RESERVE BANK OF INDIA

OCCASIONAL PAPERS

VOL. 13 NO. 1 MARCH 1992

The Reserve Bank of India Occasional Papers contains contributions by the Staff of Reserve Bank of India. Articles, notes and reviews published in this journal do not necessarily reflect the views of the Editorial Committee or of the Reserve Bank of India. Responsibility for the views expressed and for the accuracy of statements contained in the contributions rests with the author(s).

Subscription rates for 1992 are :

Inland :
(i) Rs. 140 (for four issues of the 1992 volume inclusive of postage.
(ii) Rs. 35 (for a single issue of the 1992 volume inclusive of postage).

Foreign :
(i) $ 100 (for four issues of the 1992 volume inclusive of registered air mail charges).
(ii) $ 25 (for a single issue of the 1992 volume inclusive of registered air mail charges).

There is no special rate for any category of subscribers. Subscriptions and orders, accompanied by cheques/drafts drawn on Bombay in favour of Reserve Bank of India, should be sent to :

The Director,
DRRP (Sales Section),
Department of Economic Analysis and Policy,
Reserve Bank of India,
Amar Building (Ground Floor),
Post Box No. 1036,
Bombay-400 001 (India).

All other correspondence may be addressed to the Editor, Reserve Bank of India Occasional Papers, Department of Economic Analysis & Policy, Reserve Bank of India, Post Box No. 1036, Bombay-400 023.

RESERVE BANK OF INDIA

OCCASIONAL PAPERS

VOL. 13 NO. 1 MARCH 1992

ARTICLES Page

BOOK REVIEWS

Published by A. Vasudevan for the Reserve Bank of India and printed by him at Karnatak Orion Press, 17-18, Prospect Chambers Annexe, Dr. D. N. Road. Fort, Bombay - 400 001.

Reserve Bank of India Occasional Papers
Vol. 13 No. 1, March 1992

Industrial Inflation in India during the Eighties : An Explanation

Partha Ray & K. Kanagasabapathy*

The monetarist explanation of iflation seeks to explain it in terms of overall excessive liquidity generation, focusing in particular on profligacy of government budgetary operations. The structuralists, on the other hand, put the onus of structural bottlenecks, in particular the agricultural supply shocks. Industrial sector pricing is often modelled in terms of mark-up. Against this background, the present study addresses a particular question : if the mark-up pricing model of Indian industrial sector becomes valid, does the central bank have any role to play in arresting industrial inflation? Based on empirical examination, it is argued that the central bank can, in fact, play a significant role by targeting supply of credit to the industry as an intermediate instrument.

We have chosen five variables, viz., industrial price, wage cost, index of raw material cost, non-food credit, industrial credit and index of industrial capacity utilisation. Monthly data series were used for the period 1982-83 to 1990-91. We developed a model essentially following the mark-up approach set out by Balakrishnan for industrial pricing, but introduced credit as an additional variable. Equations estimated on the basis of an Error Correction Model, clearly establish credit as a determinant of industrial inflation with the relationship being direct.

The important policy implication is that quantitative credit restrictions to the commercial sector could remain as one of the major policy tools of the central bank.

Introduction

The nature of Indian inflation has been a subject to intense debate. Much of the discussion has been conducted in macro terms, sectoral inflation studies being few and far between. A journey through the relevant literature clearly enables one to discern two distinct, though not mutually exclusive, hypotheses. The usual monetarist explanation of in-

---

* Shri Partha Ray is Research Officer and Shri K. Kanagasabapathy is Director in the Internal Debt Management Cell. The authors are indebted to Dr. Pulapre Balakrishnan, Associate Professor, Indian Statistical Institute, Bangalore for his extensive comments and his guidance. Authors wish to thank Shri K.S. Ramachandra Rao, Dr. A. Vasudevan and Dr. S.L. Shetty for discussion on relevant issues and Shri S. Mohanan Pillai for his computing assistance. Shri A.B. Joshirao helped producing this paper. Errors and omissions, if any, would be the authors' responsibility.

flation, couched generally in aggregative terms, seeks to explain it in terms of overall excessive liquidity generation, focusing in particular on profligacy of government budgetary operations. The structuralists, on the other hand, put the onus on structural bottlenecks, in particular the agricultural supply shocks. Industrial sector pricing is often modelled in terms of mark-up. Against this background, the present study addresses a particular question: if the mark-up pricing model of Indian industrial sector becomes perfectly valid, does the central bank have any role to play in arresting industrial inflation? We will argue, based on empirical examination, that the central bank can, in fact, play a significant role by targeting supply of credit to the industry as an intermediate instrument.

For expository convenience, the study is organised thus: Section 1 sets out the theme of the study. Section 2 gives a resume of the Indian literature on the subject. An analytical description of data is provided in Section 3. Section 4 presents the model and its analytics. Policy implications are brought out in Section 5.

Section 1 : The Theme

It would be necessary at the outset to clarify our approach towards treating credit as a target instrument. In the aggregative models of stabilising monetary policy, the transmission mechanism runs through two channels, viz., costs or interest rates and availability of money. However, in terms of aggregates, there has been a long-standing debate whether it is 'money' or 'credit' variable that is important in influencing the real sector. One has to contend with the fact that the process of money creation reflected in the growth of liabilities of the banking system is enabled on the assets side mainly by credit creation. Secondly, while increase in credit leads to monetary expansion, it also facilitates creation of output. Hence, credit has the effect of enhancing demand and thereby increasing prices as also increasing supply and thereby decreasing prices. If one however, takes the view that money supply/credit is endogenous, it becomes feasible only to control the price at which money/credit is supplied, i.e., the short-term interest rate.[1] It may nevertheless be noted that in a developing country like India the volume of credit and its availability count more than the cost at which credit is supplied. In fact, this to a large extent explains the existence of an informal credit market, despite a fairly widespread network of banking institutions.[2] Secondly, while one could view credit as performing an accommodative role, it

1 See Moore (1988).

2 See Bottomley (1975) and Gangopadhyaya and Sengupta (1985).

is equally important to perceive the forces making credit as a cost/price-augmenting phenomenon.

Once we stress the role of credit in explaining the inflationary process, the theoretical rationale becomes diverse. Is it the volume of credit or cost of credit, which is important? In a Taylor-variety of structuralist macroeconomic models, a contraction of credit will invariably be stagflationary.[3] Apart from establishing the theoretical possibility of stagflationary impact of a contractionary monetary policy, Taylor's simulation results show its empirical validity in a three sector 'Money-in-India' model. The rationale of credit-constrained inflation again runs in terms of an increase in rate of interest and a reduction in investment demand in the idustrial sector. While the Taylor story may be found useful in explaining partly the current inflation (i.e., during 1990-91 and 1991-92), extending it over the whole of the eighties for empirical analysis may not be very realistic because the range of administered lending rates was limited and positioned at levels that are relatively low.

It is in the above context we turn to a class of models developed by Blinder and Stiglitz (1983) and Blinder (1987). In particular, Blinder (1987) developed a model in which the explanation of central bank policy affecting real variable has nothing to do with money; instead, credit rationing is used as the operating instrument. In his model, the rate of inflation is principally dependent upon the availability of credit. The model, however, differs from Mckinnon (1975)-type explanation of credit-rationing in terms of inadequate savings in an underdeveloped country, in that it envisages credit-rationing as an equilibrium phenomenon and does not rely upon the effect of interest rates on aggregate supply. In particular, Blinder shows that when the economy is credit constrained it is subject to a kind of instability owing to inflation.[4] If its adverse effect on supply is more than that on the demand, a reduction in credit may be inflationary and can thereby cause the real supply of credit shrink further. Taking a cue from Blinder's model of credit rationing, we introduce the quantity of credit as a determinant of industrial inflation in an otherwise mark-up pricing model.

---

3 See Taylor (1983)
4 See Blinder and Stiglitz (1983), and Blinder (1987)

Section 2 : Studies on Industrial Inflation in India : A Resume

There has been no dearth of empirical investigation of Indian inflation. As mentioned earlier, the studies have followed two distinct approaches viz., monetarist and structuralist. Bhattacharya and Lodh (1990) provide an extensive survey of most of the studies. Since our investigation is concerned mainly with the role of moneraty policy (via money or credit) in containing industrial inflation, we follow a rather selective approach in this resume, without any claim of giving an exhaustive coverage.

Most of the studies on industrial inflation in the 'seventies or early 'eighties depicted what may loosely be called a mixed monetarist-structuralist framework. In most cases, these studies are not independent investigations of industrial inflation; they form usually part of a larger macroeconometric model.[5] Marwah (1972), taking industrial price as being determined by capacity utilisation, food and import prices finds a pro-cyclical pricing behaviour. Industrial wages and wholesale semi-manufactured price index emerge as the major independent variables in Pani (1977). Interestingly Chakrabarti's (1977) pricing equation contains M1 as a variable (other than raw material cost and industrial wage-output ratio) which has been found to be significant. In both Bhattacharya (1984) and Krishnamurty (1985), M1/GNP has been considered as a major determinant of industrial prices. However, of all the studies we have seen, Pandit's (1984) specification alone gives a role to credit explicitly, other independent variables are raw material cost, fuel price, wage rate corrected for productivity and rate of change in indirect taxes. Estimating over the period of 1950-78, Pandit takes the rate of change of bank credit to commercial sector as an influencing factor; its coefficient has been found to be positive. However, credit is endogenously determined in his macroeconomic model.

In the latter part of the 'eighties, there had been a number of studies on industrial inflation and its relation with the demand using a mark-up model. In a disaggregative framework, Madhur and Roy (1986) estimate the pricing equation for four types of manufacturing industry and find that excepting capital goods industry, in all other industries of their sample, capacity utilisation index exerts direct impact on the mark-up. On the contrary, Chatterjee's (1989) finding for the aggregative industry indicates that demand plays no significant role; her results for six individual industries more or less support this claim.[6]

---

5 With the exception of Chakrabarti (1977)

6 However, in two of six industries activity has been shown to be inversely related with the inflation.

Balakrishnan's (1991a and 1991b) analysis of industrial inflation has been somewhat distinct in that it clearly indicates the role of demand factors. In his formulation, the rate of industrial inflation has been shown to be positively related with change in labour and raw material costs. Activity has an inverse relation with industrial inflation, indicating the presence of a counter-cyclical mark-up. Furthermore, the statistical significance of the error-correction terms in his model indicates the existence of an error-correcting response to any short-run dynamic inconsistency between prices and costs. He interprets counter-cyclical mark-up in terms of the existence of an indirect impact (via cost) of activity on prices.

The present paper in a sense is close to Balakrishnan's (1991a and b) in its model formulation. But, it is also close to Pandit's (1984) in the sense that there is an explicit role for credit in our model.

Section 3 : Data Description and Analysis

In econometric analysis, exercising a choice of data series consistent with theoretical rationale built up into analytical framework is always beset with some problem or the other. What is normally attempted is to use proxies or transformations ending in a marriage, often of convenience, between the data and analysis. Our analysis claims no exception to this general practice.

Industrial Inflation

In modelling inflation, there is choice between using wholesale price index or GDP deflator. Construction of a monthly series of GDP deflator is not possible, more so for any particular sector. Hence our inevitable choice was the index number of wholesale prices (Base : 1981-82) in respect of manufactured products which has a weightage of 57 per cent in the general index (Statement 1).

Non-administered prices

Our choice of industrial inflation as the independent variable was governed by an important consideration. We felt that the pricing process in industry should be 'free', since the influence of credit on prices can then be more appropriately related. Industrial prices represent the non-administered price behaviour in the economy.

The one way of doing it is to construct a non-administered price index. Attempts in this regard were earlier made by Rao (1984) and

and Karnik (1991). While the former used the input-output coefficients to identify and also capture the impact of administered prices on the rest of non-administered sectors, the latter simply excluded the non-administered items from the series to derive the administered price index.

