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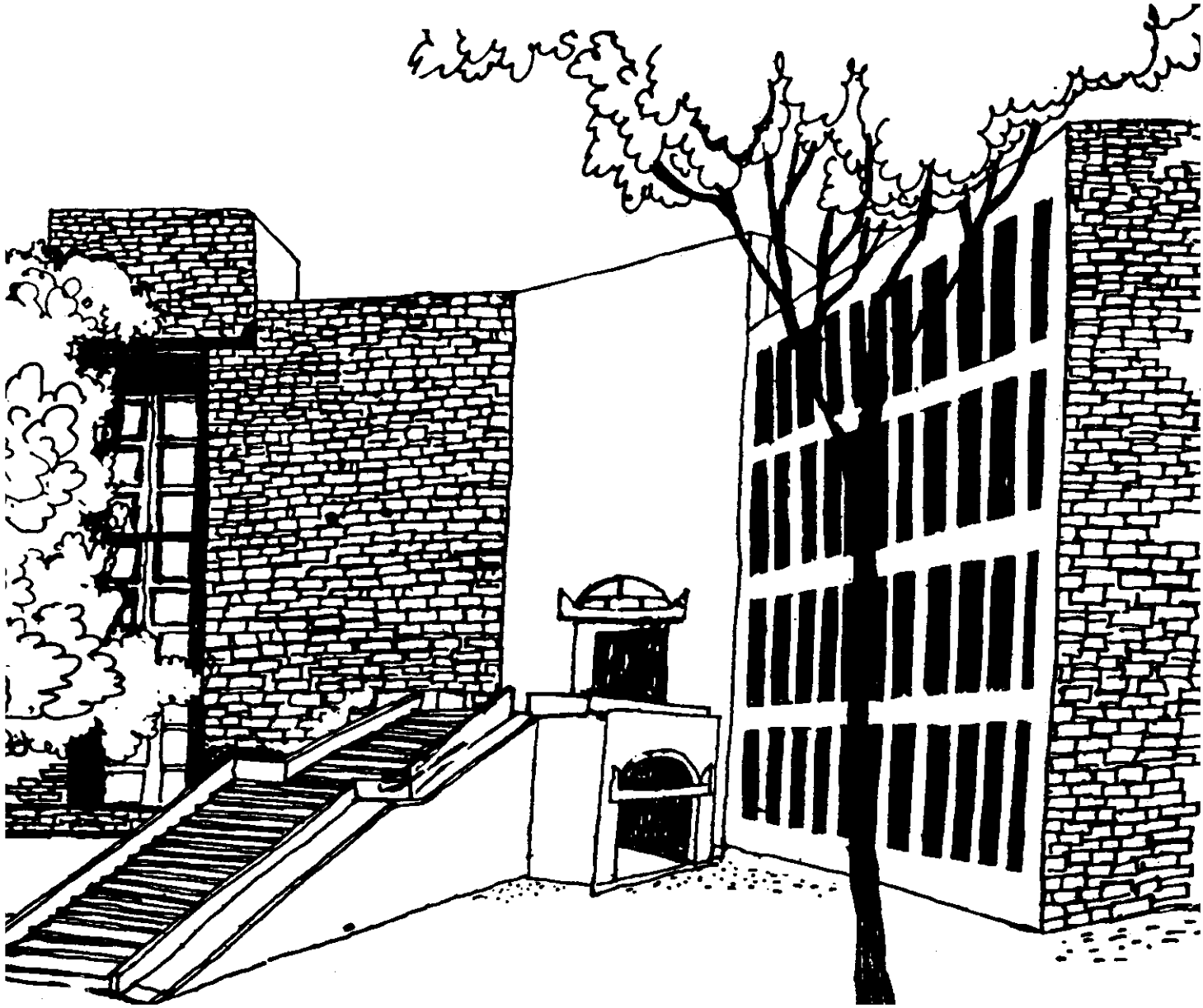

SOME COMMENTS ON THE DEBATE ON INDIA'S ECONOMIC GROWTH IN THE 1980S

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W P No. 1015
March 1992

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Abstract

In this paper an attempt has been made to identify the exact year in which India broke the so called "hindu" rate of growth by employing the switching regression technique. The study suggests that the year 1981/82 is the point of break. The trend rate of growth of GDP which was 3.52 per cent for the period 1950/51 to 1981/82 significantly increased to 5.15 per cent thereafter. The primary sector exhibited break in the trend in 1980/81 and tertiary sector in 1982/83. The secondary sector showed two breaks viz. 1964/65 and 1981/82. From the results it appears that primary sector has led the process of break in the trend growth of GDP. The substantially high growth rate of GDP in the 1980s is the result of breaks in the growth rate of all the three sectors and not due to secondary and tertiary sectors alone.

