asymmetry. 13/

Applying an F-test did not reveal that the unconstrained regression represented by equation 12 was statistically more significant than the regression equation 9, where the demand explanatory variables have been combined into one. Consequently, equation 9 becomes our preferred variant, which in addition is more parsimonius. Chart 5 shows that this version tracks inflation quite well over the sample period, reproducing virtually all of the turning points. The response coefficient of 0.94 for the excess demand variable indicates that when aggregate demand exceeds potential supply, 94 percent of the excess is converted into an increase in the inflation rate, suggesting that there is a small positive output response. 14/ Analogously, when potential supply exceeds the growth in demand, there is a small negative response of output of about 6 percent of the negative excess demand, with the bulk of the adjustment taking place in the inflation rate. The sum of the coefficients attached to the inertial inflation term and the administered price term is 0.97, or close to unity. This indicates that the equation has satisfactory long-run properties in the sense that when it is on its potential output path and there is no excess demand, the inflation rate will settle at the steady state level that is implied by the steady state rate of growth in the money supply. On the long-run path, the inflation in administered prices will have to reflect the general rate of inflation.

In appraising a theory it is more important to assess how well it forecasts than how well it tracks the dependant variable. Out-of-sample dynamic forecasting results for the period 1991-1994 are presented in Chart 6. Under dynamic forecasting prediction errors are cumulated as each successive year's forecast builds on the previous year's forecast and no attempt is made to correct for intervening year's errors. By choosing a sufficiently long forecasting period such as the three year horizon here, a more reliable indication is obtained about the validity of a theory. If the theory is a poor predictor, forecasting errors would become cumulatively larger. However, the chart demonstrates that the cumulative

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13/ The negative sign attached to the excess supply coefficient reflects the multiplication of the concerned observations by -1 so as to differentiate an excess supply situation, for which the observation would be positive, from an excess demand one. Pooling the observations of the two cases together in a single excess demand variable, transfers the negative sign back to the observation classified now as excess demand, so that it is correctly read as a negative excess demand, equivalent to a positive excess supply.

14/ This is easily determined by using the solved inflation rate p to deflate the prior solution for nominal income growth y to generate real output growth q = $\{(1+y)/(1+p)\}-1$.

forecasting errors are very small - the RMSPE is only 0.5 percent - thereby serving to increase our confidence in the approach. 15/

4. Fiscal and other policies to control inflation

a. Strategic considerations

The scope for policies to influence the inflation rate can be examined in the context of equation 4, proceeding successively through the various terms of that equation. We begin with the element of inertial inflation. Confronting it directly requires recourse to a prices and incomes policy, which regulates the rate at which prices and incomes can be increased. The standard objection to such policies is that they interefere with the free operation of markets. A related objection is that when the prices and incomes policy is lifted, the brake on inflation is found to be temporary. In response, several attempts have been made to design market friendly prices and incomes policies, and to link them to traditional macroeconomic stabilization policies. The hope of so-called heterodox stabilization policies is that the constraint on prices and incomes will exert a favorable effect on expectations so that less draconian cuts in fiscal deficits and credit allocations will be required. It is thereby hoped to avoid unduly severe contractions in output.

However, with rational expectations, the transactor will anticipate the short-run decline in the inflation rate as a consequence of the price and incomes policy but will not necessarily be persuaded that inflation will be permanently reduced, after the incomes policy is lifted, unless additional actions will be taken. In particular, transactors will be concerned about what will be done to contain the excess demands that the prices and incomes policy will have suppressed rather than being continuously eliminated through prices rising freely. If these excess demands are cumulated and carried forward, then when the controls are lifted the excess demand term in equation 4 will become larger. To contain the implied price explosion may require a much larger degree of financial restraint, including sharp cuts in the fiscal deficit over and above what might have been required had the prices and incomes policies not been introduced in the first place. Given that recourse to such policies was motivated by the wish to avoid painful real and financial adjustments, it is unlikely that the required sharper cuts in fiscal deficits later on in time will be made. This has been borne out by the mixed experience with the operation of prices and incomes policies and heterodox stabilization strategies.

Regarding the second term in the equation, attempts can be made to influence the inflation outcome by manipulating administered prices. A technique that is sometimes used is to let the exchange rate appreciate. The relief, however, is temporary. Aside from the allocational damage that is inflicted through imposing a hidden tax on exporters, the way is paved for a variety of fiscal and quasi-fiscal costs that will become manifest when the policy has to be eventually reversed. Other approaches involve delaying required adjustment in prices of critical commodities, restraining state owned enterprises from raising tariffs to ensure financial viability, and providing explicit increases in subsidies on various prices.

15/ Nonetheless, it should be noted that the dynamic forecasting test employs actual data on the determining variables in the inflation equation, except for the lagged inflation terms (including their use in valuing the growth in potential supply), which are as forecast.

These strategems are not sustainable as they carry a significant fiscal cost that could adversely impact on inflation through the the excess demand term.

For a sustained improvement in the inflation rate in a free market environment, there would appear no alternative to aggregate demand and supply management. As is evident from the equation, reducing the inflation rate requires generating excess supply. In the short-run, it is easier to do so by operating on the demand side, which explains the predominant emphasis on fiscal and monetary policies of demand restraint. However, such policies must be undertaken adroitly. In particular, they should avoid exerting any adverse supply side impact, that would make it more difficult to generate the needed excess supply for reducing inflation. For example, if the demand restraint is exercised through, say, the denial of working capital to enterprises, not only will they be forced, as intended, to cut down on their other outlays and demands, but the enterprises' potential supply will be lowered as an input needed to maintain production will no longer be available. In these circumstances, there will have to be an even bigger cut in demand to offset the adverse effects on supply.

It might appear more burdensome for the economy to generate the needed excess supply solely through demand cuts, as this could contract the real level of activity unduly. However, the final estimated form of equation 4 suggests that adverse effects on the level of activity are likely to be limited. Nevertheless, the frequent presumption that the supply potential can only be increased by long gestating investments in fixed capital formation or human capital building, which would justify exclusive reliance on demand management, is too pessimistic. Some scope for an enhanced supply response may exist even in the short-run, especially if there are present some bottlenecks and other impediments that have the effect of raising the costs of production.16/ Introducing more efficient institutional arrangements, practices and procedures can reduce transaction costs, thereby increasing the level of potential supply that is economic.

Fiscal policies could play an important role insofar as government interventions underly the higher transaction costs encountered by producers. The appropriate use of budget outlays to address critical bottlenecks may at times also make a significant contribution in the short-run. For example, an outlay that promotes the more efficient use of the existing transportation network, pending the longer drawn out improvements in physical capacity, could yield dividends. Such outlays need not be particularly costly - a relatively small sum spent on assigning more policemen to enforce traffic rules on the highways could pay for itself several times over by reducing high transaction costs faced by hauliers through excessively high traffic accident rates and very slow speeds of movement. Government procurement of additional inputs and their greater availability in an input constrained environment could also have the effect of increasing the supply

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16/ A simple criterion for assessing whether or not a measure enhances potential supply is that of improved profitability. Thus if a measure lowers transportation costs, activities dependant on transportation will at the underlying, previous period's, prices become more profitable. If those prices were to prevail, more supply would be forthcoming. While in practice quantifying the next period's potential supply response might be difficult, nevertheless some allowance should be made when using equation 4 to project the inflation rate.

potential, although this will only be sustainable if the input constraint is permanently eased, and the procurement does not lead to excessive increases in aggregate demand. 17/

b. Assessing the fiscal impact on inflation

The estimation of equation 4 established that the primary channel for influencing the inflation rate is through the excess demand variable. In the short-run, the demand side component indicated by the growth rate in nominal income is generally more amenable to policy influence than is the supply side. Consequently, the traditional focus has been on assessing the demand effects of fiscal and monetary actions. To establish these effects, a model is needed for determining the nominal income growth rate that explicitly identifies the role of fiscal and monetary actions. Such a model should also indicate the appropriate measure to be employed in assessing the policy effects.