We attempted to construct a non-administered price index (1981-82 = 100) adopting essentially the methodology of Ramachandra Rao. The methodology is given in Appendix 1 and the data are provided in Statement 2.

Industrial Credit

There is no monthly series of industrial credit available for our use. Data from **Basic Statistical Returns** (BSR) are available half-yearly upto June 1989; but, it has been converted into an annual feature from March 1990. Data from Credit Authorisation Scheme / Credit Monitoring Arrangement, relevant for borrowers enjoying credit limits of more than a threshold level though available, are not strictly comparable between periods and their coverage is limited. So, we rely upon the data series generated out of returns relating to Section 42 of the Banking Regulation Act, 1949, received from scheduled commercial banks. As it is difficult to get industrial credit as such, we used 'non-food credit' as a proxy for industrial credit (Statement 3). Yet another limitation is that it covers only scheduled commercial banks' credit. Cooperative institutions and term lending and investment institutions could not be covered in view of inadequacy of data.

However, one may argue that non-food credit has a boarder coverage which includes within its fold agriculture, trade and services besides industry, and hence it truly cannot represent industrial credit. To overcome this limitation, we have tried another measure of industrial credit by generating an adjusted series making use of the half-yearly BSR data. The series takes the industrial credit measure as given by BSR (available six monthly upto June 1989), and for those months for which BSR data are not available, the series is generated through the imputation of the proprotion of industrial credit to total non-food credit. The methodology is given in Appendix 2 and the data are provided in Statement 4.

Mark-up Factors

In the mark-up analysis, the relationship between price and cost emerges after identification of major cost components. The two major cost components normally considered are raw material cost and wage

cost. The methodology for costruction of a raw material index is adopted from Balakrishnan (1991a). The details are set out in Appendix 3. Data series are given in Statement 5.

As regards labour, labour cost, which includes besides wage cost labour productivity, should also have been taken. But, in the absence of such data series on a monthly basis we had to find a limited surrogate in the form of wage cost. Though, there is no wage-cost data available on a monthly basis, it is generally observed that wage increases in the industrial sector are closely linked to Consumer Price Index (CPI) for industrial workers, as most wage settlements, at least in the organised sector, contract for an indexed compensation of wages on that basis. Though there can be a time lag between vairation in index and wages and also the compensation may not be to the full extent, the direction of movement in wages could be proxied by the variations in CPI. Hence, we use CPI for industrial workers as a proxy for wage cost (Statement 6)

There could be technically another important component, viz., interest cost. But, in the Indian situation, the contribution of interest to total cost has been observed to be small.[7] Since, in our view, credit in its volume and timeliness is more important in reflecting the demand for credit than the interest rate/interest cost we use credit itself as an input in the otherwise mark-up equation structure. In otherwords, there is an underlying assumption that interest-elasticity of credit is negligible. This has indeed been borne out by the actual trends in credit flow vis-a-vis changes in lending rates.[8]

Index of Capacity Utilisation

Many of the studies on industrial inflation give a specific role to demand factors, although evidence on this count is rather uncertain about the influence of activity on industrial pricing and whether the influence, if any is procyclical or counter-cyclical. We have chosen to incorporate an index of capacity utilisation in the industrial sector as a proxy for activity. The methodology of construction of index is given in Appendix 4. Data series are provided in Statement 7.

Stylized Facts

The data series in general show a problem of multicollinearity as with the case of many time series data in general. This is duly be-

7 Lopez (1992)

8 We replicated our econometric excise using interest rate as a component of the unit cost. Interest rates turned out to be insignificant both in its level and first difference.

ing taken care of while modelling the relationships. For purposes of studying the trends as revealed by these series, we have worked out yearly changes based on average and the summary statistics are presented in the following table.

Table 1 : Yearly percentage growth rates of different variables

	WPI (Manufactured products)	IIP	Non-food Credit	Industrial Credit	CPI	Raw Material Index
1983-84	6.1	6.7	16.7	14.4	12.6	9.9
1984-85	7	8.6	16.7	8.9	6.4	6.1
1985-86	6	8.7	15.2	13.4	6.4	2.1
1986-87	3.7	9.2	16.0	17.9	8.8	8.7
1987-88	7.3	7.3	17.5	11.2	9.1	9.8
1988-89	9.4	8.7	20.2	27.6	9.1	5.3
1989-90	11.2	8.6	21.6	23.6	6.5	2.3
1990-91	8.4	8.5	13.6	11.6	11.2	12.9
Compound growth rate p.a. between 1982-83 and 1990-91	7.37	8.28	17.18	15.9	8.76	7.07

Note: All growth rates are based on corresponding yearly average values.

We can make some tentative observations on the basis of the above data :

(1) Though the overall increase per annum in the WPI-manufacturing was 7.37 per cent, the variation in growth rates ranged betweem 3.7 per cent in 1986-87 to 11.2 per cent in 1989-90.

(2) The increase in WPI was not matched well by either the change in raw material cost index or in the CPI (wage cost) on a year-to-year basis.

(3) As a matter of fact, the year in which the WPI-manufacturing showed the largest increase at 11.2 per cent, the CPI as also the raw material cost index sbowed lower grwoth rates. The raw materials cost index actually recorded the lowest growth rate in 1989-90.

(4) On the other hand, when there was a fall in industrial inflation in 1990-91 to 8.4 per cent from 11.2 per cent in 1989-90, the raw material cost index showed a sharp increase of 12.9 per cent compared to the previous year increase of only 2.3 per cent.

(5) The variations in WPI are generally in line with variations in non-food credit and the largest increase in WPI in 1989-90 was correspondingly in relation to the largest increase in credit at 21.6 per cent during that year. A fall in the rate of inflation in 1990-91 is explained largely by a corresponding decrease in the rate of credit expansion.

(6) The yearly increase in CPI (wage cost) during the sample period (excluding 1983-84 and 1990-91) was more or less uniform as also that of the increase in industrial production index.

Section 4 : Industrial Price and Non-Food Credit : A Model

We have already noted that our model will largely be in the approach set out by Balakrishnan (1991). However, it may be noted that once the industrial pricing decisions are only through a mark-up over its cost (comprising wage and raw material cost), monetary policy has little role to play. Yet, the literature is replete with instances in which monetary policy has an important role to play. Often this is brought about through an aggregative model of general price level (usually an inverted demand-for-money function). Thus, a standard monetarist explanation of Indian inflation would run in terms of the prevalence of excess liquidity at the aggregative level, and sector-specific determinants of sectoral inflation. But, as Balakrishnan has shown, the role of monetary variables even in such an aggregative framework can be questioned and as revealed from the result of his non-nested tests, a structuralist model outperforms its monetarist counterpart as alternative explanation of Indian inflation.[9] Therefore, in our explanation of industrial prices, we choose credit as a policy variable.

However, to term credit as a policy variable is to open a Pandora's box. After all, so long as credit is 'inside money', as argued by Gurley and Shaw (1960), it does not represent the net worth of the private sector. However, in a developing country like India, in the absence of a well-developed capital market, credit may paly an important role in the determination and formation of working capital. Given the spread of banking network in the economy in the post-nationalisation period, the importance of institutional credit can hardly be ignored in the industrial sector.

Ideally, in a cost-plus framework, the cost of credit (i.e., rate of interest) should be included as an argument in the industrial price equation. Instead we chose to include the amount of non-food credit advanced

9 See Balakrishnan (1991a) p. 196.

by scheduled commercial banks. The reason is two-fold. First, in the Indian context until recently interest rates were largely administered, and as noted earlier, interest costs, **per se,** constituted a small proportion of total cost. Secondly, since bank-lending in India has been governed by the inventory and receivables norms as advocated by Tandon and Chore Committees, the inventory cost of the firm has largely become an important policy-input. The imposition of a stipulated incremental non-food credit-deposit ratio has added to this effect.

Our study is concerned with the 'eighties' 1982-83 to 1990-91 (i.e., 9 years), with data taken on a monthly basis. However, there is an inherent problem of using monthly data. While it increases the number of observations for conducting statistical analysis, it makes the data increasingly noisy, making the extraction of information on the behaviour and inter-linkage of the time series more difficult. In addition, due to the problem of serial correlation, the statistical trade-offs looks less impressive. To improve the explanatory power of particular equations some seasonal or monthly dummies have therefore been tried.

In terms of specifics, we have chosen six variables, viz., (i) industrial price (P), (ii) wage cost (W), (iii) index of raw material cost (R), (iv) non-food credit (C), (v) industrial credit (IC), and (vi) index of industrial capacity utilisation (U).

We start our exercise with a coventional model of mark-up pricing, with credit, where the pricing decision of a firm is postulated to depend upon wage and material cost, credit available and the degree of capacity utilisation. Our equations are given in Table 2.

A look at Table 2 confirms that credit plays a significant role in the price formation of the industrial sector.[10] However, a general shortcoming of all the equations is that they suffer from severe serial correlation. Excepting equations 1.5 and 1.10, all equations exhibit low DW (or high h) values. Even 1.5 and 1.10 are the outcome of Cochrane-Orcutt transformation. While it is a fact that dealing with monthly data naturally may lead to the problem of serial correlation, we tried all these specifications usig deseasonalised data for all the relevant series (not reported here); without obtaining any improvement in the results. However, as Granger and Newbold (1974) have shown that low DW values may

10 We have in this context introduced maximum lending rate/floor rate 'i' as an explanatory variable; it not only gives a wrong sign but also turns out to be insignificant; see equation 1.7. Furthermore, results are more or less invariant to the two definitions of credit, viz., C and IC.

be indicative of misspecifications, we have proceeded to check the time-series properties of all the series to find out the existence of stationarity in the data.

Table 2 : Equations on Industrial Price (Dependent Variable, p) (period : April 1982 to March 1991)

Equation Number	Constant	Coeffecients of Independent Variables									Test of Statistics			
		r	w	c	u	(p)t-1	(c)t-1	i	(ic)	(ic)t-1	$\bar{R}^2$	DW	F	SER
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1.1	-0.3014	1.0529	-	-	-	-	-	-	-	-	0.9573	0.1294	2399.4	0.0378
	(2.84)	(48.98)												
1.2	-0.7017	-0.0620	0.9053	-	-	-	-	-	-	-	0.9725	0.4502	1892.7	0.0303
	(7.03)	(0.42)	(7.72)											
1.3	-0.0193	0.0525	0.1527	0.335	-	-	-	-	-	-	0.9856	0.1870	22365.6	0.0223
	(0.18)	(0.48)	(1.30)	(9.50)										
1.4	0.0032	-	-	0.025	-0.000	0.9473	-	-	-	-	0.9990	h=1.96	35372.9	0.0057
	(0.17)			(2.36)	(2.24)	(37.99)								
1.5	5.44	-	-	-	-0.0144	-	0.0976	-	-	-	0.9991	1.95	28972.7	0.0054
	(1.64)				(2.26)		(3.85)							
1.6	0.003	-	-0.000	0.025	-	0.9473	-	-	-	-	0.999	h=1.97	35372.9	0.0057
	(0.17)		(2.24)	(2.36)		(37.99)								
1.7	5.19	0.0870	0.0344	-	-	-	-	-0.0044	-	-	0.9989	1.57	23195.3	0.0061
	(7.81)	(1.74)	(1.23)					(0.87)						
1.8	0.1092	-0.1113	0.3002	-	-	-	-	-	0.3321	-	0.9898	0.3640	3371.5	0.0187
	(1.25)	(1.23)	(3.50)						(13.10)					
1.9	0.0259	-	-	-	0.0002	0.9349	-	-	0.0312	-	0.9990	h=1.98	33632.2	0.0057
	(1.18)				(2.32)	(33.11)			(2.53)					
1.10	6.0248	-	-	-	-0.0002	-	-	-	-	0.060	0.9991	1.96	26767.7	0.0056
	(1.87)				(2.24)					(2.30)				
1.11	-0.0076	-	0.0062	-	-	0.9474	-	-	0.0226	-	0.9990	h=2.05	33902.5	0.0059
	(0.28)		(0.35)			(31.13)			(1.77)					

Note : (i) Figures under brackets are respective t-statistic values, (ii) Equations 1.5 and 1.7 have been derived through a Second-order Cochrane-Orcutt transformation, (iii) All lower-case variables are log values of the corresponding upper-case variables, excepting rate of interest (i).