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I. Introduction

Despite planned efforts ever since independence to move to a higher growth path, India's secular trend growth rate hovered around 3.5 percent till the early 1980s. This growth rate has been called 'hindu' rate of growth by Raj Krishna, former member, Planning Commission. Recent studies which analysed the growth rate of Indian economy [Goldar and Seth(1989), Kelkar and Rajiv Kumar(1990) and, Nagraj(1990)] have shown that there has been a shift in the growth rate of Indian economy in the 1980s. Some studies have attempted to identify the break(s) in time trend of gross value added in industry/ total GDP [Goldar and Seth (1989), Bhargava and Joshi (1990), and Nagraj(1990)]. Goldar and Seth chose 1965/66 and 1975/76 as break points in the trend growth rate of industry and tested their hypotheses. Bhargava and Joshi (1990) examined whether there was any break in the trend growth rate of GDP in 1975/76 and 1980/81 (these years were chosen on *a priori* considerations). Nagraj (1990) considered two alternative years (1975/76 and 1979/80) to test the hypothesis of break in the GDP series. These studies have chosen break points based on *a priori* considerations and have put their hypotheses to test. When *a priori* reasoning is used the choice of the exact break point tends to be arbitrary and it is possible that the same data might support alternative hypotheses

of break in the trend. Bhargava and Joshi(1990), while drawing inferences from the estimated equations, use a rule of thumb as the criterion when results were statistically non significant as per the Chow's test. This criterion is "sizeable change" - defined as any change in growth rate of at least 1 per cent in comparison to the previous period. This criterion does not make any sense in statistical terms [see Nagraj(1991) for a critique of Bhargava and Joshi's study].

Nagraj (1990) using the criterion of significance of the coefficient of the term (Dt) in the exponential trend model - $\log Y = a_0 + a_1 + b_0 t + b_1(Dt) + e$, found that both 1975/76 and 1979/80 are break points for the GDP series, with growth rates for post 1979/80 higher than that for post 1975/76. When he considered the two break points together the coefficient for 1975/76 was found to be non-significant. This led him to conclude that "..the break in the series at 1979/80 and a higher growth rate in eighties appears to be a statistically stronger proposition than the break in the series at 1975-76"(p.1400). He was not able to say which one of the two years is the exact break point. In another study, Nagraj (1991) employed the same technique as Nagraj(1990), but examined for three possible break points. He observed that " irrespective of the turning point under consideration - 1975/76 or 1980-81 or 1981/82- a trend increase in the growth rate of GDP is undeniable". Again, he failed to point out as to which one of these three years considered is the break point. Moreover, it is often argued that the GDP originating from the public administration and

defense(PAD) is in the form of government expenditure and that it does not contribute to the real growth of the economy. It may be interesting to exclude the GDP originating in the public administration and defense sector from the GDP originating in the tertiary sector and total GDP and examine whether the adjusted series show any break.

In this study we attempted to answer the following questions- i) which are the exact years in which total GDP and its three broad sub sectors (primary, secondary and tertiary) experienced breaks(if any) in their series? ii) Do the answers to question (i) change if weather is introduced as variable in the growth equations? In the Indian economy, the growth of primary sector and consequently the overall GDP are likely to depend on weather fluctuations. iii) Is public administration and defense responsible for the break in the growth rate of tertiary sector and GDP in the 1980s as is believed by some authors? and, iv) Did the primary sector have any role in the shift in growth rate of GDP? We try to answer these questions using the information contained in the data themselves rather than *a priori* identification.

Rest of the paper is organized as follows : Section II explains the methodology used in the study and data sources. Section III discusses the results of the study and finally section IV contains conclusions of the study.

II. Methodology and Data Base

We have employed data relating to GDP originating in primary sector, secondary sector, tertiary sector and overall GDP (at

1980/81 prices) relating to the Indian Economy. The data were obtained from the Economic Survey, 1990/91 and pertain to the period 1950/51 to 1989/90[1]. Data regarding the GDP originating from the public administration and defense(PAD) was obtained from the National Accounts Statistics,1991[2]. We employed switching regression technique [(due to Quandt(1958)] to identify the breaks in trend growth rates of the selected variables (see Appendix I for details). We used kinked exponential trend model [see Poirier(1976)] for estimating the growth rate of GDP. The specific model employed was the one suggested by Gujrati(1988; p.455).[3]

$$\text{Ln } Y_t = a_1 + b_1 t + b_2 D(t-t^*) + e_{1t} \qquad (1)$$

where,

Y_t =Value of the dependent variable year 't' at constant(1980/81) prices,

t^* = the year of switch in growth rate of GDP,

$D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$,

a_0, b_1, b_2 are regression coefficients and e_{1t} is the error term.

The equation(1) was estimated for GDP originating in primary, secondary, tertiary sectors and overall GDP. Different values of t^* beginning from 1974/75 were considered for primary sector, tertiary sector and overall GDP. The value of t^* which yielded the maximum t-statistic for the term $D(t-t^*)$ in (1) provided the break point (see appendix I for details). Ofcourse, the statistical significance of the term $D(t-t^*)$ is a necessary condition for identification of the break.

Since the primary sector, especially the farm sector output, in India depends on weather conditions it may be interesting to examine whether inclusion of weather dummy as an explanatory variable[4] in the equation (1) alters the conclusion regarding the break point of primary sector and GDP.