In a monetarist model, fiscal actions are adjudged through their monetary implications. One convention is to measure the central bank financed portion of the budget, or the net borrowings from the central bank, which in India is given by the "deficit financing" measure. This measure is defined as the net increase in the RBI's holding of treasury bills and other government securities net of any increase in government deposits with it. 18/ The measure assesses fiscal policy through its contribution to high-powered money supply and can be readily justified by referring to to the basic monetarist model set out in Section 2, to which is now appended an equation of the money supply process.

(13) $M = Dg + Dp + EF,$

where Dg denotes the credit extended to the government sector by the banking system, Dp is credit to the private sector, E is the exchange rate in domestic currency terms, and F represents the net foreign assets of the banking system. 19/

Equating money supply from equation 13 to the demand for money set out in equation 1, shows that nominal income

(14) $Y = v(Dg + Dp + EF)$

or in growth terms where d refers to the increment in the variable to which it is attached

(15) $y = v(dDg + dDp + dEF)/Y_{-1}.$

17/ An example would be a drought induced adverse supply shock, which if not address would in the face of unchanged demand result in a price explosion. Releasing resources from a buffer stock or otherwise procuring foodgrains would be a supply enhancing response.

18/ See Rangaranjan, et.al (1994) for a discussion of fiscal measures.

19/ The form stated here refers to the creation of broad money (M3), which includes the credit operations of the money banks. By redefining the credit variable as central bank credit only and net foreign assets as those of the central bank, the equation explains the determination of high-powered money.

The above equation represents the reduced form solution for nominal income growth in a model where net foreign assets can be treated as an exogenous variable, which is only possible if the external sector is fully controlled, as was the case earlier in India. Insofar as the only fiscal variable that influences nominal income growth is the rate of growth of credit to budget, the same solution is obtained as would obtain in a closed economy version of the monetarist model. The deficit financing concept is then appropriate. It indicates the contribution of fiscal operations to nominal income growth and the excess demand variable in equation 4, and through it the impact on inflation.

It should be noted that the appropriate form of the deficit financing concept to employ in the inflation equation is the rate of growth of deficit financing, rather than its level. This is shown in Chart 7. Nonetheless, just as with the level variable, no systematic relationship with the inflation rate is exhibited.

However, the deficit financing concept is not appropriate in an open economy where the external sector is responsive to domestic developments and net foreign assets are endogenously determined. Rather than employ the basic monetarist model of an open economy, which assumes that nominal income growth is exogeneously given, that can only be justified if there is an infinitely elastic demand for exports, we employ a more general version in which nominal income growth is endogenous. The reduced form solution is

(16) $y=\{v/(1-z+zv)\}[(1-z)(\Delta Dg+ETrg+E\Delta Kg+\Delta Dp+ETrp+E\Delta Kp)+PxX-zY_{-1}]/Y_{-1}$ 20/

Here z refers to the average propensity to import, Tr represents net transfers from abroad, K is the net capital inflow from abroad, Px is the price of exports in local currency, and X denotes exports.

In the above model, the nominal income growth rate is affected by the growth rates of both domestic and external sources of financing. The fiscal impact is now measured by adding to the rate of growth in domestic monetary financing the rate of growth in foreign sources of financing of the budget (adjusting for the net receipt of foreign transfers). As before, the assessed impact on the nominal income growth rate is a component in the excess demand term of the inflation equation 4. However, as is evident from equation 16, there is considerable scope for offsetting movements in other variables such as exports or foreign transfers to the private sector. Consequenly, unless these other items are not controlled, the inflationary impact of the budget, even using the more appropriate measure argued for here would be obscured. This effect is indicated in Chart 8, which presents a plot of the rate of change in the broader deficit financing ratio against the inflation rate and shows no systematic relationship.

Instead of a monetarist framework, where expenditures are liquidity constrained, it could be argued that a Keynesian framework is more suited for non-liquidity constrained environments, and that this better describes the situation in India (at least until recently and for the fiscal sector). If so, the relevant concept of fiscal operations is based on the income and expenditure account of government, a summary expression of which would be the fiscal deficit. While increases in government expenditure are stimulative, these would be offset by increases in taxes.

20/ See Chand and Shome (1995) for a derivation of this reduced form equation for determining nominal income. Chand (1989) discusses the relation between the basic open economy monetarist model and the version set out above.

However, just as with the conventional monetarist measure of fiscal impact, the simple use of the fiscal deficit measure, which in India is defined as equal to the increase in gross indebtedness of government to the rest of the economy and the world, is not appropriate. In this instance it is because the model that would justify the simple use of the fiscal deficit to register the impact of government operations on nominal income growth makes the implausible assumption that revenue is not responsive to nominal income fluctuations. 21/ This could explain why using the fiscal deficit or its rate of change (Chart 9) does not exhibit any relationship with the inflation rate.

To overcome the problem of fiscal responsiveness to nominal income, the fiscal impulse indicator was developed many years ago. In Chand (1993) it is shown, by reference to a simple Keynesian model but without assuming price rigidities, that the fiscal impact on nominal income growth is given by the following fiscal impulse indicator:

$$(17) \qquad FI = a_{-1}\{[\Delta G/G_{-1} - \hat{y}\,](G/Y)_{-1} - [\Delta T/T_{-1} - \hat{y}\,](T/Y)_{-1}]\}$$

where a_{-1} is the multiplier lagged one period, $\hat{y}$ is the nominal potential output growth rate, G denotes government expenditures and T is government revenue.

Now the fiscal impulse influences nominal income growth together with impulses from the external sector (export and import operations), and the private sector (investment and consumption). Hence, even if the inflationary impact of fiscal operations is correctly assessed by FI, a simple plot of FI against the inflation rate may not reveal any systematic relationship, unless the fiscal impulse has been the dominant impulse throughout. The lack of such relationship is confirmed in Chart 10. Chart 11 reveals that the fiscal impulse has not been the dominant influence on the excess demand variable over the sample period, but that other influences such as from the external sector and domestic investment have also played a role.

To complete the use of an appropriately defined measure of fiscal impact on nominal income growth, some assessment should also be made of how the fiscal operations influence other sources of nominal income growth and the supply-side. Fiscal operations may exert a profound influence on the behaviour of other sectors, and an indication of an expansionary fiscal impact using the above measures may need to be modified to take such repercussions into account. For example, in an inflationary context, the payment of that portion of interest on government debt that merely compnensates the holder for the inflation induced erosion in real holdings should not be assessed as part of the inflationary impact of the budget (Tanzi, et al. 1993). The fiscal impulse measure should then be defined excluding such interest related outlays. On the other hand, strategically directed fiscal outlays could improve productivity to an extent that would significantly affect the potential aggregate supply response. The fiscal assessment should be adjusted for such a development.

21/ Just as with the monetary measure there is an issue as to whether the level or rate of change of the measure is the appropriate indicator of the impact on inflation. Given that the inflation equation is explained by a term that includes nominal income growth, it is how fiscal actions influence such growth that determines the measure. In general, the level of the fiscal balance is appropriate when the concern is with the level of nominal income, but its rate of change when determining the growth rate of nominal income.

5. Conclusion

This paper has argued that it is possible to identify the primary channels of influence on the short-run inflation rate in India. This required recourse to an underlying theory of nominal income determination by reference to which the inflation rate is determined. In the estimated inflation equation, it was shown that the main sources of influence include the key fiscal and monetary policy instruments, but that these enter in ways that do not permit a direct association of fiscal and monetary actions with the inflation outcome.