Table 3 presents the results of unit root test as given by both Dickey-Fuller and Augmented Dickey-Fuller statistic to discern whether the series are integrated of order zero or unity.

Table 3 : Unit Root Test–Data for April 1982 to March 1991

Variables	Dickey-Fuller Test*		Augmented Dickey-Fuller Test**	
	Level	Difference	Level	Difference
p	1.84	-8.23	2.11	-3.35
w	-0.71	-14.58	-0.03	-5.53
r	-0.10	-8.37	0.26	-4.04
c	0.10	-14.08	0.80	-5.63
ic	0.94	-12.64	2.69	-3.15
u	-7.00	-15.31	-6.32	-7.27

Notes : (iii) All the variables are in natural logarithm.

(ii) * The Dickey-Fuller (DF) Test is based on the following regressions, viz., (a) $\Delta X(t) = a+bX(t-1)$ (in case of levels), (b) $\Delta^2 X(t) = a'+b'\Delta X(t-1)$ (in case of difference).

** The Augmented Dickey-Fuller (ADF) test is based on the following regressions viz.,

(a) $\Delta X(t) = a+bX(t-1) + \sum_{i=1}^{8} c_i \Delta X(t-i)$ (in case of levels), and

(b) $\Delta^2 x(t) = a'+b' X(t-1) + \sum_{i=1}^{8} c_i \Delta^2 x(t-i)$ (in case of difference)

(iii) The table gives t-statistic values of b or b (as the case may be); the tabulated values are obtained from Fuller (1976).

The results in Table 3 cannot reject the null hypothesis of a unit root in levels excepting for capacity utilisation index, implying non-stationarity of all other series. However, both DF and ADF tests indicate that all other series are clearly integrated of order unity.

Once we have established time series properties of the variables, we tried to fit an error correction model (ECM). Strictly speaking we have not followed a two-step procedure on the basis of Granger Representation Theorem (1987). Rather, our procedure is more close to Hendry and Richard (1983). However, under certain conditions the two

approaches will produce near-identical results (see Granger - 1981). The best fit in terms of first differences with proper restrictions[11] imposed on the EC terms is given in Table 4.

Though the equations have a low $\bar{R}^2$ value, yet considering the fact that data have been made stationary (and hence time trend has been removed), it should not give a cause for concern. However, most of the other statistical criteria are satisfactory. Credit clearly emerges as a major determinant of price formation in the industrial sector. In fact deleting the term (c)-1 from equation (2.1) and (2.2) yields the following likelihood ratio statistics [following $\chi^2(i)$] viz., 6.41 and 6.57 respectively. Similarly deleting (ic)-1 from equations (2.3) and (2.4) yields LR values of 8.35 and 3.19 respectively.

Thus, equations (2.1), (2.2) and (2.3) clearly establish credit as a determinant of industrial inflation with the relationship being direct. We have also reworked the exercise using the index of non-administered prices as the dependent variable. The findings are more or less in tune with the results derived from taking inflation rate as the dependent variable in all our exercises.[12] In other words, credit availability clearly gives rise to inflationary pressure in the industrial sector. This finding is in line with Pandit (1984). However, in most of our equations activity or capacity utilisation index fails to emerge as a major significant determinant of industrial inflation. This is further reinforced by equations 3.3

---

11 In fact if we write the industrial inflation equation in the following form viz.,

$\Delta p(t) = ao + a1\Delta w(t) + a2\Delta r(t) + a3\ p(t-1)] + a4\ w(t-1) + a5r(t-1)$

Now a restriction of the form, a3+a4+a5 = 0 implies the following equation with error correction terms.

$\Delta p(t) = ao + a1\ \Delta\ w(t) + a2\ \Delta r(t) + a3\ [(p-r)(t-1)] + a4\ (w-r)(t-1)$, which is exactly like our equation (2a) or (2b) without additional credit (Δc) and capacity utilization (u or Δ u) terms.

12 As for example, when we have redone equation 2.2 in terms of index of non-administered prices (Pn) we got the following equation. Although the ECM terms have turned out to be insignificant, the equation in general is a better fit even without monthly dummies. However, the apparent insignificnace of the credit term may be due to the fact that credit is required even for those commodities whose prices are administered.

$$\Delta pn = \underset{(3.75)}{0.0027} + \underset{(9.36)}{0.4179}\ (\Delta r) + \underset{(1.36)}{0.0424}\ \Delta c(t-1) - \underset{(1.48)}{0.0001}\ (\Delta u) - 0.0001\ (\Delta u\ (t-1) - \underset{(2.40)}{0.0579}\ (\Delta w)$$

$\bar{R}^2 = 0.5958$, DW = 2.12, SER = 0.0052, F(5,100) = 29.48

Table 4 : Industrial Price Equations : An Error Correction Model (dependent variable Δp[t])

Equation Number	Constant	Coefficients of Independent Variables											Tests of Statistics		
		Δw(t)	Δr(t)	Δc(t-1)	Δic(t-1)	(w-r)(t-1)	(p-r)(t-1)	u(t)	u(t-1)	Δu(t)	Δu(t-1)	D2	$\bar{R}^2$	Serial Correlation	SER	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
2.1	0.2570	0.0103	0.0684	0.0779	-	0.2459	0.0615	-0.0001	0.0001	-	-	0.0032	0.3592	DW= 1.67	0.0050	6.79
	(2.03)	(0.40)	(1.57)	(2.68)		(2.37)	(1.60)	(1.60)	(1.98)			(3.80)		LM=10.68		
2.2	0.2471	0.0130	0.0701	0.0745	-	-0.2360	0.0638	-	-	-0.0001	0.0001	0.0034	0.3623	DW= 1.67	0.0050	6.89
	(1.96)	(0.41)	(1.63)	(2.55)		(2.29)	(0.91)			(1.67)	(0.89)	(4.01)		LM=10.46		
2.3	0.2194	0.0161	0.0758	0.1044	-	-0.2118	-0.0584	-	-	-	-	0.0037	0.3256	DW= 1.68	0.0051	7.97
	(1.73)	(0.62)	(1.77)	(3.96)		(2.04)	(0.82)					(4.45)		LM=14.06		
2.4	0.2453	0.0132	0.0469	-	0.0699	-0.2072	0.0349	-0.0001	-	-	-	0.0037	0.2861	DW= 1.72	0.0053	5.61
	(1.85)	(0.49)	(1.03)		(2.84)	(1.92)	(0.47)	(0.81)				(4.35)		LM=10.84		
2.5	0.2696	0.0080	0.0469	-	0.0460	-0.2386	0.0452	-	-	-0.0002	-	0.0033	0.3194	DW= 1.75	0.0051	6.57
	(2.08)	(0.31)	(1.08)		(1.74)	(2.25)	(0.63)			(2.34)		(3.82)		LM= 8.39		
2.6	0.2399	0.0150	0.0550	-	0.0719	-0.2067	0.0313	-	-	-	-	0.0038	0.2813	DW= 1.72	0.0052	6.45
	(1.82)	(0.57)	(1.24)		(2.94)	(1.92)	(0.42)					(4.38)		LM=10.35		

Notes : (i) Figures in brackets are respective t-statistic values;

(ii) All LM statistics for serial correlation follow χ^2 (12);

(iii) Degrees of freedom for F in both the equations 2.1 and 2.2 is (8,97); the same for both the equations 2.3 and 2.4;

(iv) All lower case variables are log values of corresponding upper case variables.

and 3.6. Furthermore, the statistical insignificance of the error correction terms casts doubt on the equilibrating mechanism of short-term inconsistency between prices and costs.[13]

Relationship between Credit and mark-up in industry

One issue is : how could the volume of credit have any influence on mark-up? This requires rather a clear perception of the actual forces at work. The endogeneity view of credit postulates that credit has no role in mark-up pricing, since credit plays simply an accommodating role. If there are increases in input costs, they are reflected by way of higher demand for credit which gets accommodated through the banking system. In an essentially cash-credit system of credit dispensation, this argument no doubt has some validity. However, there are other forces in operation which tend to support our result that credit need not be accommodating, but can cause augmentation of input prices and thereby the mark up directly and not necessarily via output. The following considerations may particularly be of interest in this regard.

1. Though under Credit Monitoring Arrangement, borrowing units are not allowed to incorporate inflationary factor into their financial projections for purposes of the fixation of cash credit limits, inflating credit requirements through other means of window-dressing cannot be ruled out.

2. Application of the 'second method'[14] of lending norms as also the inventories and receivables norms, though attempting to prevent the firms from getting accommodation of credit simply through their valuation of stocks, has not been entirely successful. It is a well-established fact that the follow-up and quarterly information system on Credit Monitoring Arrangement had not been very helpful. Many relaxations, in fact, were allowed in respect of inventory norms. Many borrowers did not adhere to the second method of lending. The borrowers in fact could avail of excessive credit. Such an excessive availability of credit provides the firms with a higher purchasing power in the market and thereby to bid for higher prices on their items of purchase. Such bidding can always have the influence of pushing up prices. One of the objectives of stipulating inventories and receivables norms is to arrest such competitive and

13 One of Balakrishnan's industrial price equation too shows an insignificant ECM term; see equation (c) in Table 2 of Balakrishnan (1991b), p. 319.

14 The second method of lending as prescribed by the Tandon Committee stipulates that borrowers should meet at leat 25 per cent of total current assets out of long-term funds or a minimum current ratio of 1.33:1.

speculative bidding by firms in the market for sensitive items like raw materails and intermediate products.

3. Yet another factor is that all firms may not have the same leverage. Firms with higher bank borrowings and thereby higher leverage may enjoy a cost advantage in relation to firms with lower level of bank borrowings. In such instances, the higher mark-up is a direct result of credit availment.

4. In practice, credit itself is sometimes used as a means of pushing up the demand for industries suffering on account of recessionary trends. For example, when demand for tractors and other farm equipments were low and their inventory was piling up, credit norms were eased to boost the demand for such items. Similar parctices were in vogue even in respect of certain consumer durables like automobiles and electrical and electronic goods. In such instances, credit provides the direct opportunity to firms to push their sales as also helping them to enhance their mark up.

5. Yet another factor is the extent of credit absorption and conversion of credit into actual saleable goods and services. Credit many times initially results in higher nominal incomes/liquidity, resulting in pressure on aggregate demand and there is always a lag before the credit facilitates supply. Hence there is a competitive bidding of prices from consumers. It is a fact that in most of the consumer products, sellers market has remained an overriding phenomenon and the position has not changed much today. This is more so in cases where credit is used for expansion purposes. Industrial licensing practices and oligopolistic market structures have also strengthened this phenomenon. Furthermore, higher the capital output ratio, larger will be the lag between disbursement and enhancement of supply in the market. The experience in India in this regard is well known, with ICOR remaining very high over the period.

In view of these considerations, it may be argued that during the 1980s the cost of credit did not play a significant role in explaining industrial inflation. It is, therefore, possible to use quantitative or other credit restrictions as an effective means of containing industrial inflation.

Section 5 : Policy Implications

The main thrust of the present paper is that credit plays a significant role in determining industrial inflation. In an otherwise mark-up structure of industrial price determination, we have tried to show that expansion

of credit to the commercial sector may be inflationary in nature. This is not to deny that credit has no output effect and that unduly restrictive credit expansion may be stagflationary in the short-run. If the story we presented above has any validity, then one may infer that during the 'eighties the price effect of credit outweighs the output effect of credit.[15]

A number of policy implications emerge out of this study.