The industrial sector faced a decline in the growth rate since the mid-1960s upto mid 1970s. This has been well documented in earlier studies [for example, see Ahluwalia(1985)]. Some studies [Raj(1984) and Ahluwalia(1988)] have indicated that after the mid-1970s the recovery began in the industrial sector. Further, studies have also shown that growth rate of secondary sector has been substantially higher in the 1980s compared to the 1970s [see for example Kelkar(1990)]. Thus based on the previous studies we may hypothesise that the secondary sector has experienced two breaks in the series- first around the mid sixties and the second around the early eighties. The methodology outlined above will not help test this hypothesis of two breaks simultaneously. Hence we identified the first break by considering the data from 1950/51 to 1980/81. This was followed by identification of second break using the data for the period 1966/67 to 1988/89. Then the two breaks identified were included to estimate the growth rates in three sub periods using the following two-break model.

$$\text{Ln } Y_t = a_1 + b_1 t + b_2 D_1(t-t_1^*) + b_3 D_2(t-t_2^*) + e_{1t} \qquad (2)$$

where,

t_j^* = the year of switch in growth rate of GDP,

D_j = 0 for $t \leq t_j^*$

= 1 for $t > t_j^*$, j= 1,2.

In cases where autocorrelation problem was encountered it was corrected by employing Cochrane-Orcutt iterative procedure. Such cases are mentioned in the foot-notes of the tables.

III. Results and Discussion

Primary Sector

For the primary sector, as per our decision criterion [i.e., maximum t-statistic for the term $D(t-t^*)$], the year 1979/80 turned out to be the year of break in the trend growth rate (see table 1A). The results with the weather dummy (table 1B) indicate that the year 1980/81,and not 1979/80, is the year in which primary sector experienced a break in the series. It may be recalled here that the year 1979/80 was agriculturally a bad year. The growth rate for 1950/51 to 1980/81 was 2.24 per cent and it increased significantly to 3.14 per cent during the period 1981/82 to 1989/90 (refer table 1B). The primary sector has not experienced any break in the series around the mid and late sixties despite the advent of green revolution in agriculture. Ahluwalia(1991a), in assessing the growth performance of Indian agriculture during the period 1950/51 to 1987/88, used 1968 and 1978 as two cut-off periods to examine whether there was any difference in the growth rates of GDP originating in agricultural sector between the pre and post green revolution periods and, 1970s and 1980s. He had the following remark to make - "Overall growth in the post-green revolution period is not significantly different than the pre-green revolution period. Growth in the 1980s is not significantly different than 1970s. Neither is there a difference if any other cut-off point is chosen"(p.606-7). Thus

our results in this study are not in line with that of Ahluwalia(1991a). It must be noted here that our data pertain to primary sector and cover the period upto 1989/90. We carried out the exercise of identifying the break in the farm sector(i.e., primary - mining quarrying) growth. The National Accounts Statistics,1991 provides data on farm sector upto 1988/89. For the purposes of comparability we estimated the GDP originating in the farm sector for the year 1989/90 by multiplying the GDP originating in the primary sector (available in the Economic Survey,1990/91) with the average share of the farm sector in primary sector during 1986/87 to 1988/89. The results show that the hypothesis of break can not be rejected at 90 per cent confidence level (refer table 2). We have considered the GDP originating from the farm sector as a whole because of two reasons - i) there are inseparable inter linkages within the farm sector, among the agriculture and allied activities like dairy farming, poultry farming etc., and ii) if the discussion is regarding the distribution of income, then perhaps it makes better sense to take agriculture and its allied sectors together. A recent study by Dholakia and Dholakia(1991) showed that growth of total factor productivity(TFP) in farm sector was 0.57 %, 1.05% and 2.35 % respectively for the periods 1950/51-1966/67, 1966/67 -1980/81 and 1980/81-1988/89(p.19). During the same periods the total factor input index (TFI) growth was 1.42 %, 1.19 % and 0.55 % in that order(p.17). Perhaps, the decline in the growth rate in the farm sector in the 1980s due to fall in TFI growth was more than compensated by the increase in the growth rate of TFP resulting in a break in the trend growth of farm sector and

primary sector.

The relative contributions[5] of different sectors to the growth of GDP in the 1980s are given in table 10. The results indicate that while the contribution of primary sector in the 1980s has been lower than the earlier periods it is still around 21 per cent which is quite substantial.

Secondary Sector

As outlined already, we had to carry out our analysis for the two periods (1950/51 to 1980/81 and 1966/67 to 1989/90) separately to identify the two breaks in gross value added of secondary sector. The breaks identified were 1964/65 and 1981/82 for the periods 1950/51 to 1980/81 and 1966/67 to 1989/90 respectively (see tables 3 and 4). The introduction of weather dummy did not alter the conclusion regarding the breaks and its coefficient was also statistically non-significant. The results with both these breaks in the same growth equation is given in table 9.

A recent study by Ahluwalia (1991b) showed that there has been a long term decline in TFP at the rate 0.3 per cent p.a. in the 1960s and 1970s, whereas in the 1980s (1980/81 to 1987/88) it exhibited an increase of 2.5 per cent p.a. Perhaps this was the crucial factor which brought about a dramatic increase in the industrial growth in the 1980s.