The paper considered the possibility that the lack of direct association could be the result of incorrect specification of the policy measure. It was argued that certain of the conventional measures of fiscal impact could only be justified by assumptions that are implausible in the Indian context. Alternative specifications of fiscal actions that appeared to better suit the environment were tried, but they too, did not generate the sought after direct association with the inflation outcome. This finding should not be construed as evidence of the lack of significance of fiscal actions for the short-run inflation rate outcome. To the contrary, the model-based measures of fiscal influence that were set out can be used to indicate the inflationary contribution of fiscal operations. However, such indications should be sharply distinguished from the actual inflation outcome, as the latter reflects the effect of other forces as well. Only if fiscal actions were the dominant influence, or the other forces could be controlled, would using a more appropriate measure exhibit a systematic association.

The conclusion is that fiscal and monetary actions do matter and are critical elements in a strategy of inflation reduction, both for the short- and long-run. They need, however, to be appropriately defined and placed in context.

References

Blanchard, O.J., and Fischer, S., Lectures on Macroeconomics,1989, MIT Press.

Chand, S.K., "Toward a Growth-Oriented Model of Financial Programming," World Development, Vol. 17, No. 4, 1994, 567-78.

Chand, S.K., "Fiscal Impact Measures and Their Fiscal Impact" Ch. 5 in How to Measure the Fiscal Deficit ed.,Blejer M, I., and Cheasty, A.,IMF,1993.

----------and Shome, P., "Poverty Alleviation in a Financial Programming Framework" in Studies on the Macroeconomic Dimensions of Public Finance ed.,Blejer M,I., and Ter-minassian, T. forthcoming 1996.

Friedman, M., "A Monetary Theory of Nominal Income", Journal of Political Economy, 1971, 323-337.

Lucas, R.E., "Some International Evidence on Output-Inflation Trade-Offs", American Economic Review, 1973, 326-324.

McCallum, B,T., "Friedman's Missing Equation: Another Approach" The Manchester School of Economic and Social Studies, Sept. 1973, 311-327.

Rakshit, M., "The Macroeconomic Adjustment Programme: A Critique", Economic and Political Weekly, August, 1991.

Rangaranjan, C., "Monetary Management: The Changing Framework", The Indian Economic Journal, Vol. 43, July-Sept. 1995, 1-10.

---------- and Arif, R. R., "Money, Output and Prices: A Macroeconometric Model", Economic and Political Weekly, April, 1990.

Rangaranjan, C., Basu, A., and Jadhav N., "Dynamics of Interaction between Government Deficit and Domestic Debt in India" ch. 3 in Tax Policy and Planning in Developing Countries ed., Bagchi A., and Stern N., Oxford University Press, Dehli, 1994.

Tanzi, V.,Blejer, M, I., and Teijeiro M, O., "Effects of Inflation on Measurement of Fiscal Deficits: Conventional Versus Operational Measures" Ch. 9 in How to Measure the Fiscal Deficit ed.,Blejer,M., and Cheasty, A.,IMF, Washington, 1993.

Yadav, N., Monetary Economics For India, Macmillan, India, 1994.

CHART 1

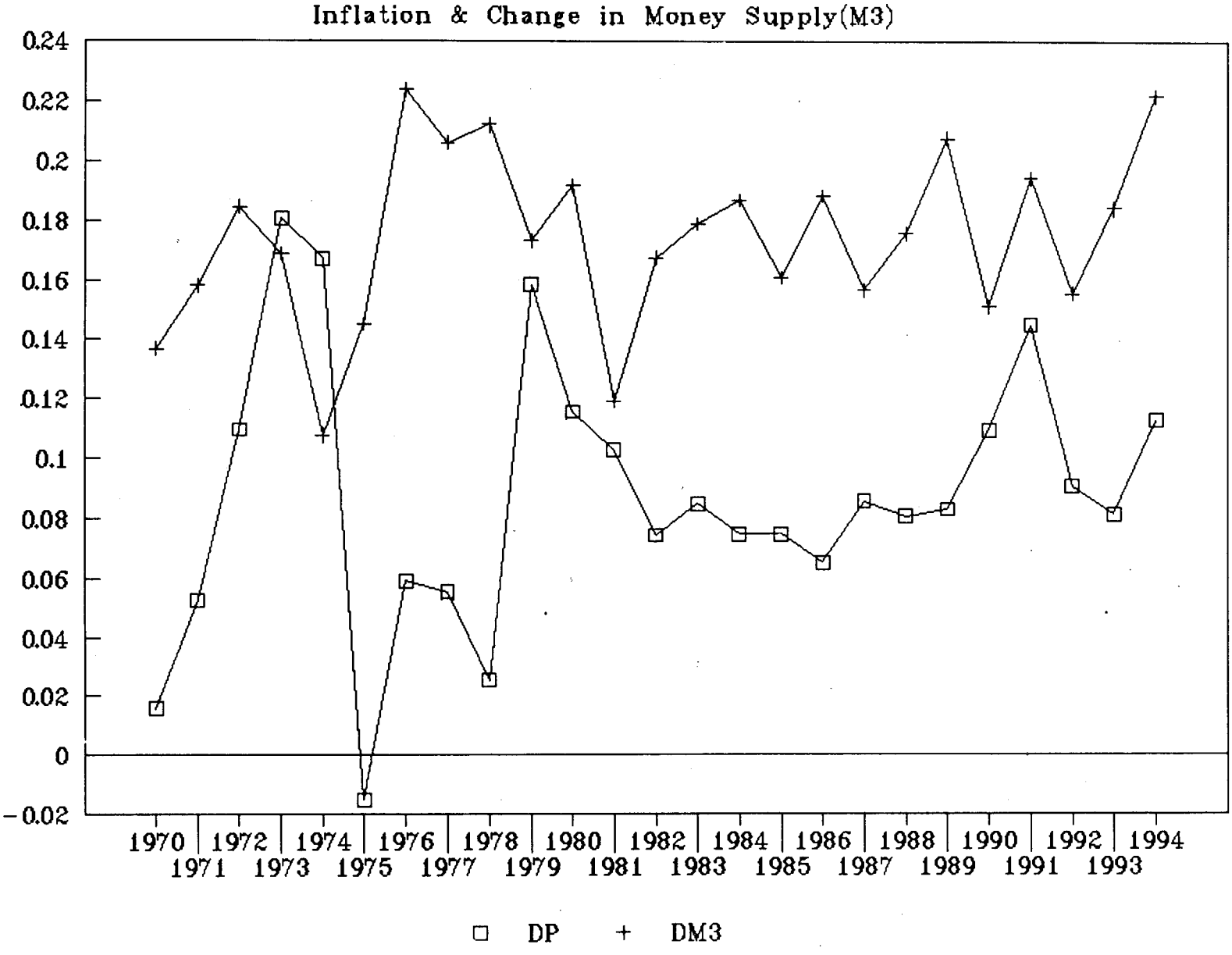

Inflation & Change in Money Supply(M3)
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
DP
DM3