1. Quantitative credit restriction to the commercial sector could remain as one of the major policy tools. This contention is likely to gain more weight in the years to come in view of the fact that in the recent past there has been an emphasis to reduce the budget deficit. Thus, if there was any crowding out due to excessive government budget deficit during the past, it is likely to reverse in the near future and to that extent commercial sector credit may experience an upturn. Therefore, quantitative credit restrictions may stand out to be an effective tool for controlling inflationary pressures.

2. With growing disintermediation, one may also expect that dependence of the industrial sector on the commercial banks may come down. If the firms switch over to capital market substantially for their credit needs, quantitative credit restrictions might become ineffective unless the umbrella of central bank credit policy extends beyond the commercial banking system. In terms of specifics, this will call for spreading of the central bank regulation over the entire financial sector. Furthermore, credit as an aggregative measure may also need to be redefined.

3. In the wake of financial deregulation and innovations, the monetary targeting approach has been relegated to the background even in the western countries. Credit as an aggregative measure is reemerging as a policy tool. This only emphasises that we should continue to place emphasis upon credit as a target of monetary policy.

4. Though during the 1980s, interest rate because of its administered nature, did not show a statistically significant influence on credit demand, it might gain more policy credibility in an emerging market-related financial environment. Even in that environment, as long as credit remains potent in causing inflation, quantitative credit restrictions would continue to have a significant role.

---

15 This result is for the industrial sector as a whole. In a disaggregated framework, the effect as between samll and large scale industries could possibly be different.

Appendix - 1 : Index of Non-Administered Prices

We classified in the first stage the price index data into administered and non-administered items. The twelve administered items identified for our purpose (as listed in GOI Economic Survey) were : (i) petroleum, crude and natural gas, (ii) petroleum products (mineral oils), (iii) electricity, (iv) fertilizer, (v) iron and steel, (vi) other monferrous metals (other basic metal industry), (vii) coking coal. (viii) non-coking coal, (ix) lignite, (x) iron ore and (xi) pesticides. For most of these items in the price index, a similar/matching item was invariably found input-output matrix tables.

The non-administered price index was derived in the following steps:

First, the wholesale price index series was split into administered and non-administered groups, the former accounting for a weightage of 19.989 and the latter 80.011.

Second, the administered price index was derived from the above series using the weightage in respect of wholesale price index.

Third, the construction of non-administered price index series was based on three of our important assumptions : (a) the intra-impact of administered prices on rest of administered items is zero; (b) the impact of administered prices on non-administered categories would be one-time and only in the first stage; and (c) the extent of impact of administered prices on non-administered categories would be proportionate to the input coeffecients of administered items in the non-administered group.

Last, the increase in wholesale price index could be viewed as consisting of two elements, viz., (i) due to the increase in administered prices and its impact on non-administered group and (ii) autonomous increase in non-administered group. On this basis, the increase in non-administered prices due to the impact of administered prices was eliminated and the residual variation in price of non-administered group was considered for the purpose of deriving the non -administered price index series. (Statement 2).

Appendix - 2 : Industrial Credit

Apart from non-food credit we have used an alternative measure of industrial credit by generating an adjusted series making use of the data on bank credit to the industrial sector. Prior to June 1989 BSR data are available on a six-monthly basis, whereas since then it is available on a yearly basis (the latest being March 1990). For those months for which BSR data are available we have taken industrial credit as per the BSR. The series for the other months are generated through the imputation of the proportion of industrial credit (as per the BSR) to non-food credit for the respective months. The period-wise proportions arrived at and used for generating the adjusted series are given below:

Relevant Period	Proportion of Industrial Credit to Non-food Credit
April, 1982 to November, 1982	0.51215
December, 1982 to May, 1983	0.51583
June, 1983 to November, 1983	0.51317
December, 1983 to May, 1984	0.48483
June, 1984 to November, 1984	0.47797
December, 1984 to May, 1985	0.45137
June, 1985 to November, 1985	0.46786
December, 1985 to May, 1986	0.45863
June, 1986 to November, 1986	0.47168
December, 1986 to May, 1987	0.47243
June, 1987 to November, 1987	0.47881
December, 1987 to May, 1989	0.47479
June, 1989 to November, 1989	0.47242
December, 1989 to May, 1990	0.46448
June, 1990 to February, 1990	0.47649
March, 1990 to March, 1991	0.51129

Appendix - 3 : Index of Raw Materials Cost

Our construction of index of raw materials cost follows Balakrishnan (1991a).[16]First we have identified three groups of commodities as the major constituents contributing to raw material cost, viz., (i) primary agricultural products, (ii) minerals, and (iii) fuel, power, light and lubricants; their weightage in the index number of wholesale prices (base: 1981-82 = 100) being 27.367, 4.830 and 10.666 respectively. However, the 'primary agricultural products' itself is a composite commodity, the two sub-components being food articles (with weight 17.386) and non-food articles (with weight 10.081). Thus, based on these WPI weights we first computed the index number series of primary agricultural products.

But, for purposes of constructing index numbers of raw material cost, the weightages as applied in the construction of index number of wholesale prices will not be relevant. We should have a proxy for respective commodities' contribution to the total manufacturing cost. Hence, we instead used the cost/value coefficients of these commodity groups as found in the 60-sector input-output matrix (1983-84) of the Indian economy. From the input-output relationships the following percentage weights were derived :

Primary agricultural products	67.15
Minerals	9.57
Fuel, power, light and lubricants (POL)	23.23

It may be added that due to the use of input-output tables pertaining to different time periods, our weights differ considerably from that of Balakrishnan's.[17] In particular, agricultural products show a considerable reduction in weightage, while the POL show a substantial increase in its weightage. These changes are, no doubt, in consonance with the structural changes in the Indian economy between these two periods.[18]

16 See Balakrishnan (1991a) p. 232.

17 Balakrishnan used 1973-74 input-output matrix.

18 See Divatia (1991).

Appendix 4 : Index of Capacity Utilisation[19] of the Industrial Sector

There are a number of methods available for measuring capacity utilisation for the industrial sector. However, measuring capacity utilisation for the industrial sector in India on the basis of monthly data has been a difficult task. This is due to the fact that in almost all the years over the 'eighties, March has been consistently a peak month (Graph A). This phenomenon reflected partly the impact of the energy factor subjected to fluctuations on the rest of industrial sector and partly a data reporting problem. The March figure looks often too high. Non-reporting of a number of activities in all the other months often makes March data a kind of a residual for the year. In other words, for the sake of making yearly figure representative, March figure tends to get inflated. This is borne out by the fact of very high seasonal factors for March. Therefore, we had some difficulty in applying the standard procedure like Wharton Index for measuring capacity utilisation. Instead we used a simple variant of the Wharton technique, viz., the ratio between trend and actual. First, the trend index of industrial production has been estimated by the equation :

$$\log (IIP) = \underset{(367.06)}{4.66} + \underset{(33.85)}{0.0068}\ T$$

$(R^2 = 0.9153,\ DW = 1.35$

Sample : April, 1982 to March 1991) ;

which yield the trend values of IIP, designated by IIP^c. The index for capacity utilisation has been defined as :

$$U_t = (IIP_t)/(IIP_t^c)$$

because of the March-over reporting phenomenon, this is not observed in this case (Graph B). However, it may be observed that peaks of capacity utilisation too correspond to the peaks of actual data, viz., March (Graph C).

As an alternative, we have deseasonalized the IIP data, using the X-11 method as developed by the U.S. Bureau of Census, Department of Commerce, and a trend equation of the following form has been fitted, viz.,

---

19 This section heavily depends upon : Briscoe, O'Brien P, and Smyth, (1970).

$$\log (IIP_s) = 4.67 + 0.0067\ T$$
$$(1069.8) \quad (95.93)$$

($R^2 = 0.9886$, DW = 1.12

Sample : April, 1982 to March 1991, where IIPs is the deseasonalized IIP).

One may note that the coefficients have largely been invariant to the deseasonalization, though explanatory power of the trend equation has been improved. However, this alternative set of trend values of IIP yielding a separate series for deseasonalization, designated U_s, have been tried, though no substantial change was effected. Though the derived series is termed for convenince as index of capacity utilisation, truly it represents the degree of cyclical activitv *vis-a-vis* the trend.

Statement 1 : Wholesale Price Index (Manufactured Products)*

(1981-82 = 100)

	April	May	June	July	August	September	October	November	December	January	February	March
1982-83	101.2	101.9	102.6	103.0	103.7	103.7	103.8	104.1	104.1	104.5	104.6	105.3
1983-84	107.0	107.9	108.3	108.9	109.7	110.2	110.3	110.2	110.2	111.3	111.7	112.0
1984-85	113.4	114.1	115.1	117.3	118.1	118.2	118.5	118.5	118.5	119.2	119.1	120.2
1985-86	123.1	124.2	124.4	125.0	124.9	124.5	124.7	124.3	124.3	124.8	124.7	125.4
1986-87	126.0	126.8	127.7	128.3	128.7	129.4	129.6	129.4	129.3	131.3	131.4	132.1
1987-88	132.7	133.7	135.1	136.1	138.0	138.2	138.7	139.6	140.1	143.2	143.3	143.7
1988-89	147.0	147.8	148.6	150.4	151.2	152.2	152.6	151.7	151.5	154.1	154.7	156.7
1989-90	160.6	162.3	163.2	165.2	168.4	170.9	171.3	171.1	170.8	172.0	172.9	174.0
1990-91	175.8	176.0	177.8	179.9	180.8	181.6	183.6	184.1	185.7	188.1	189.6	190.1

* Weight of Manufacturing products in total WPI is 57.04 per cent.

Source: Ministry of Industry, Office of The Economic Adviser, Government of India.

Statement 2 : Index of Non-Administered Prices*

(1981-82 = 100)

	April	May	June	July	August	September	October	November	December	January	February	March
1982-83	102.13	101.16	103.02	104.80	106.32	105.71	105.31	105.90	105.47	105.82	106.60	107.20
1983-84	108.69	111.01	111.98	113.57	114.54	115.01	115.12	115.45	115.21	115.83	115.96	115.97
1984-85	116.60	118.01	120.87	122.76	124.06	122.94	123.50	123.25	122.25	122.89	122.47	122.37
1985-86	122.36	124.81	125.87	127.03	127.15	125.75	126.09	125.74	125.92	126.21	126.39	127.34
1986-87	128.89	130.60	131.95	134.21	134.89	134.77	135.65	135.55	134.38	136.86	135.66	135.70
1987-88	137.49	139.70	141.74	143.94	148.28	148.30	148.89	150.17	149.88	150.57	151.34	152.14
1988-89	153.56	154.50	156.33	159.05	159.25	158.94	160.93	160.63	159.54	159.81	159.99	160.32
1989-90	162.28	164.82	166.29	168.47	172.05	174.21	174.20	173.17	171.99	172.83	174.13	175.05
1990-91	177.08	179.73	182.88	185.80	186.83	187.57	187.73	189.40	191.98	195.65	196.39	197.19

* Derived

Note : For methodology and derivation see Appendix 1.

Statement 3 : Non-food Credit (Scheduled Commercial Banks)

(Rs. crore)

	April	May	June	July	August	September	October	November	December	January	February	March
1982-83	27551	27505	27355	27783	27581	28237	28935	28998	31746	30810	31040	32528
1983-84	32330	32169	32417	32616	32504	33474	34044	34095	36111	35487	35974	37272
1984-85	37394	37227	38376	37666	37897	38699	39702	40140	42323	42030	42108	43287
1985-86	43017	42940	44156	43776	44068	44704	45705	46084	47775	48144	48549	50533
1986-87	50125	49944	50818	50541	50570	51539	53064	53156	56019	56656	56680	58204
1987-88	58443	58141	59178	59682	59849	60847	62392	62553	66106	66419	67119	68346
1988-89	68861	69041	70367	70749	71229	74013	74855	75813	80804	79963	80668	83950
1989-90	86031	85881	87421	87231	87469	91689	92411	92489	94276	94960	95598	99446
1990-91	102055	100524	100094	100320	99865	102703	103269	103651	105119	106985	107758	111795

Data relate to last Friday, excepting for March 1990 & 1991 for which they relate to last reporting Friday.