Tertiary Sector

The tertiary sector experienced break in the trend growth rate in the year 1982/83(see table 5). There was no support for break in

the trend in the mid 1960s. Introduction of dummy for weather did not alter the the break point. Is the GDP originating in the public administration and defense(PAD) the cause for the break ? Nagraj (1990) rejected the hypothesis that PAD has grown faster in the 1980s. The findings of the present study with the time series of GDP originating in the tertiary sector as a whole minus GDP originating in PAD show that 1981/82 is the year of break for the period 1950/51 to 1988/89(see table 6).

Overall GDP

We could not get evidence in support of the hypothesis that there was a break in the growth rate of GDP in the mid 1960s. The deceleration in the industrial sector since the mid-1960s upto early 1980s had no impact on the trend growth rate of GDP. This was perhaps due to the fact that average share of secondary sector in GDP was low at 23.4 per cent during 1965/66 to 1980/81 (refer table 10). Further, as discussed earlier primary and tertiary sectors which constituted the remaining 76.6 per cent did not experience any break in the mid 1960s. Nagraj(1990) also rejected the hypothesis of break in the GDP series in mid 1960s. The year 1981/82 is the year when there was a switch in the growth rate of GDP(table 7). As we have discussed already according to Nagraj(1990), 1979/80 is the year of break in the GDP series. Our conclusions differ from that of Nagraj(1990) possibly because of the more precise definition of break adopted by us. The Indian economy which was growing at a trend rate of 3.52 per cent from 1950/51 to 1981/82 has taken off to a higher growth path of 5.15 per cent thereafter. Introduction of the

weather dummy did not alter the decision regarding the break point or the growth rates though the coefficient of the weather dummy was significant.

Nagraj(1990) found that adjusted GDP (GDP- PAD) experienced break in the 1980s. In this case also Nagraj failed to point out the exact year of break in the GDP-PAD series. The present study revealed that GDP series after adjusting for PAD exhibited break in the year 1980/81 (see table 8).

The 1980s has witnessed substantial improvement in productivity in the economy. We have already discussed that primary and secondary sectors have shown higher growth rate of TFP in the 1980s. The incremental capital output ratio for the economy as a whole during the period 1980-90 was 4.0 as against 6.2 for the period 1973-80.[6] Thus it appears that higher growth rate in the 1980s is mainly due to improvements in productivity.

IV. Conclusions

The results of the study clearly indicate that there is a need to determine the break in the trends using switching regression technique. We can easily see from tables 1 through 8 that many of the possible breaks considered could well fit into the definition of break if only significance of the coefficient of the term $D_j*(t-t_j^*)$ in equation(1) and (2) is used as the criterion as in the case of earlier studies [Goldar and Seth(1989) and, Nagraj(1990,1991)]. It is perhaps meaningless to say that GDP has broken the trend growth rate in each/any of the years from 1974/75 to 1984/85.

The present study finds that Indian data on real GDP supports the

hypothesis of break in the trend in the year 1981/82 more than any other year. Further, the break in the growth rate seems to have been triggered off by the break in the growth rate of primary sector. This was followed by secondary and tertiary sectors. The substantially higher growth rate of GDP in the 1980s is because of breaks in the growth rates of all the three sectors and not because of the secondary and tertiary sectors alone. Further, the tertiary sector growth is also not only due to the increase in the growth of GDP originating in Public Administration and Defense.

Acknowledgment

[I am thankful Prof.R.H.Dholakia for useful suggestions and comments.]

Notes

1. Primary sector includes agriculture, forestry and logging, fishing and, mining and quarrying. Secondary sector incudes manufacturing, electricity, gas and water supply. Tertiary sector incudes transport, communication, trade, banking, insurance, real estate and ownership of dwellings, public administration and defense and, other services.
The data available in the Economic Survey,1991,are provisional for the years 1984/85-1989/90 and quick estimates for the year 1989/90.

2. The data on GDP originating in PAD was available only upto 1988/89 in the National Accounts Statistics,1991.

3. Kinked exponential models have certain advantages over piece-wise exponential trend models [see Boyce(1986)]. In a study [(Ganesh Kumar(1991)], it was shown that the the kinked exponential models used by Boyce(1986) and, Goldar and Seth(1989) in their studies is identical to the model employed in this study. The main advantage of stating the model as given by Gujrati(1988) over that used by Boyce and, Goldar and Seth is that it is easy to identify the breaks. All that one has to do is to look at the coefficient of the term D(t-t*).

4. Dholakia and Dholakia(1991) suggest the use of modified time trend for the agricultural sector by adjusting for the weather conditions. They remarked that "Since Indian agriculture has witnessed drought years persistently with remarkable degree of regularity, it is necessary for any exercise attempting to measure the growth of factor productivities in Indian agriculture to hold the weather factor constant."(p.17)

5 We computed the approximate contribution of different sectors to the GDP growth in table 10 as follows-

$$C_{ij} = S_{ij} * \frac{g_{ij}}{g_j}$$

where,

C_{ij} is the contribution in per cent of the ith sector in the jth period; S_{ij} is the share(in per cent) of ith sector in GDP in the jth period; g_{ij} is the growth rate of real GDP originating in the sector i in period j; g_j is the growth rate of total real GDP in the jth period. S_{ij}s have been computed as geometric mean of the annual shares. There were no breaks in the growth rates of primary and tertiary sectors in 1960s. So we have used the growth rates of these sectors for the period from 1950/51 to the point of break in the 1980s for the periods 1950/51 to 1964/65 and 1965/66 to their points of break in the 1980s.
The contributions do not add upto 100 because - i)our formula will give only the approximate contributions and ii) the break points are not the same for the three sectors.