CHART 2

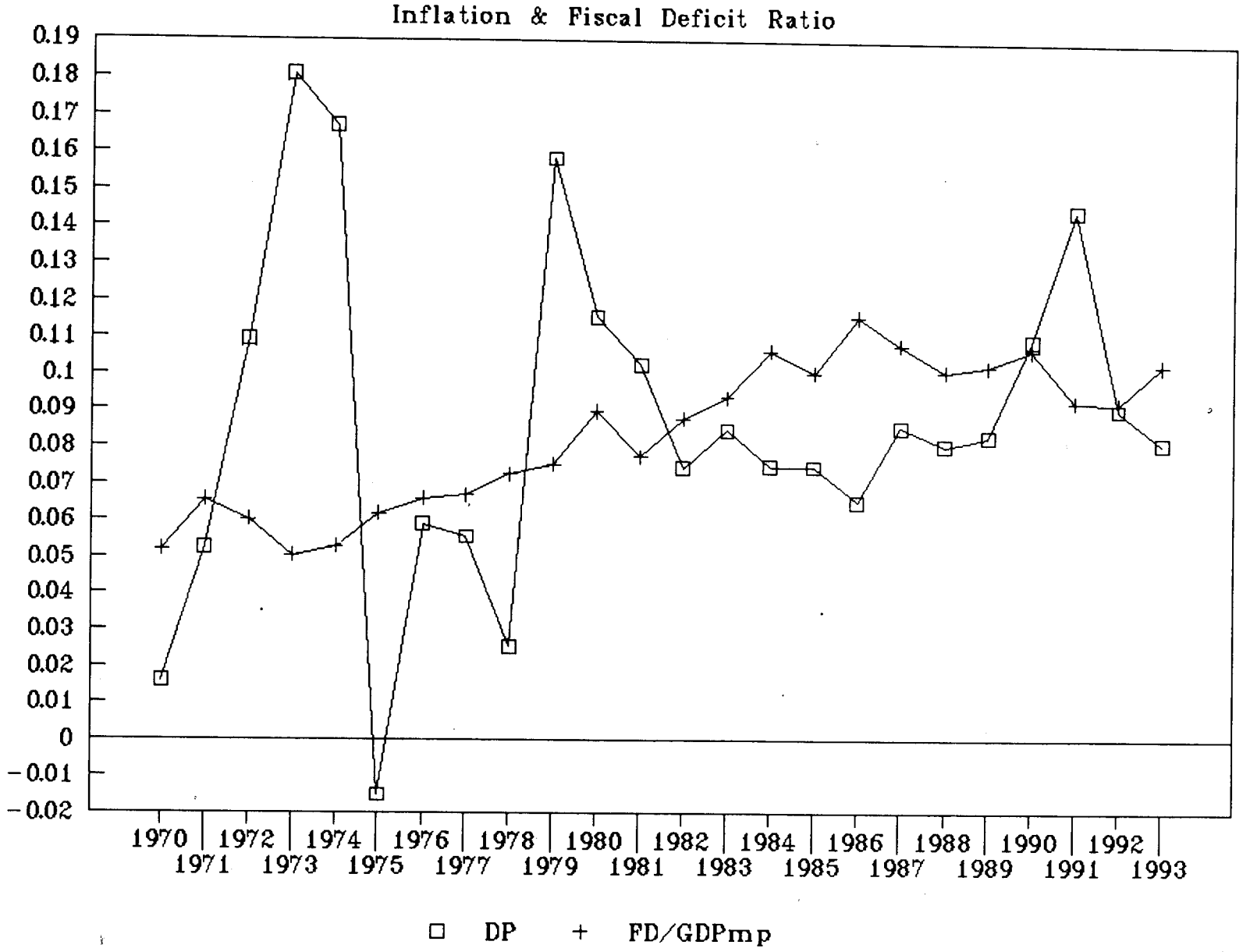

Inflation & Fiscal Deficit Ratio
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
□ DP + FD/GDPmp