Source : R.B.I. Bulletin, various issues.

Statement 4 : Industrial Credit

(Rs. crore)

	April	May	June	July	August	September	October	November	December	January	February	March
1982-83	14110	14087	14010	14229	14126	14461	14819	14851	16375	15893	16011	16779
1983-84	16677	16594	16635	16737	16680	17178	17470	17496	17507	17205	17441	18071
1984-85	18130	18049	18343	18004	18114	18497	18976	19186	19103	18971	19006	19539
1985-86	19417	19382	20659	20481	20617	20915	21384	21561	21911	22080	22266	23176
1986-87	22989	22906	23970	23839	23853	24310	25029	25073	26465	26766	26777	27497
1987-88	27610	27468	28335	28576	28657	29134	29874	29951	31386	31535	31867	32450
1988-89	32695	32780	33243	33424	33650	34965	35363	35816	37531	37141	37468	38993
1989-90	39960	39890	41655	41565	41678	43689	44033	44070	44922	45247	45551	50846
1990-91	52179	51397	51177	51292	51060	52511	52800	52995	53746	54700	55095	57159

Note : Derived data. Data for June & December are from BSR. For methodology and derivation see Appendix 2.

Statement 5 : Index of Cost of Raw Materials*

(1981-82 = 100)

	April	May	June	July	August	September	October	November	December	January	February	March
1982-83	100.98	101.05	104.85	107.33	109.43	107.90	107.07	108.05	107.38	107.65	109.63	109.77
1983-84	110.74	113.94	115.04	116.87	118.16	118.40	118.42	119.32	118.94	119.55	119.06	119.01
1984-85	119.00	120.60	125.25	126.68	127.52	125.18	125.88	125.26	127.71	123.98	123.17	122.92
1985-86	123.90	124.65	126.46	127.76	128.27	126.04	126.61	126.71	127.09	127.75	129.35	130.60
1986-87	132.59	134.45	136.37	138.82	140.70	140.01	141.18	140.88	138.93	138.90	137.29	137.63
1987-88	139.99	144.06	145.56	148.48	154.25	154.10	154.46	156.27	155.48	155.26	155.61	156.39
1988-89	155.31	156.07	158.45	161.41	164.75	158.52	162.30	162.76	161.01	159.63	159.06	157.73
1989-90	156.77	159.20	160.95	162.98	166.16	166.67	165.99	164.48	162.46	164.08	164.63	166.26
1990-91	170.36	173.65	177.52	180.40	181.41	181.85	184.85	188.22	189.81	193.63	195.55	196.23

* Derived

Note : For methodology and derivation see Appendix 3.

Statement 6 : Index of Consumer Prices (Industrial Workers)

(1960 = 100)*

	April	May	June	July	August	September	October	November	December	January	February	March
1982-83	459	462	470	478	488	489	491	496	497	495	500	502
1983-84	508	521	533	541	549	554	558	561	559	563	561	558
1984-85	559	562	574	585	586	589	592	595	588	588	585	586
1985-86	594	600	606	615	618	619	625	630	630	629	633	638
1986-87	643	651	658	668	672	676	685	692	688	688	686	686
1987-88	691	703	715	724	736	745	750	755	752	753	749	753
1988-89	763	771	782	795	800	806	823	828	818	813	813	818
1989-90	823	833	838	848	858	868	868	868	863	858	863	873
1990-91	887	897	912	932	937	942	961	976	981	996	996	999

* Data from October 1900 onwards, have been transformed from the new base (1982=100) to the 1960 with the conversion factor 4.93

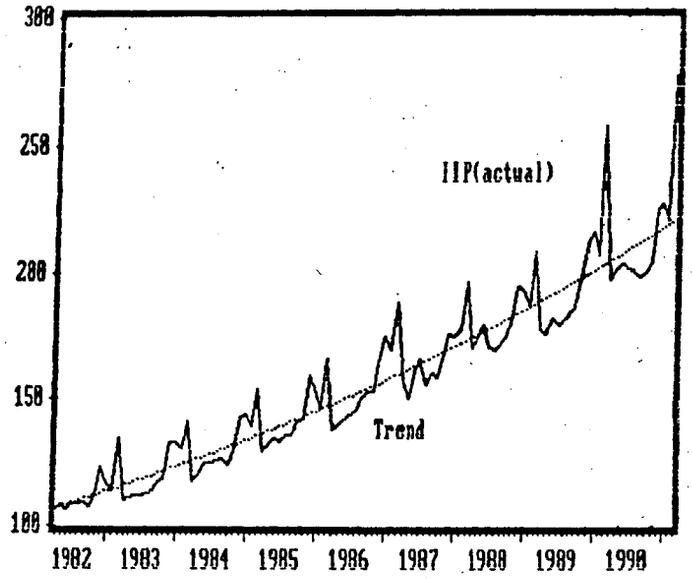
Source : Labour Bureau.

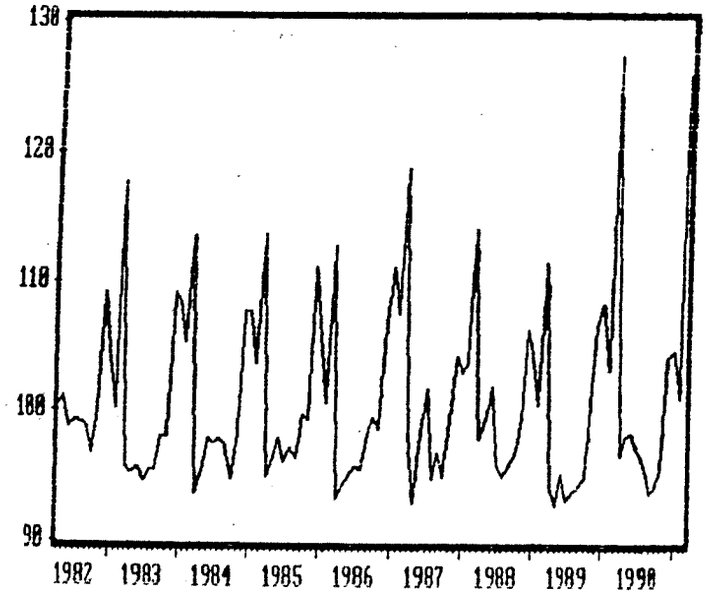
Statement 7 : Index of Capacity Utilisation*

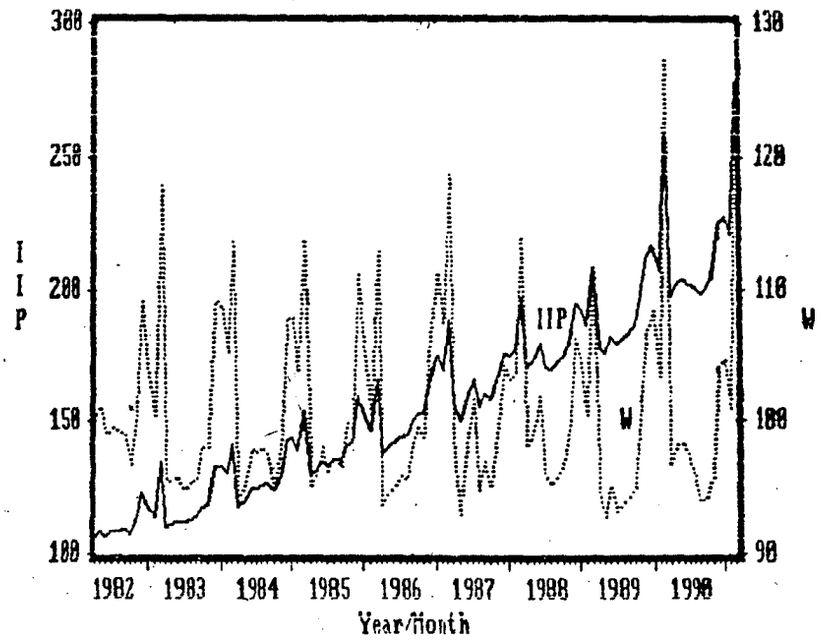
	April	May	June	July	August	September	October	November	December	January	February	March
1982-83	100.26	100.88	98.62	99.14	98.83	98.61	96.49	99.86	108.96	103.62	99.94	117.45
1983-84	95.38	95.07	95.44	94.37	95.16	95.18	97.68	97.76	108.79	108.13	104.97	113.24
1984-85	93.43	95.09	97.50	97.23	97.57	97.06	94.49	98.09	107.38	107.32	103.24	113.32
1985-86	94.57	95.82	97.56	95.67	96.73	96.07	99.36	98.96	110.72	105.20	100.10	112.34
1986-87	92.92	93.90	94.53	95.34	95.15	97.76	99.11	98.17	106.33	110.63	106.91	118.21
1987-88	97.55	92.49	97.94	101.18	94.25	96.31	94.46	98.86	103.60	102.43	103.07	113.39
1988-89	97.42	98.69	101.30	95.27	94.51	95.09	96.09	98.93	105.58	103.89	99.76	110.94
1989-90	93.75	92.17	94.51	92.52	93.17	93.61	94.29	99.99	105.96	107.57	102.40	126.58
1990-91	95.94	97.41	97.61	96.23	95.15	93.14	93.53	94.89	103.31	103.84	100.23	125.08

* Derived

Note : For methodology and derivation see Appendix 4.


300
250
200
150
100
IIP(actual)
Trend
1982
1983
1984
1985
1986
1987
1988
1989
1990
Year/Month


130
120
110
100
90
1982
1983
1984
1985
1986
1987
1988
1989
1990
Year/Month



References :

1. Balakrishnan, Pulapre (1991a): *Pricing and Inflation in India,* Delhi : Oxford University Press.

2. Balakrishnan, Pulapre (1991b); 'Industrial Price Behaviour in India' An Error Correction Model', *Journal of Development Economics* Vol. 37, pp 309-326.

3. Blinder, Alan, S (1987); Credit Rationing and Effective Supply Failure, *Economic Journal,* June, pp 327-352.

4. Blinder, Alan S. and Joseph E Stiglitz (1983); Money, Credit Constraints and Economic Activity, *American Economic Review,* May, pp 297-302.

5. Bhattacharya, B.B. (1984) : *Public Expenditure, Inflation and Growth : A Macroeconometric Analysis for India,* Delhi : Oxford University Press.

6. Bhattarchaya, B.B. and M. Lodh (1990) : 'Inflation in India : An Analytical Survey', *Artha Vijnana,* Vol. 32, pp 25-68.

7. Bottomley, A (1975), 'Interest Rate Determination in Underdeveloped Rural Areas', *American Journal of Agricultural Economics,* Vol. 57, pp 279-291.

8. Briscoe, G.P. O'Brien and D.J. Smyth (1970) : The Measurement of Capacity Utilisation in the United Kingdom, *Manchester School,* Vol. 38, pp 91-117.

9. Chakrabarti, S.K. (1977) : *Behaviour of Prices in India 1952-70 : An Emperical Study*, Calcutta : Macmillan.

10. Chatterjee, Ruchira (1989) : *The Behaviour of Industrial Prices in India*, Delhi: Oxford University Press.

11. Divatia, V.V. (1991) : 'Structure of Indian Economy' : As seen from CSO's Input-Output Tables', *Economic and Political Weekly*, May 11, pp 1235-1242.

12. Engle, R.F. and C.W.J. Granger (1987), 'Co-integration and Error-Correction': Representation, Estimation and Testing', *Econometrica*, Vol. 55, pp 251-276.