7 See World Bank,(1991),Trends in Developing Economies, Washington D.C.

Appendix 1

Test for Break in Trend Growth Rate

We briefly describe below the test suggested by Quandt(1958). Let $Y_1,\ldots,Y_n$ be the values of GDP for the years 1,...,n. It is hypothesized that the growth rate of GDP has not remained constant throughout the period in question. Let t^* be the year when GDP moved on to a higher growth path. Thus we have,

$$Y_t = a_1 + b_1 t + u_{1t} \quad \text{for} \quad t < \text{or} = t^* \qquad (i)$$

$$= a_2 + b_2 t + u_{2t} \quad \text{for} \quad t > t^* \qquad (ii)$$

Where, a_i, b_i (i=1,2) are the regression coefficients and, u_{1t} and u_{2t} are the error terms.

Under these conditions, the log likelihood function conditional on t^* can be expressed as [see Quandt and Goldfeld(1972),pp.259-60].

$$\ln(Y_t/t^*) = -n\sqrt{\ln(2\pi)} - (n/2) - (t^*/2)\ln\left[\sum_{t=1}^{t^*} e^2_{1t}/t^*\right] - [(n-t^*)/2]\ln\left[\sum_{t=t^*+1}^{n} e^2_{2t}/(n-t^*)\right] \qquad (iii)$$

Where, e_{1t}, e_{2t} are error terms from the OLS estimates of equations (i) and (ii) respectively, and 'n' is the total number of observations . Once the t^* which gives the maximum value for equation (iii) is determined the log likelihood ratio (λ) suggested by Quandt(1958) is applied.

$$\lambda = s_1^{t^*} \cdot s_2^{n-t^*}/s^n$$

Where, λ is the log likelihood ratio, s_1 and s_2 are respectively the standard errors of estimate of of first and second regimes identified by the optimum t^* and 's' that of the overall sample. The quantity $-2*\log(\lambda)$ follows Chi-square distribution with 4

d.f. The null hypothesis of no switch is rejected if $-2*\log(\lambda)$ is greater than the tabulated value. Fortunately for us there is a short cut available to identify the break. If the growth function is specified as in equation (1) in the text, the year for which maximum t-statistic for the term $D(t-t^*)$ is attained provides the break point for at this point the value of the log likelihood function as defined by Quandt also reaches its maximum [see Moschos(1989)]. This point of break also corresponds to the attainment of maximum R^2 [see Silber(1974).]

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Table 1A. GDP originating in the Primary Sector
(1950/51 to 1989/90)

Year of Break(t^*)	Const.	t	$D(t-t^*)$	R^2	DW Ststistic
1974/75	10.105 (559.37)	0.0219 (19.848)	0.0057 (2.0549)	0.9748	1.8764
1975/76	10.104 (568.53)	0.0220 (20.918)	0.0057 (2.034)	0.9748	1.8861
1976/77	10.103 (589.43)	0.0221 (24.1234)	0.0062 (2.1096)	0.9749	1.8842
1977/78	10.102 (601.31)	0.0222 (24.281)	0.0066 (2.2026)	0.9750	1.8983
1978/79	10.102 (601.31)	0.0222 (24.281)	0.0074 (2.2026)	0.9752	1.9163
1979/80	**10.102 (616.47)**	**0.0222 (25.542)**	**0.0086 (2.3928)**	**0.9757**	**1.9206**
1980/81	10.100 (623.88)	0.0224 (26.651)	0.0094 (2.3593)	0.9756	1.9341
1981/82	10.099 (628.96)	0.0225 (27.706)	0.0103 (2.2652)	0.9754	1.9223
1982/83	10.097 (634.29)	0.0227 (28.772)	0.0114 (2.1842)	0.9752	1.8953
1983/84	10.095 (636.53)	0.0228 (28.750)	0.0126 (2.0124)	0.9747	1.8844
1984/85	10.094 (643.30)	0.0229 (30.869)	0.0153 (1.9855)	0.9747	1.8714

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. Figures in the parentheses are t-ratios for regression coefiicients.

Table 1B. GDP Originating in the Primary sector (1950/51 to 1989/90)