CHART 3

Inflation & Deficit Financing Ratio

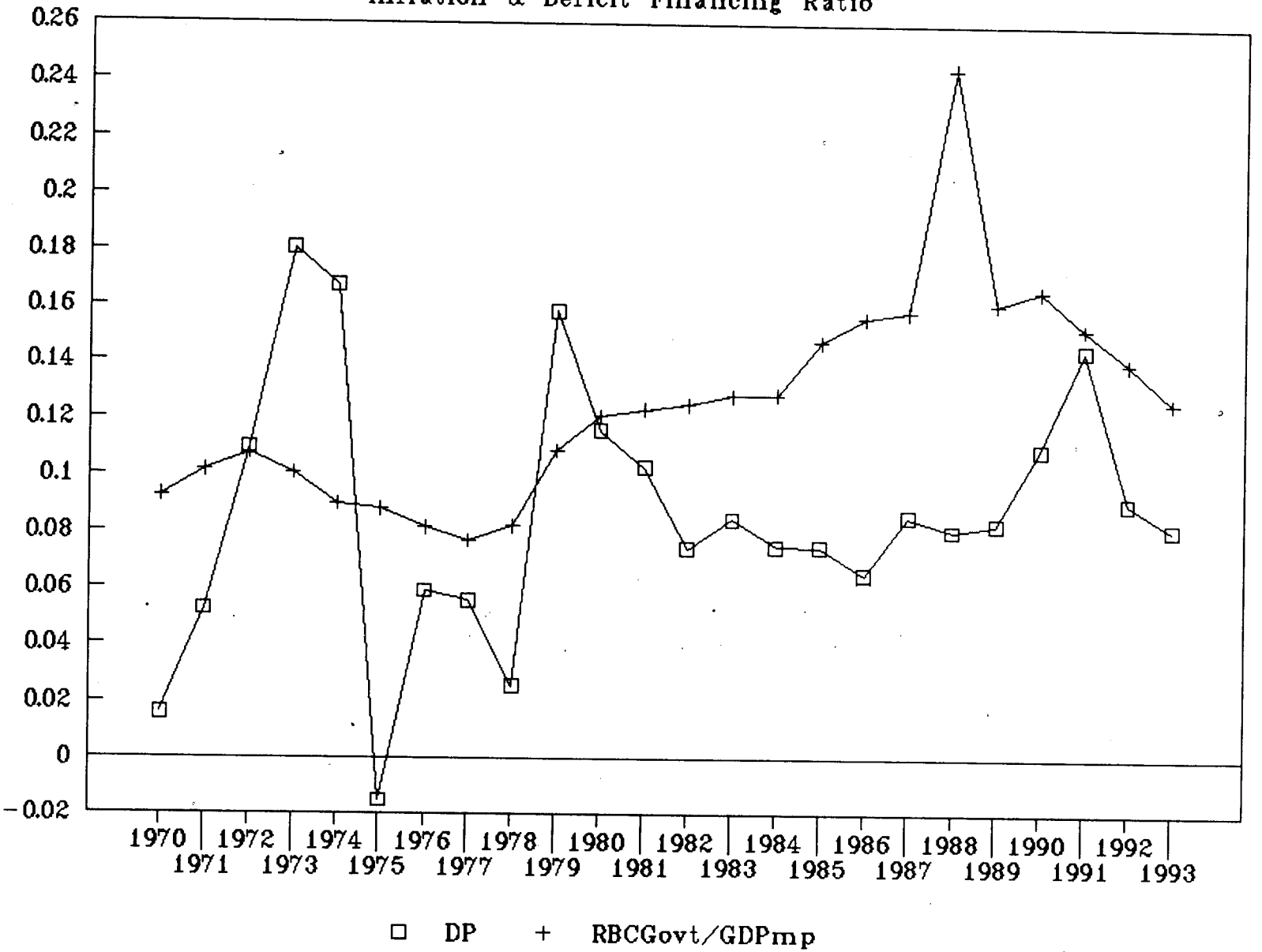


CHART 4

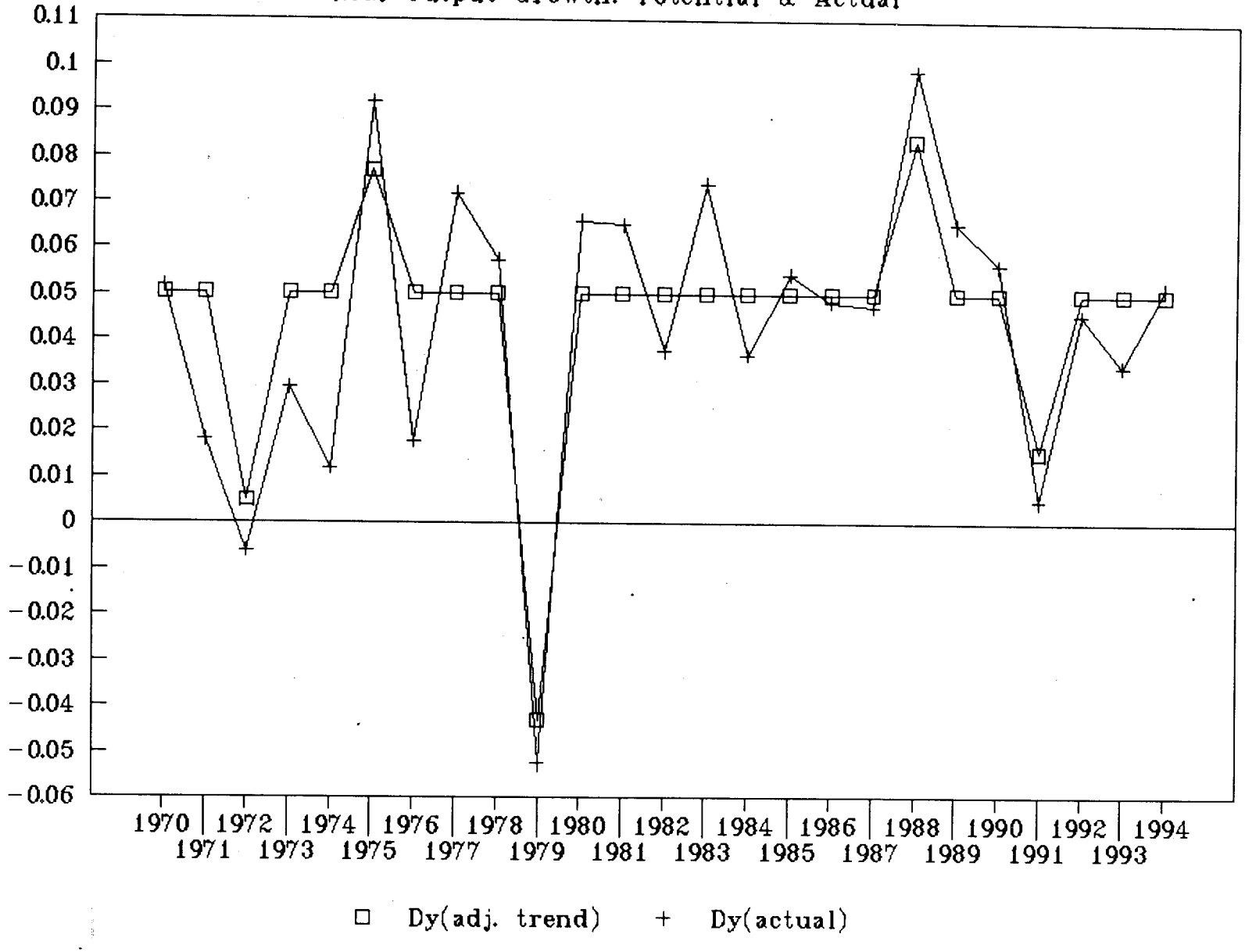

Real Output Growth: Potential & Actual
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
□ Dy(adj. trend) + Dy(actual)

CHART 5

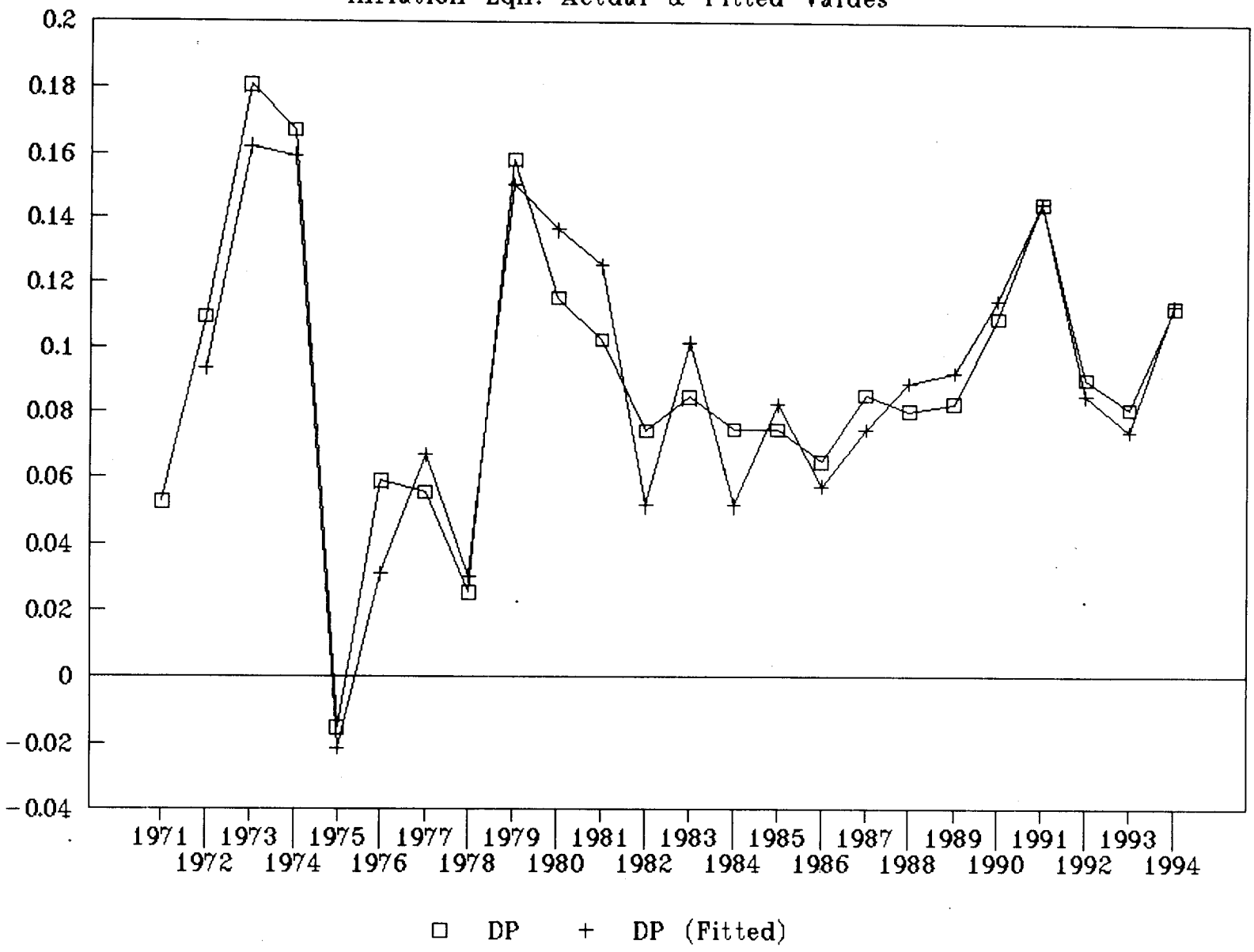

Inflation Eqn: Actual & Fitted Values
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
□ DP + DP (Fitted)