13. Fuller, W.A. (1976); *Introduction to Statistical Time Series*, New York : John Wiley & Sons.

14. Gangopadhyaya, S and K. Sengupta (1987), 'Small Farmers, Money-lenders and Trading Activity, *Oxford Economic Papers*, Vol. 39, pp 333-342.

15. Granger, C.W.J. (1981), 'Some Properties of Time Series data and their use in Econometric model Specification', *Journal of Econometrics*, Vol. 16, pp 121-130.

16. Granger, C.W.J. and Newbold, (1974) 'Spurious Regression in Econometrics', *Journal of Econometrics*, Vol. 2, pp 199-212.

17. Gurely, J.G. and E.S. Shaw (1960), *Money in a Theory of Finance*, Washington: The Brookings Institution.

18. Hendry, David F. and J.F. Richard (1983): 'The Econometric Analysis of Economic Time Series', *Internation Statistical Review*, Vol. 51, pp 111-163.

19. Karnik, Ajit (1991), 'Administered Prices, Budget Deficit and Growth : Some Policy Implications for Indian Economy using Optimal Control Methods', *Journal of the Indian School of Political Economy*, Vol, III, pp 111-143.

20. Krishnamurty K. and V. Pandit (1985) : *Macroeconometric Modelling of the Indian Economy : Studies on Inflation and Growth*, Delhi : Hindustan Publishing Corporation.

21. Lopez, J.M. (1992), Incidence of Interest Cost on Private Corporate Sector, *RBI Staff Studies*.

22. Marwah, (1972) : 'An Econometric Model of India : Estimating Prices, Their Role and Sources of Change', *Indian Economic Review*, pp 53-91.

23. Madhur, S. and P. Roy (1986) : 'Price Setting in Indian Industry', *Journal of Development Economics*, Vol. 20, pp 205-224.

24. Mc Kinnon. Ronald I. (1973) : *Money and Capital in Economic Development*, Washington, D.C. Brookings Institution.

25. Moore, Basil. J. (1988), 'The Endogenous Money Supply', *Journal of Post Keynesian Economics*, Spring Vol. X, No. 3, PP. 372-389.

26. Rao K.S.R. (1984), 'Impact of Administered Price on Wholesale Price Level (1970-71 to 1983-84) *RBI Occasional Papers*, vol. no. 2 December, pp 240-290.

27. Pani, P.K. (1977) : *A Macroeconometric Model of the Indian Economy*, Delhi: Macmillan.

28. Pandit V. (1984) : Macroeconomic Adjustment in a Developing Economy : A Medium Term Model of Output and Prices in India, *Indian Economic Review*.

29. Taylor, Lance (1983) : *Structuralist Macroeconomics*, New York, Basic Books.

Reserve Bank of India Occasional Papers
Vol. 13 No. 1, March 1992

Modeling Nonstationary Macroeconomic Time Series

By
Ghanshyam Upadhyay*

In this paper, presence of stochastic trend and deterministic trend in six macroeconomic time series has been tested by using Dickey-Fuller test for unit root. Models for forecasting for all the series have also been developed. These series are aggregate deposit, money supply, non-food credit, index number of industrial production, index number of wholesale prices and index number of consumer prices. It has been found that the first four series are having deterministic trend while the remaining two are characterised by stochastic trend.

1. Introduction

In the theory of time series analysis it is assumed that a sequence of observations $Y_1, Y_2, \ldots, Y_T$ is a realization of random variables following a stochastic process. The stochastic process generating the observations is generally assumed to be stationary. A time series is said to be stationary in weak sense if mean and variance (finite) are constant for each time point 't' and the autocovariances depend only on the interval between two occurences. It ensures that the structure of the process remains fundamentally same over time which is a prerequisite condition for building an ARMA model for the purpose of forecasting. But, in reality almost all economic time series are non-stationary, i.e. they are characterised by some type of trend or other making it difficult to build an ARMA model in the presence of the levels of the series.

In such a situation, it is a common practice to transform a nonstationary time series into stationary one by taking simple differences so that an appropriate model could be fitted on the transformed series. But, this method to make the series stationary, should not be adopted without studying the true nature of the series, as it may not be proper to do

---

* Shri Ghanshyam Upadhyay is Research Officer in the Department of Statistical Analysis and Computer Services. The author expresses his deep sense of gratitude to Dr. D. Ray and Shri R.B. Barman for their valuable suggestions and also for providing continuous encouragement in completion of this paper. The author is also grateful to Shri R. Nagaraja Rao for his suggestions which were useful in shaping of this paper in its present form. Views expressed here are those of the author and not of the institution.

so if the series is characterised by deterministic trend and not by stochastic trend. A nonstationary series is said to have deterministic trend if it is characterised by stationary flactuations around a deterministic time trend. These type of series are called trend stationary (TS) series. A non-stationary series is said to have stochastic trend if the variation in the mean level is completely stochastic and has no tendency to follow any fixed path (random walk model is the simplest cast of this). These series are called difference stationary (DS).

If a series belongs to TS class, the same can be detrended by fitting appropriate regression equation on time t and the residuals so obtained will be stationary. For long term forecasting of this type of series, the trend equation should be enough, while for short term forecast, information contained in the residual series can also be exploited.

To ascertain whether a particular series belongs to TS class or DS class, Dickey-Fuller test for unit root can be used.

In the present exercise, apart from testing whether a series belongs to TS class or DS class, models have been developed for forecasting of six economic time series.

The six economic time series considered are (i) aggregate deposits of all scheduled commercial banks (AD) (ii) non-food credit of all scheduled commercial banks (NFC) (iii) money supply (M_3) (iv) index number of industrial production (IIP) (v) index number of wholesale prices (WPI) and (vi) index number of consumer prices (CPI). All series are monthly and they cover the period April 1982 to March 1991 except for the CPI where the coverage is from April 1983 to March 1991. The data are collected from different issues of Reserve Bank of India Bulletin.

Organization of this paper is as follows : deterministic and stochastic trend and their implications are briefly discussed in section 2 following Nelson and Plosser (1982). Short description of Dickey-Fuller test with results is presented in section 3. Model building and forecasting has been discussed in section 4 where identified models and their evaluations are presented with empirical results. The conclusions are given in section 5.

2. Deterministic and Stochastic Trend

There are two fundamentally different classes of non-stationary processes. The first one consists of those which can be expressed as a

deterministic function of time plus a stationary stochastic process. We also assume that the deviations from the trend line can be represented as a stationary and invertible ARMA process. Since these are stationary about the time trend line, the same are also called trend-stationary process. A series of linear TS class can be represented by

$$X_t = a + bt + C_t \qquad (2.1)$$
$$\text{and } F_1(B)\ C_t = G_1\ (B)\ u_t;$$

where a and b are fixed parameters, C_t is a stationary process, B is lag operator and $F_1(B)$ and $G_1(B)$ are polynomials in B satisfying the conditions of stationarity and invertibility. u_ts are independently and indentically distributed (i.i.d.) normal variate with mean zero and variance σ_u^2.

From (2.1) it follows that if the series is forecast only by the trend component the forecast error would be equal to C_t which is stationary with finite variance. So, the uncertainty lies within bounds even in the indefinitely distant future. Therefore, for long-term forecasts, trend component only can be projected while for the short-term forecasts, the autocorrelation among C_ts can also be gainfully exploited.

The second class of processes consists of those which become stationary and invertible after differencing appropriate number of times. These are called difference stationary (DS) processes. It can be represented as :

$$X_t = b + X_{t-1} + \delta_t \qquad (2.2)$$
$$\text{and } F_2(B)\ \delta_t = G_2(B)\ v_t\ ;$$

Where b is constant, δ_t is a stationary process, $F_2(B)$ and $G_2(B)$ are polynomials in B satisfying the conditions of stationary and invertibility and v_ts are i.i.d. normal variates with mean zero and vairance σ_v^2.

From (2.2), one can easily get

$$X_t = X_0 + bt + \sum_{i=1}^{t} \delta i \qquad (2.3)$$

If we compare (2.1) and (2.3), we find that -

(i) X_0 in (2.3) is a function of past and not a constant while 'a' in (2.1) is a constant.

(ii) C_t in (2.1) is stationary, but in (2.3) $\sum_{i=1}^{t} \delta_i$, being accumulation of all stationary disturbances, is nonstationary and its variance increases as t increases. On the other hand, variance of C_t is constant for every t.

We also see that in TS class, an innovation at any time point has no effect on future values of the variable while in DS class, it has permanent effect on the variable. So it is felt that these two classes, while building suitable model for forecasting, need to be dealt with differently.

3. Dickey-Fuller's Test for Unit Root

Dickey and Fuller (1979) have suggested a procedure by which one can test whether a series is having unit root or not. This test can also be used for testing whether a series belongs to TS class or DS class. Assuming the following model for any economic time series Y(t).

$$Y(t) = \alpha\, Y(t-1) + \varepsilon(t), \quad t = 1,2,3,... \tag{3.1}$$

Where $Y(O) = O$, α is a real number and $\{\varepsilon(t)\}$ is a sequence of i.i.d. $N(O,\sigma^2)$.

If $|\alpha| < 1$, Y(t) becomes stationary at $t \to \infty$. If $|\alpha| = 1$, variance of Y(t) increases with t and is $t\sigma^2$. If $|\alpha| > 1$, variance of Y(t) increases exponentially.

The hypothesis that $|\alpha| = 1$ is of interest because it corresponds to the hypothesis that it is appropriate to transform Y(t) by differencing in order to make it stationary.

Two more models which are considered are given by

$$Y(t) = \mu + \alpha\, Y(t-1) + \varepsilon(t), \quad t = 1,2,3,.... \tag{3.2}$$
$$Y(O) = O$$

and

$$Y(t) = \mu + \beta t + \alpha\, Y(t-1) + \varepsilon(t), \quad t = 1,2,3,... \tag{3.3}$$
$$Y(O) = O.$$

To test the hypothesis $|\alpha| = 1$, Dickey and Fuller have suggested the statistics which are calculated in the same manner as t-statistics but

since under the null hypothesis, the observations are not independent the distribution of these statistics do not follow t-distribution. Dickey and Fuller have derived the limiting distribution (JASA, p. 247, 1979) and have calculated the lower percentage points at different levels of significance for them using Monte-Carlo simulation technique.

For a given series of observations, we first find the appropriate model from among the three models given above which can be done by testing for the presence of drift (μ) and time coefficient (β). After recognizing the true model, we test for the presence of unit root, i.e., $|\alpha| = 1$. Acceptance of the null hypothesis, while the established model is any one of three mentioned above, means that the series is having unit root and it belongs to DS Class. Rejection of the null hypothesis while established model is (3.1) or (3.2) implies that the series is stationary with drift (μ) zero or non-zero respectively. And rejection of hypothesis with model (3.3) means that the series belongs to TS class.

We have applied this test on the six economic time series. Specific models and calculated test statistics have been given in Table 3.1. We have transformed four series, viz., money supply, aggregate deposits, non-food credit and index of industrial production logarithmically as we observe that they follow some exponential pattern.

Table 3.1

Series Name	Model	Dickey-Fuller Stat.	Tab. value at 5% l.s.	Tab. value at 1% l.s.
1. Money Supply	$LnY(t) = \mu+\beta t+\alpha\ LnY(t-1)+\varepsilon(t)$	-6.843*	-3.45	-4.04
2. WPI	$Y(t) = \mu+\alpha\ Y(t-1) + \varepsilon(t)$	3.154	-2.89	-3.51
3. CPI	$Y(t) = \mu + \alpha\ Y(t-1) + \varepsilon(t)$	1.537	-2.89	-3.51
4. Aggregate Deposit	$LnY(t) = \mu+\beta t+\alpha\ LnY(t-1)+\varepsilon(t)$	-7.117*	-3.45	-4.04
5. Non-food Credit	$LnY(t) = \mu + \beta t+ \alpha\ LnY(t-1)+\varepsilon(t)$	-4.408*	-3.45	-4.04
6. IIP	$LnY(t) = \mu+\beta t+\alpha\ LnY(t-1)+\varepsilon(t)$	-7.004*	-3.45	-4.04

* Significant at both 5% and 1% l.s. [See Dickey (1976) for Tabulated values].