Year of Break(t^*)	Const.	t	$D_1(t-t^*)$	D_2	R^2	DW Statistic
1974/75	10.126 (530.90)	0.0222 (19.238)	0.0050 (1.7768)	-0.0616 (6.5214)	0.9875	1.8818
1975/76	10.125 (542.18)	0.0222 (20.412)	0.0051 (1.7720)	-0.0618 (6.5233)	0.9875	1.8804
1976/77	10.124 (555.03)	0.0222 (21.552)	0.0056 (1.8536)	-0.0616 (6.5114)	0.9876	1.8786
1977/78	10.124 (507.60)	0.0223 (22.909)	0.0068 (1.9402)	-0.0618 (6.5348)	0.9878	1.8898
1978/79	10.123 (591.41)	0.0224 (24.469)	0.0066 (2.0842)	-0.0611 (5.4428)	0.9866	1.3799
1979/80	10.125 (610.16)	0.0222 (25.837)	0.0082 (2.3650)	-0.0614 (6.5851)	0.9882	1.8956
1980/81	**10.123 (624.99)**	**0.0224 (27.304)**	**0.0090 (2.3879)**	**-0.0618 (6.5970)**	**0.9882**	**1.9029**
1981/82	10.122 (627.45)	0.0227 (28.367)	0.0104 (2.2786)	-0.0615 (6.5692)	0.9878	1.8936
1982/83	10.120 (624.85)	0.0227 (29.097)	0.0104 (2.1113)	-0.0615 (6.4956)	0.9878	1.8867
1983/84	10.118 (621.52)	0.0229 (21.859)	0.0117 (1.9874)	-0.0619 (6.5359)	0.9877	1.8879
1984/85	10.117 (623.50)	0.0229 (30.745)	0.0143 (2.0146)	-0.0620 (6.5734)	0.9878	1.8956

Note: 1. $D = 0$ for $t \leq t^*$
$= 1$ for $t > t^*$

2. $D_2 = 0$ for good agricultural year,
$= 1$ for bad agricultural year.

3. Figures in the parentheses are t-ratios for regression coefiicients.

4. The results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported are based on the original variables and not transformed variables.

Table 2. GDP Originating in the Farm Sector (1950/51 to 1989/90)

Year of Break(t^*)	Const.	t	$D_1(t-t^*)$	D_2	R^2	DW Statistic
1974/75	10.108	0.0219	0.0041	-0.0639	0.9857	1.8854
	(509.18)	(17.992)	(1.4237)	(6.5471)		
1975/76	10.107	0.0216	0.0042	-0.0641	0.9856	1.8844
	(518.45)	(19.024)	(1.4051)	(6.5510)		
1976/77	10.106	0.0216	0.0046	-0.0639	0.9857	1.8832
	(529.08)	(20.010)	(1.4705)	(0.5407)		
1977/78	10.106	0.0217	0.0051	-0.0641	0.9858	1.8845
	(541.50)	(21.161)	(1.5361)	(6.5600)		
1978/79	10.106	0.0217	0.0057	-0.0614	0.9859	1.8920
	(558.05)	(22.452)	(1.6547)	(6.5579)		
1979/80	10.107	0.0216	0.0071	-0.0637	0.9862	1.8974
	(573.12)	(23.556)	(1.9204)	(6.5990)		
1980/81	**10.106**	**0.0217**	**0.0078**	**-0.0640**	**0.9862**	**1.9037**
	(586.34)	**(24.906)**	**(1.9424)**	**(6.6100)**		
1981/82	10.105	0.0219	0.0082	-0.0641	0.9861	1.8960
	(591.21)	(25.916)	(1.8600)	(6.5879)		
1982/83	10.103	0.0220	0.0090	-0.0638	0.9860	1.8901
	(592.58)	(26.741)	(1.7313)	(6.5272)		
1983/84	10.102	0.0221	0.0100	-0.0642	0.9859	1.8910
	(592.79)	(27.590)	(1.6330)	(6.5596)		
1984/85	10.102	0.0221	0.0100	-0.0642	0.9859	1.8910
	(592.79)	(27.590)	(1.6330)	(6.5596)		

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. $D_2 = 0$ for good agricultural year
$= 1$ for bad agricultural year

3. Figures in the parentheses are t-ratios for regression coefiicients.

4. The results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported are based on the original variables and not transformed variables.

Table 3. GDP Originating in the Secondary Sector (1950/51 to 1980/81)

Year of Break(t^*)	Const.	t	$D(t-t^*)$	R^2	DW Statistic
1961/62	8.671 (221.20)	0.0667 (14.906)	-0.0213 (3.4071)	0.9964	1.4614
1962/63	8.663 (272.39)	0.0668 (19.554)	-0.0225 (4.4712)	0.9966	1.4871
1963/64	8.659 (331.45)	0.0666 (25.171)	-0.0236 (5.7190)	0.9970	1.4794
1964/65	**8.661 (372.72)**	**0.0657 (29.488)**	**-0.0238 (6.4363)**	**0.9971**	**1.4926**
1965/66	8.668 (372.82)	0.0644 (30.365)	-0.0234 (6.1920)	0.9970	1.5069
1966/67	8.667 (341.87)	0.0630 (28.517)	-0.0228 (5.3793)	0.9969	1.4759
1967/68	8.697 (306.87)	0.0616 (26.161)	-0.0221 (4.5187)	0.9967	1.4785
1968/69	8.695 (277.17)	0.0605 (24.238)	-0.0218 (3.8963)	0.9966	1.5051
1969/70	8.699 (251.17)	0.0598 (22.723)	-0.0228 (3.5652)	0.9967	1.4783
1970/71	8.708 (227.32)	0.0559 (21.021)	-0.0218 (2.9560)	0.9964	1.5233
1971/72	8.717 (205.62)	0.0574 (19.485)	-0.0207 (2.4387)	0.9963	1.4910

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. Figures in the parentheses are t-ratios for regression coefficients.

3. The results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported are based on the original variables and not transformed variables.