CHART 6

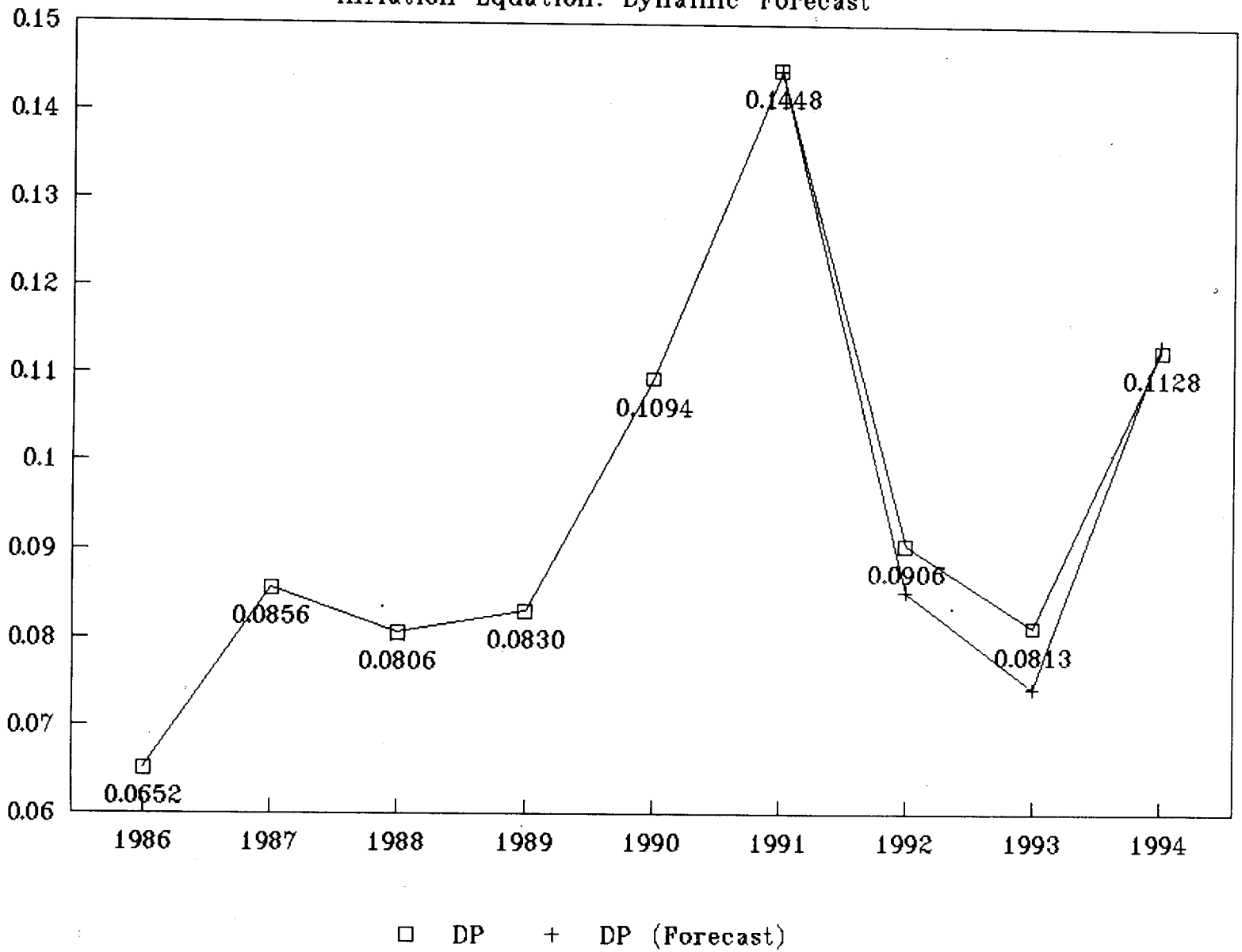

Inflation Equation: Dynamic Forecast
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.0652
0.0856
0.0806
0.0830
0.1094
0.1448
0.0906
0.0813
0.1128
1986
1987
1988
1989
1990
1991
1992
1993
1994
□ DP + DP (Forecast)

CHART 7

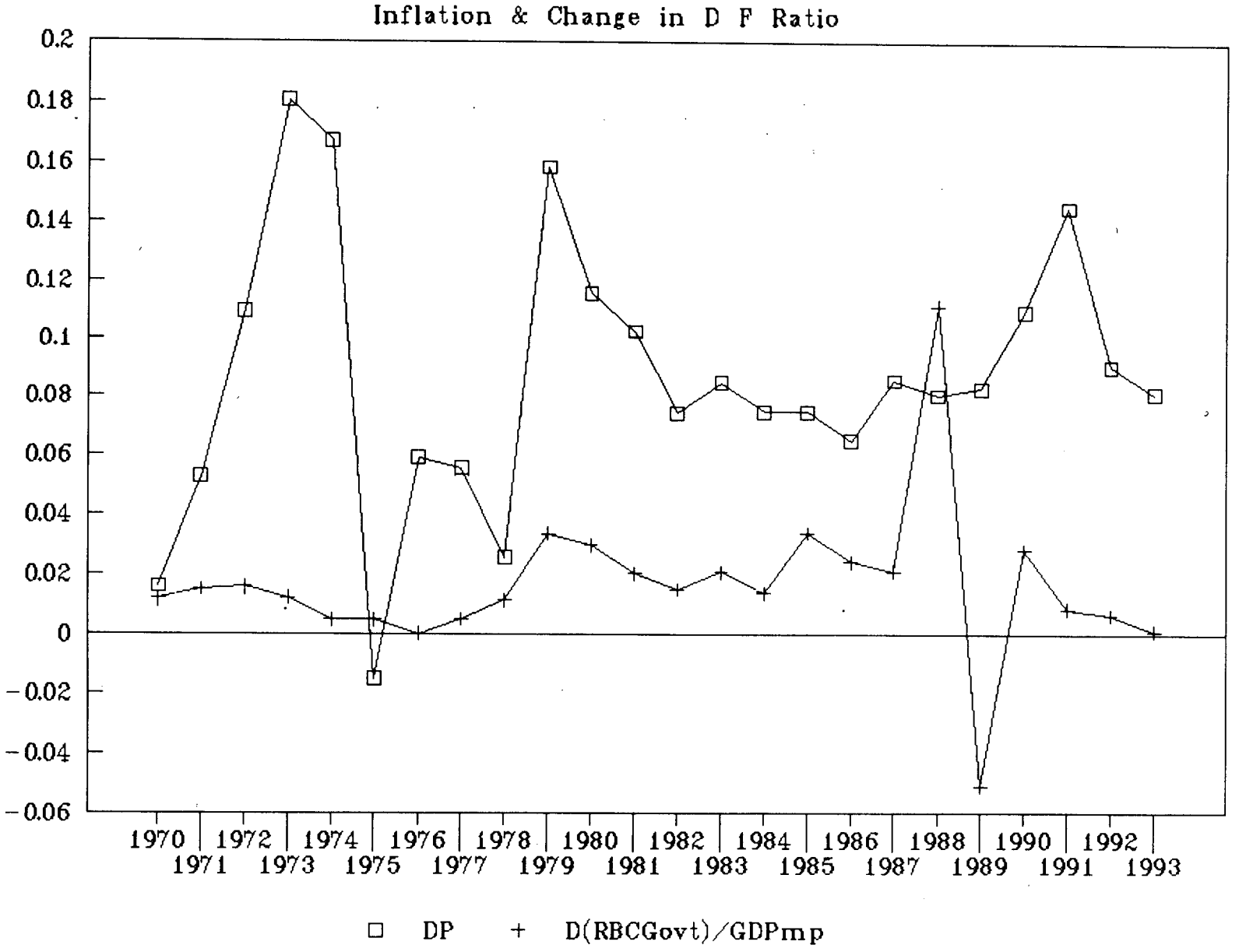
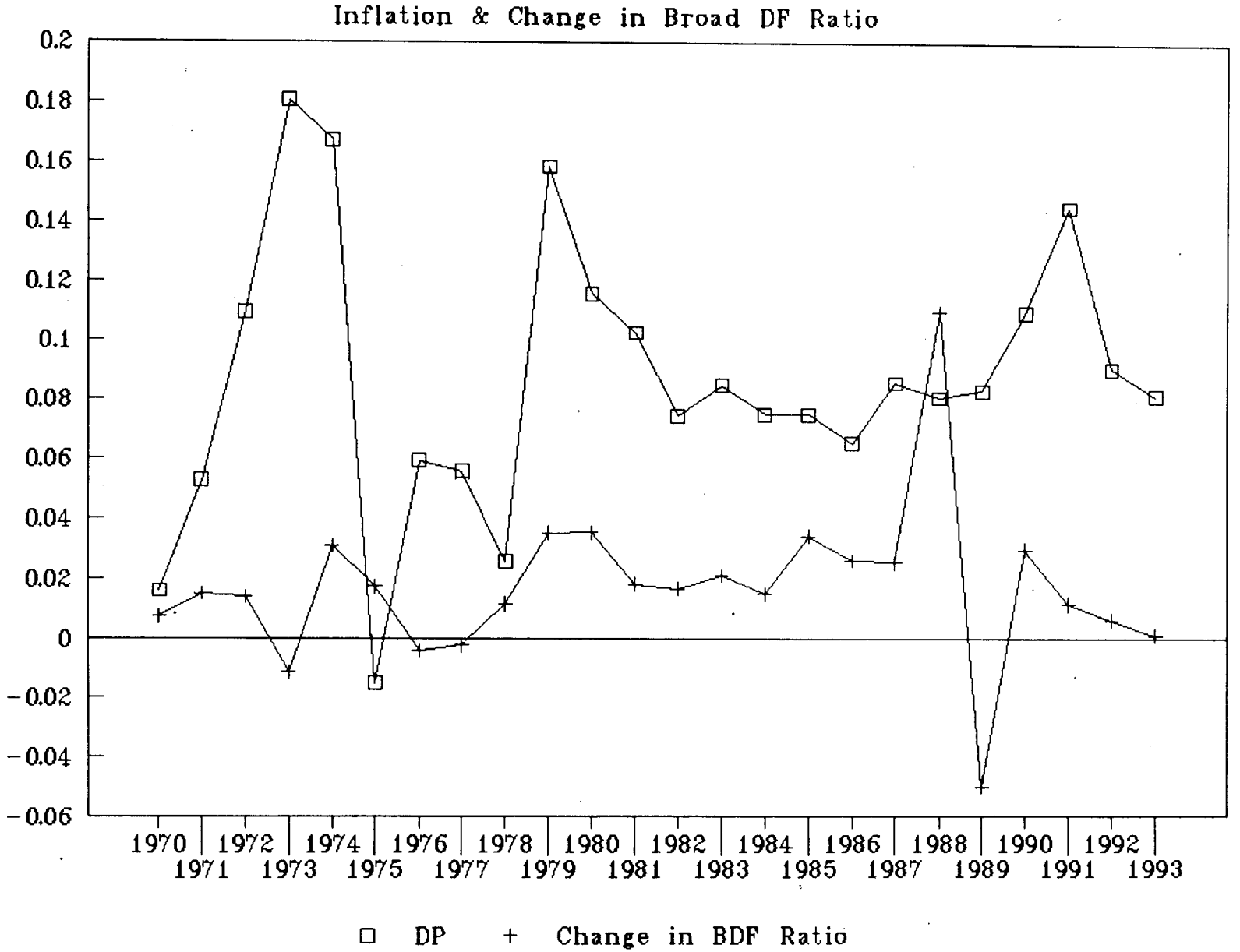