It can be observed from table 3.1, that the null hypothesis of unit root is rejected for four series, viz., money supply, aggregate deposit, non-food credit and index of industrial production. At the same time Coeffecient of time (β) is also significant which implies that these four series belong to TS class. For two remaining series the null hypothesis of unit root is accepted with some non-zero drift which means that these two series belong to DS class.

This result implies that the four macroeconomic time series, viz., money supply, aggregate deposit, non-food credit and index of industrial production are mainly moving along a deterministic path though there may be some stationary fluctuations around it with mean zero. Therefore, even if one forecasts these series with the help of deterministic part only, the error committed will be equal to the fluctuation at that point of time which has mean zero and variance independent of the time point thus making the uncertainty bounded even for indefinitely distant future. But, in the case of two remaining series, the variation in the level of series is completely stochastic and the forecast error increases with increase in lead period.

4. Model Building and Forecasting

After classifying the six series into two classes, an attempt is made to evaluate the forecast performance of the two methods as discussed below :

Method A : First of all, an appropriate trend equation with time t is fitted to the series using Ordinary Least Squares techniques and residuals are estimated. An appropriate ARMA model is developed on the residuals. Both the trend part and residuals are forecast separately and superimposed on each other to give the final forecast.

Method B : Given a series, a model is developed by using Box and Jenkins (1976) method.

It is expected that the method A should give better results for the series belonging to TS class while for series belonging to DS class, method B should outperform method A. For all the six series, models under A and B are obtained which are given in table 4.1 and table 4.2 respectively. For the purpose of comparison, model building and forecasting have been done twenty times and every time for lead period twelve following Ray (1988).

Table 4.1

Series Name	Models under Method A
1. M_3	Ln Y(t) = 11.043 + 0.013 t + C(t) (1 - 0.7202 B + 0.2386 B^{12}) [D_{12}C(t)]* = u(t)
2. IIP	Ln Y(t) = 4.666 + 0.007 t + C(t) (1 - 0.4491 B) [D_{12}C(t)]* = (1 - 0.8879 B^{12}) u(t)
3. AGD	Ln Y(t) = 10.694 + 0.014 t + C(t) (1 - 0.6821 B) [D_{12}C(t)]* = u(t)
4. NFC	Ln Y(t) = 10.177 + 0.013 t + C(t) (1 - 0.8553 B) [D_{12}C(t)]* = (1 - 0.7883 B^{12}) u(t)
5. WPI	Y(t) = 95.995 + 0.771 t + C(t) (1 - 0.2184 B + 0.4816 B^{12}) [D_{12}D C(t)]* = (1 - 0.8499 B^{12}) u(t)
6. CPI	Y(t) = 99.335 + 0.966 t + C(t) (1- 0.2084 B + 0.4951 B^{12}) [DD_{12} C(t)]* = (1 - 0.8982 B^{12}) u(t)

D = (1 - B) and D_n = (1 - B^n)
* Deviation from mean has been taken.

Table 4.2

Series Name	Models under Method B
1. M_3	*1 + 0.2368 B^{12} [D D_{12} log Y(t)]* = v(t)
2. IIP	(1 + 0.2293 B) [D D_{12} Y(t)]* = (1 - 0.8826 B^{12}) v(t)
3. AGD	(1 + 0.2190 B) [D D_{12} log Y(t)]* = v(t)
4. NFC	(1 + 0.3278 B^{12}) [D D_{12} log Y(t)]* = (1 - 0.2717 B) v(t)
5. WPI	(1 - 0.2169 B + 0.4779 B^{12}) [D D_{12} Y(t)]* = (1 - 0.8491 B^{12}) v(t)
6. CPI	(1 - 0.2084 B + 0.4951 B^{12}) [D D_{12} Y(t)]* = (1 - 0.8982 B^{12}) v(t)

D = (1 - B) and D_n = (1 - B^n)

* Deviation from mean has been taken.

The four series, viz., money supply, aggregate deposit, index of industrial production and non-food credit which belong to TS class become stationary after substracting the trend component. In these cases, it is not required to take first difference on C(t) (Table 4.1) though twelfth

difference (since data are monthly) has been taken to capture the seasonal pattern. It is not possible to build ARMA model on the residuals of WPI and CPI as the residuals of trend equations on these two series do not become stationary. Therefore differencing is indispensable for building an ARMA model if a series belongs to DS class.

The results showing Mean Square Percentage Error (MSPE) under methods A and B for all the six series are given in table 4.3

Table 4.3 : Mean Square percentage Errors Under the Two Methods

Lead Period	SERIES											
	AD		M_3		NFC		IIP		WPI		CPI	
	A	B	A	B	A	B	A	B	A	B	A	B
1	1.82	2.42	0.82	0.73	2.71	2.91	2.85	2.82	0.21	0.20	0.43	0.49
2	2.11	3.46	1.62	1.71	5.58	4.66	4.56	4.63	0.66	0.65	1.18	1.41
3	1.98	3.70	1.91	2.26	8.66	5.66	5.39	6.88	1.02	1.07	1.70	2.22
4	1.51	2.51	1.97	1.98	10.56	5.59	6.03	8.68	1.28	1.41	2.12	2.82
5	1.25	1.47	2.04	1.71	12.05	5.90	6.54	10.04	1.51	1.66	2.62	3.48
6	1.42	1.67	2.15	1.59	13.86	8.26	6.74	12.77	1.83	1.91	3.23	4.25
7	1.81	3.00	2.21	2.37	15.96	11.92	6.49	14.35	2.33	2.22	4.19	5.19
8	1.97	3.38	2.32	3.07	17.37	14.85	6.27	15.59	3.07	2.61	5.66	6.33
9	2.32	3.19	2.39	4.10	19.06	17.50	6.05	15.43	4.10	3.10	6.36	7.57
10	2.65	3.09	2.39	4.45	19.13	18.44	5.24	13.49	5.51	3.66	9.78	8.92
11	2.91	3.30	2.33	4.40	19.07	20.13	4.37	10.66	7.46	4.30	12.69	10.20
12	3.20	3.73	2.36	4.57	18.72	22.72	3.44	7.19	9.51	4.75	15.54	11.24

A: Method A, B : Method B.

From the results shown in table 4.3, it is clear that all the series belonging to TS class except one have performed much better with method A while method B has given better forecasts than method A for both the series belonging to DS class. The exceptional series is one relating to non-food credit. As remarked by Nelson and Plosser (1982), one possible explanation for this may be the high autocorrelation of residuals. It can also be seen from table 3.1 that Dickey-Fuller statistic under the hypothesis of unit root for non-food credit is marginally significant. It may be said that the empirical results are consistent with the assertion that method A should be adopted for building models for series belonging to TS class while method B is more appropriate for dealing with series belonging to DS class.

5. Conclusions

In our present study, we have applied Dickey-Fuller test for unit root on six Indian macroeconomic time series to ascertain whether the series belonged to TS class or DS class. Our analysis shows that out of six series, four, viz., aggregate deposit, money supply, non-food credit and index number of industrial production belong to TS class. The implication of this is that these series will move on a deterministic path together with stationary fluctuations so that the series can be forecast even for very long leads with bounded uncertainty. On the other hand, the remaining two series, viz., index numer of wholesale prices and index number of consumer prices belong to DS class. The implication is that these two series will have a stochastic trend together with the cyclical component and as such the uncertainty in the distant future is unbounded.

References

1. Box G.E.P. and G.M.Jenkins (1976), *Time Series Analysis Forecasting and Control*, San Francisco, Holden-Day.

2. Dickey, D.A. and W.A. Fuller (1976), *Estimation and Hypothesis Testing in Nonstationary Time Series*, Unpublished doctoral dissertation (Iowa State University, Ames, IA).

3. — (1979), 'Distributions of the Estimations for Antoregressive Time Series with a Unit Root', *Journal of American Statistical Association*, 74, p. 427-431.

4. Nelson, C.R. and C.I. Plosser, (1982), 'Trends and Random Walks in Macroeconomic Time Series,' *Journal of Monetary Economics*, Vol. 10, p. 139-162.

5. Ray, D. (1988), Comparison of Forecasts : An Empirical Investigation, *Sankhya: The Indian Journal of Statistics*, Series B, p. 258-277.

Reserve Bank of India Occasional Papers
Vol. 13 No. 1, March 1992

BOOK REVIEWS

Latin American Adjustment - How Much Has Happened? Edited by John Willamson, (April 1990) - Institute For International Economics, Washington DC, pp, xv + 445, $ 37.96.

The Latin American adjustment experience during the eighties provides many lessons for the countries faced with major imbalances on the internal and external fronts. Internal imbalances, it is well known, manifest themselves as high inflation, and external imbalances as unsustainable current account deficits and balance of payments crisis. Ever since the early eighties, and more particularly since 1982, Latin America, groaning under the burden of a severe external debt, grouped with problems of external and, in many cases, structural adjustment and, in the process, exposed itself a number of times to errors of judgement and false understanding of the internal economic management. The adjustment experience has also often been subjected to external shocks. To facilitate adjustment, most Latin American countries have sought external financial assistance, in particular from the IMF. In the process, they have had to follow stabilization policies that often are characteristic features of Fund-supported programmes.

The book under review, edited by John Williamson, presents the papers and proceedings of a Conference held by the Institute for International Finance to assess the course of Latin American adjustment in the wake of profound political and economic changes in a number of Latin American countries after mid-1985. The book contains nine chapters including four devoted to country studies. Williamson's background paper (Chapter 2) presents a stylized description of the approach to a desirable set of economic policy reforms normally prescribed by what he termed as "Washington" to mean primarily the IMF, World Bank, the US Government, the Federal Reserve Board and the think tanks. While this implies an aggregation of views across a wide spectrum of institutions and personalities, it lays bare ten policy instruments as playing a critical part in adjustment programmes in Latin America. These are : fiscal policy, public expenditure priorities, tax reforms, interest rates, the exchange rate, trade policy, foreign direct investment, privatization, deregulation

and property rights. Williamson himself does not seem to be always in "consensus" with "Washington" and has, as Fischer termed it, taken a new 'potshots' at the US fiscal and exchange rate policy in the process. Although Williamson himself has listed precisely the same reforms that are suggested by Washington, he distances himself from the ideas of the latter, and has articulated sharply distinct views of his own. For example, according to him, sustained and large fiscal dificits result not from any rational calculation of expected economic benefits, but from lack of political courage or honesty to match public expenditures and the resources available to finance them (p.10). He is very critical of the supply-side politics of the Reagan administration which preferred to cut public expenditures rather than to increase taxes.

The U.S. model may not work in Latin America where the level of taxation is already relatively low (Meller). Although "indiscriminate subsidies" should be eschewed, carefully targetted subsidies can be useful from the point of view of cutting expenditures, as pointed out by Williamson. Williamson favours real domestic interest rates to be moderately positive, so as to promote investment, and more importantly, to avoid an explosion in government debt. Exchange rates too, in Williamson's view, should not be competitive in the conventional sense so that unnecessary inflationary pressures could be avoided. The author firmly believes that public ownership is preferable to private enterprise contrary to Washington's views but admits that privatisation can be very constructive where it results in increased competition. Williamson's views on Latin America bear the stamp of his familiarity with the Latin American economic situation.