Table 4. GDP Originating in the Secondary Sector (1966/67 to 1989/90)

Year of Break(t^*)	Const.	t	$D(t-t^*)$	R^2	DW Statistic
1974/75	9.152	0.0349	0.0202	0.9951	1.6482
	(92.045)	(7.7368)	(3.2872)		
1975/76	9.122	0.0366	0.0193	0.9952	1.6332
	(105.26)	(9.5253)	(3.4576)		
1976/77	9.081	0.0386	0.0176	0.9949	1.6161
	(114.65)	(11.265)	(3.2770)		
1977/78	9.053	0.0401	0.0168	0.9948	1.5382
	(122.45)	(12.787)	(3.1614)		
1978/79	9.029	0.0412	0.0163	0.9946	1.6183
	(136.24)	(15.000)	(3.7862)		
1979/80	9.033	0.0412	0.0189	0.9953	1.5996
	(154.99)	(17.359)	(3.8530)		
1980/81	9.023	0.0417	0.0205	0.9957	1.6930
	(179.30)	(20.758)	(4.3815)		
1981/82	**9.004**	**0.0425**	**0.0215**	**0.9956**	**1.7408**
	(198.67)	**(23.987)**	**(4.5129)**		
1982/83	8.990	0.0425	0.0234	0.9956	1.6686
	(199.48)	(24.950)	(4.3405)		
1983/84	8.968	0.0442	0.0243	0.9951	1.6792
	(192.94)	(25.188)	(3.7514)		
1984/85	8.949	0.0450	0.0264	0.9948	1.6531
	(181.13)	(24.557)	(3.2277)		

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. Figures in the parentheses are t-ratios for regression coefficients.

3. The results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported are based on the original variables and not transformed variables.

Table 5. GDP Originating in the Tertiary Sector (1950/51 to 1989/90)

Year of Break(t^*)	Const.	t	$D(t-t^*)$	R^2	DW Statistic
1974/75	9.364 (338.64)	0.0415 (26.951)	0.0147 (4.5411)	0.9995	1.2630
1975/76	9.358 (394.92)	0.0422 (31.597)	0.0137 (4.4425)	0.9995	1.3696
1976/77	9.356 (436.78)	0.0438 (35.737)	0.0143 (4.7889)	0.9995	1.2874
1977/78	9.354 (490.83)	0.0426 (41.097)	0.0149 (5.1598)	0.9995	1.2252
1978/79	9.350 (580.25)	0.0430 (49.706)	0.0150 (5.4825)	0.9955	1.3837
1979/80	9.351 (633.81)	0.0430 (55.758)	0.0174 (6.5329)	0.9996	1.2931
1980/81	9.349 (738.98)	0.0432 (66.672)	0.0192 (7.5017)	0.9996	1.4771
1981/82	9.346 (847.33)	0.0434 (78.552)	0.0210 (8.3138)	0.9996	1.4656
1982/83	**9.342 (919.52)**	**0.0437 (87.749)**	**0.0229 (8.4481)**	**0.9996**	**1.5243**
1983/84	9.341 (840.20)	0.0440 (82.946)	0.0257 (7.9131)	0.9996	1.4455
1984/85	9.338 (685.23)	0.0443 (70.526)	0.0278 (6.5969)	0.9996	1.4233

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. Figures in the parentheses are t-ratios for regression coefiicients.

3. The results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported are based on the original variables and not transformed variables.

Table 6. GDP Originating in the Tertiary Sector minus Public Administration and Defense(1950/51 to 1989/90)

Year of Break(t^*)	Const.	t	$D(t-t^*)$	R^2	DW Statistic
1974/75	9.286 (380.13)	0.0395 (27.887)	0.0145 (4.5682)	0.9994	1.3203
1975/76	9.280 (459.77)	0.0402 (34.281)	0.0134 (4.5416)	0.9994	1.3899
1976/77	9.278 (507.99)	0.0404 (38.980)	0.0139 (4.8456)	0.9994	1.2932
1977/78	9.276 (565.30)	0.0407 (44.660)	0.0138 (5.1458)	0.9994	1.3766
1978/79	9.272 (653.26)	0.0410 (53.110)	0.0147 (5.4277)	0.9994	1.3837
1979/80	9.274 (691.61)	0.0410 (57.814)	0.0174 (6.3529)	0.9995	1.2937
1980/81	9.372 (774.38)	0.0411 (66.557)	0.0195 (7.1376)	0.9995	1.4628
1981/82	**9.269 (855.50)**	**0.0414 (75.704)**	**0.0215 (7.5528)**	**0.9995**	**1.4995**
1982/83	9.266 (865.29)	0.0417 (79.004)	0.0239 (7.3741)	0.9995	1.5057
1983/84	9.264 (778.30)	0.0419 (73.657)	0.0271 (6.7416)	0.9995	1.4831
1984/85	9.261 (632.82)	0.0422 (62.636)	0.0301 (5.7394)	0.9994	1.4097

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. Figures in the parentheses are t-ratios for regression coefiicients.

3. The results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported are based on the original variables and not transformed variables.