Inflation & Change in D F Ratio
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993
□ DP + D(RBCGovt)/GDPmp

CHART 8


Inflation & Change in Broad DF Ratio
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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1985
1986
1987
1988
1989
1990
1991
1992
1993
□ DP + Change in BDF Ratio

CHART 9

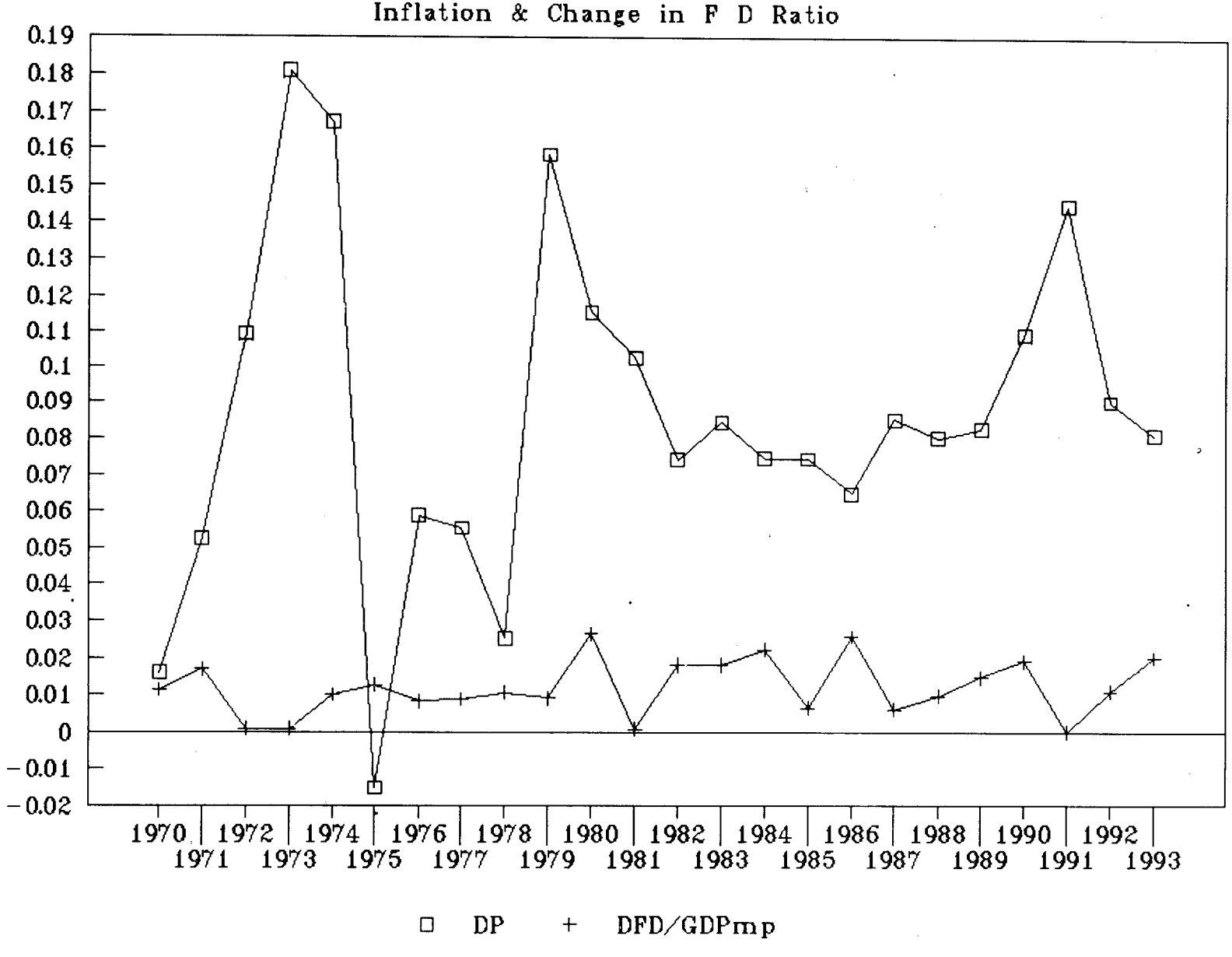
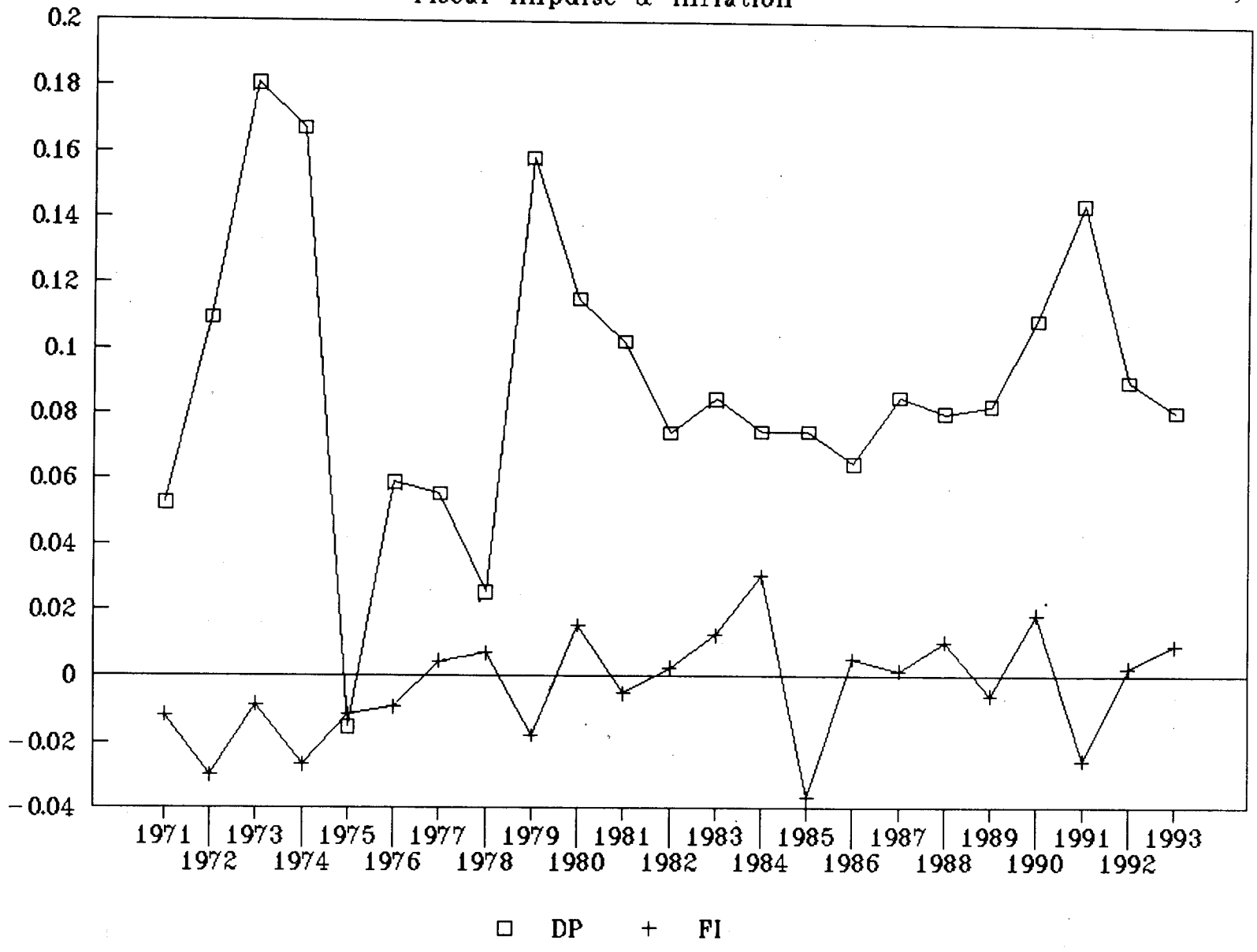