Now regarding country studies. The first set of countries discussed (Chapter 3) - Bolivia, Peru and Chile- portray different adjustment styles and different levels of success. The Bolivian experience demonstrates that with the consensus of the people, stabilization measures can succeed. The paper on Bolivia by Juan L. Cariaga summarizes the actions taken by the Bolivian government along the lines of the Washington consensus and assesses the results of these actions. Bolivia embarked on an adjustment programme in 1985. Bolivia's problem was one of tackling hyperinflation which had spiralled to an annualized rate of 24,000 percent by September 1985. The government pursued a policy of tight fiscal discipline by imposing spending cuts, by eliminating subsidies, and imposing taxes. The government also set a realistic exchange rate. The Bolivian programme established a single uniform tariff for all imports, freed interest rates, removed price controls and price regulations. These adjustment measures not only broke the phenomenon of hyperinflation but also achieved a positive net flow of resources from multilateral institutions.

Writing on Chile, Patrico Meller distinguishes the period 1982-83 as one of "recessionary adjustment" (p 57), Chile subscribed to the IMF standby programmes during 1983 and 1984 where priority was according to ensuring full debt-service payments. External adjustment required generation of surpluses in the trade account in order to meet external debt-service obligations. The most positive outcome of such a programme was an expansion in exports. The author points out, interestingly, that unlike other countires, Chile's large and unsustainable current account deficit was associated with the private sector income-expenditure imbalance rather than with public secotr deficits. The author, measuring the primary (reduction in real absorption) and secondary costs (generated by existing structural rigidities and by policies "overkill") concludes that the Chilean adjustment process has been "excessively costly and prolonged" (p 67).

Peru is an example of disaster as the domestic policies followed by the Garcia government, though populist, proved to be confrontational and thus damaging from the point of view of international approach to the debt problem. Pedro-Pablo Kuczynski crisply assesses that "not much" of structural adjustment was possible in Peru. the author recommends that the first step towards meaningful reform in Peru must be to curb inflation. Decontrolling all prices and substantial devaluation were recommended for the purpose. A major tax simplification will have to be put into effect. Priority should be given to revive investment and eventually growth. The author also feels that privatization is essential to mop up excess liquidity.

The problem of three major debtors - Argentina, Brazil and Mexico are discussed in Chapter 4. Argentina's reforms were started years ago in the area of interest and exchange rates, and proceeded only more recently to address fiscal fundamentals. Argentina's successive stabilization plans failed mainly because they were unable to close the fiscal gap. Juan Carlos de Pablo adds the issue of governmental credibility and reputation to the list of Washington's reforms.

Eliana A. Cardosa and Daniel Dantas state that although Brazil had a positive average per capita growth rate among Latin American countries between 1982-88, and also posted large trage surplus, it had not "adjusted" to the debt crisis as the government had "accommodated" the disappearance of external sources of finance by printing money and by creating domestic debt (p 129).

Domestic debt has grown to finance the budget deficit as well as to pay for large subsidies granted to public enterprises and the private sector.

Javier Beristain and Ignacio Trigueros show that since 1983 there has been a dramatic turnaround in economic policy in Mexico with each of the ten policy instruments being applied in some way or the other. The policies pursued by the Miguel de la Madrid administration during 1983-88 was very volatile, predominantly stemming from adverse exogenous factors such as the earthquakes of 1985, the crash of oil prices in 1986, and the October stock market crash, which downgraded the quality of perso denominated assets. However, the most important achievement during this period was that it prepared the economic foundations for growth (p 159). As the authors show, the Mexican liberalization reform measures were dramatic. Imports were subject to prior licences, the liberalization process was accompanied by large devaluation and most important, fiscal adjustment measures were undertaken in 1987.

The record of these three countries highlights the primacy of fiscal adjustment. While strong fiscal adjustment paved the way to Mexico's recovery, the lack of fiscal adjustment in Brazil and Argentina was the salient feature of their stabilization failures.

Rudolf Hommes and Ricardo Hausmann have written two informative and interesting papers on the adjustment cases of Colombia and Venezuela. De Lislie Worrel and Sylvia Saboria asses the extent of economic adjustment in the Caribbean and Central America in the 1980s. Both the areas, according to the authors, have a long way to go in terms of reviving growth.

The central question arising out of the book is whether Latin American adjustment has succeeded or not. Dornbusch (Chapter 7) sees the 1980s as a lost decade for Latin America and fears that the 1990s may go the same way (though Williamson does not agree with the latter view). Fischer has several misgivings against the "Washington" agenda, one of them being their "desparately slow" recognition of the need for fiscal reform. He also blames the IMF for taking almost a decade for coming into grips with the need for incomes policy. Washington relied too much on demand management policies for far too long a period.

However, without the international supportive approaches, it is doubtful whether Latin American adjustment could have been possible at all. Policies have been successful in avoiding not only a systemic threat

to the financial system but also any major repudiation of debt. There have been repeated reschedulings, extension of credit through Fund programmes and introduction of innovative debt reduction instruments including debt equity swaps, buybacks and exit bonds.

A big question that arises from the book is the implict dismissal of development literature. There is growing acceptance reagarding the inclusion of wage and price guidelines in recent adjustment packages. The book also does not tackle the question of sequencing of reforms. But, as Williamsons defends (Chapter 9), although there is significant literature on the subject of sequencing, much of it is still highly inconclusive. The book also makes no mention of the reversal of negative net transfers. As Enrigue Iglerias (Chapter 8) points out, policy reform and debt relief have to act in a complementary way to the success of reforms in Latin America in the 1990s. The Brady Plan therefore, would need to be strengthened in terms of financial availability.

The book is highly readable, and for this credit should go to Williamson and the authors of the papers. Readers would get an overview of the different perspectives on stabilization programmes at one place. the country studies by Latin American authors provide a comprehensive analysis of the progress in reforms and the expert comments by eminent economists give readers sharp insight into the problem. Ultimately, when the question is asked as to how much has happened in Latin America, the answer is positive and full of hope, as developments in the last two-three years of the 'eighties have shown.

A. Prasad*

---

* *Shri A. Prasad is Research Officer in the Department of Economic Analysis and Policy.*

Reserve Bank of India Occasional Papers
Vol. 13 No. 1, March 1992

Santalpur Block after Seven Years, by Atul Bhatt- National Institute of Bank Management pp. vii + 123, price Rs. 200/-

In order to support centralised planning, block level planning was attempted with a pointed focus on generation of employment opportunities and reduction in poverty in the late seventies in a few selected blocks of three states, viz., Gujarat, Karnataka and Uttar Pradesh. The Government of Gujarat was among the first three State Governments to start block level plan on a massive scale. In the first phase, 20 backward blocks selected in 1978-79 for the purpose. In the second phase, 20 more blocks were also added during 1979-80. A number of research institutions, universities and professional bodies were entrusted with the work of preparing full employment plan for these blocks. The plans were launched in 1979-80 for the first batch and in 1980-81 for the second batch of blocks. Block plans were prepared for a period of 5 years taking into consideration the special fund of Rs. 50 lakh (Rs. 10 lakh per year for 5 years). The study under review relates to Santalpur block plan which is one of the best block level plans. The book attempts to find out the level of implementation of block plan with particular reference to its impact on reduction in the incidence of poverty and generation of employment opportunities in the block.

The study is divided into six chapters. Chapter 1 gives the brief history and rationale of block level plan. Chapter 2 presents a profile of the block which includes physical and human resources, industries and banks as well as a comparative picture of infrastructure and service available in pre and post-era of planning. The details of the scheme/activities suggested in the block level plan and their implementation have been covered in Chapter 3. Chapter 4 provides an awareness about the plan and the role played by various agencies in the implementation process. chapter 5 deals with the impact on unemployment and poverty. The main findings of the study and suggestions have been presented in Chapter 6.

There was significant improvement in some of the basic facilities available in the block, viz., electricity, pucca roads and bus services. During the period under review, interestingly, a scheme of supply of drinking water to 54 villages in Santalpur block (under financial support of Dutch–Netherlands Government) could not serve the purpose mainly due to leakage in broken pipelines at several places. The main focus

of the Santalpur block action plan was on the development of off-farm activities to reduce the dependence on agriculture mainly through salt-based industries and tapping of mineral resources available in the block. The study reveals that the scientific and geographical investigation suggested for these activities in action plans were not undertaken. There was no improvement in the facilities provided like, supply of drinking water, building pucca approach road and supply of electricity to salt producing areas. Lack of coordination between the implementing agencies was one of the most important reasons for the poor implementation of the block level plan. Awareness about the block plan was also poor, because copies of the plan in Gujarati language were not sent to the block level officials. Multiplicity of programmes implemented through government departments has added confusion among government officials at district and block levels. Frequent transfers of officers has further aggravated the problem. The Regional Managers and other officers of the Lead Bank involved in the preparation of the district credit plan and annual action plan did not have any information about the block level plan documents.

The study reveals that credit allocation to Santalpur block was less than its due share in the district credit plan. The study further reveals that Santalpur has not only got a step-motherly treatment at the credit planning stage but also at the implementation process. The study noted that many posts in the government departments especially of the block development officers and health officers of Santalpur Taluka remained frequently vacant. Santalpur block is considered as a punishment posting among both government and bank officers. One of the most unsavoury findings of the study relates to the result of household survey in the selected villages of Santalpur Block. The percentage of unemployed and underemployed together was about 71 per cent in 1987 as compared to 50 per cent in 1980 in the Santalpur block. The study reveals that under-employment percentage was the highest among agricultural labourers and the lowest among the artisans. This suggests that as a result of drought conditions during much of the period under review, agricultural labourers were the first victims while the artisans managed to cope up with the severity of drought. Moreover, during a drought year, the fall in real wage rate of agricultural labourer is high. Agriculture, therefore, does not hold much promise in drought-prone areas for the existing population, let alone for generation of employment opportunities.

Regarding incidence of poverty, the study reveals that the proportion of the household living below the poverty line, as per monthly per capita expenditure criterion, has slightly declined. However, on monthly per

capita income basis, it was observed that the proportion of the family below the poverty line was as high as 77 per cent in both 1980 and 1987. The lower incidence of poverty under monthly per capita expenditure method suggests that some of them could keep their head above water by borrowing or disposing off assets. However, as the study has focussed only on the extent of poverty, the level of poverty may perhaps be more severe.

The book under review has reviewed the position and progress of implementation of block level plan but it is more important to analyse the reasons for poor implementation. Here, one cannot and should not blame the implementation authorities alone when the very design of action plan is perhaps not appropriate. It appears that credit component of plan was taken for granted, without looking into the banking infrastructure and credit absorption capacity in the block. This suggests that professional planning agencies should not only improve their methodology and sharpen their tools but also spend sufficient time in the block to acquire the first-hand knowledge of the area.

The study confirms the suitability of block as a unit for micro plannig; while this is welcome, there is also a need to closely examine the fast-changing developments in the sphere of rural credit planning such as Potential Linked Credit Plans, Service Area Plans and Village Credit Plans, etc.

The study has made some suggestions for better plan implementation. These include: (i) involvement of poor in the implementation of plan; (ii) improving efficiency of development staff by proper training; (iii) appreciation of block level planning by higher officials at State and district levels; and (iv) transfer of knowledge about areas to new incumbents in the implementation team. These are somewhat familiar. A number of issues have been left unaddressed. For instance, how does one retain implementing staff in positions without providing basic amenities of life like potable drinking water? How effectively can one canvass the projects whose takers are semi-starved people? How do we simplify rigid formalities and remove procedural bottlenecks in the process of implementation? How are we to ensure and enlist co-ordination and co-operation from staff of other agencies?

These limitations apart, the usefulness of the study for policy planners and rural development planners cannot be gainsaid. Those who see the socio-economic dimensions at the grassroot level as they in future

would know that micro-level planning is multi-dimensional and has to be addressed by an approach that should be informed of co-ordination of efforts at both the stages of designing and implementation of development programmes.

C.L. Dadhich*

---

* *Dr. C.L. Dadhich is Assistant Adviser in the Department of Economic Analysis and Policy.*