Inflation & Change in F D Ratio
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993
□ DP + DFD/GDPmp

CHART 10


Fiscal Impulse & Inflation
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
1971
1972
1973
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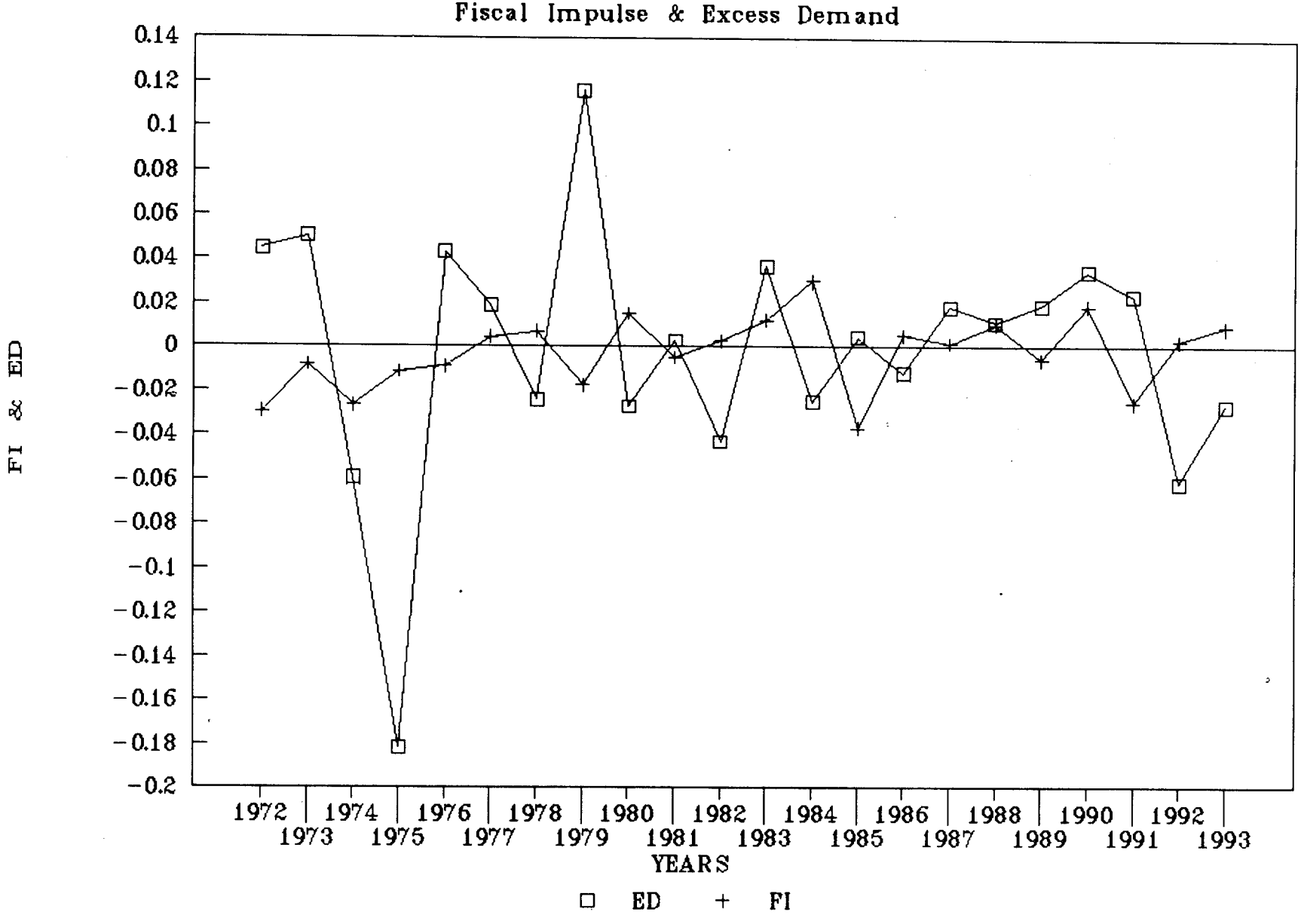
DP
FI

CHART 11


Fiscal Impulse & Excess Demand
FI & ED
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
1972
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1992
1993
YEARS
ED
FI