Table 7.Overall GDP (1950/51 to 1989/90)

Year of Break(t^*)	Const.	t	$D(t-t^*)$	R^2	DW
1974/75	10.642 (939.60)	0.0345 (49.959)	0.0078 (4.6084)	0.9959	1.2597
1975/76	10.642 (975.18)	0.0346 (53.564)	0.0084 (4.8570)	0.9960	1.3343
1976/77	10.641 (1015.20)	0.0347 (57.525)	0.0092 (5.1510)	0.9962	1.3798
1977/78	10.640 (1052.00)	0.0348 (61.462)	0.0100 (5.3945)	0.9964	1.4566
1978/79	10.640 (1099.10)	0.0349 (66.106)	0.0111 (5.7449)	0.9966	1.5535
1979/80	10.639 (1173.70)	0.0349 (72.527)	0.0127 (6.3670)	0.9969	1.6183
1980/81	10.638 (1222.60)	0.0351 (77.705)	0.0144 (6.6963)	0.9971	1.7342
1981/82	**10.636 (1249.50)**	**0.0352 (81.695)**	**0.0163 (6.8004)**	**0.9971**	**1.7836**
1982/83	10.635 (1261.90)	0.0354 (84.848)	0.0188 (6.7653)	0.9971	1.7493
1983/84	10.632 (1240.80)	0.0356 (85.825)	0.0217 (6.4110)	0.9969	1.7125
1984/85	10.630 (1224.50)	0.0358 (87.040)	0.0261 (6.0160)	0.9968	1.6227

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. Figures in the parentheses are t-ratios for regression coefiicients.

Table 8. Overall GDP minus Public Admn. and Defense(1950/51 to 1989/90)

Year of Break(t^*)	Const.	t	$D_1(t-t^*)$	D_2	R^2	DW Statistic
1974/75	10.636	0.0336	0.0077	-0.0311	0.9976	1.7413
	(604.28)	(31.241)	(2.8550)	(5.7775)		
1975/76	10.635	0.0337	0.0080	-0.0313	0.9976	1.7270
	(650.35)	(34.921)	(3.0011)	(5.7506)		
1976/77	10.634	0.0338	0.0085	-0.0310	0.9977	1.7101
	(695.43)	(38.569)	(3.1997)	(5.6471)		
1977/78	10.633	0.0339	0.0092	-0.0313	0.9997	1.6960
	(744.28)	(42.711)	(3.4330)	(5.6789)		
1978/79	10.632	0.0341	0.0101	-0.0312	0.9977	1.7290
	(817.35)	(48.467)	(3.7472)	(5.5918)		
1979/80	10.632	0.0340	0.0121	-0.0307	0.9979	1.7392
	(885.64)	(53.813)	(4.4121)	(5.7437)		
1980/81	10.632	0.0341	0.0138	-0.0312	0.9880	1.7825
	(971.55)	(61.011)	(4.8620)	(5.8412)		
1981/82	**10.630**	**0.0343**	**0.0155**	**-0.0312**	**0.9880**	**1.7721**
	(1020.1)	**(66.141)**	**(4.9704)**	**(5.7523)**		
1982/83	10.627	0.0345	0.0177	-0.0306	0.9980	1.7502
	(1016.2)	(67.752)	(4.7831)	(5.5578)		
1983/84	10.626	0.0347	0.0206	-0.0314	0.9979	1.7439
	(977.92)	(67.188)	(4.4639)	(5.6696)		
1984/85	10.624	0.0348	0.0253	-0.0315	0.9979	1.7521
	(925.76)	(65.315)	(4.1756)	(5.7500)		

Note: 1. $D = 0$ for $t \leq t^*$

$= 1$ for $t > t^*$

2. $D_2 = 0$ for good agricultural year
$= 1$ for bad agricultural year

3. Figures in the parentheses are t-ratios for regression coefiicients.

4. The results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported are based on the original variables and not transformed variables.

Table 9. Summary Results for Primary,Secondary,Tertiary and Overall GDP

Year of Break(t_1^*)	Const.	t	$D_1(t-t_1^*)$	Weather	R^2	DW Statistic
Period : 1950/51 to 1989/90						
(1) Primary Sector						
1980/81@	10.123 (624.99)	0.2224 (27.364)	0.0090 (2.3879)	-0.0618 (6.5970)	0.9882	1.9029
(2)Farm Sector						
1980/81@	10.106 (586.34)	0.0217 (24.906)	0.0078 (1.9424)	-0.0640 (6.6100)	0.9862	1.9037
(3) Tertiary Sector						
1982/83@	9.342 (919.52)	0.0437 (87.749)	0.0229 (8.4481)	-	0.9996	1.5243
(4) Total GDP						
1981/82	10.636 (1249.50)	0.0352 (81.695)	0.0163 (6.8004)	-	0.9971	1.7836
Period : 1950/51 to 1988/89						
(5) Total GDP-PAD						
1981/82@	10.630 (5.7523)	0.0343 (66.141)	0.0155 (4.9704)	-0.0312 (5.7523)	0.9980	1.7721
(6) Tertiary Sector GDP-PAD						
1981/82@	9.269 (855.5)	0.0414 (75.704)	0.0215 (7.5528)	-	0.9995	1.4995
Year of Break (t_1^*,t_2^*)	Const.	t	$D_1(t-t_1^*)$	$D_2(t-t_2^*)$	R^2	DW Statistic
Period 1950/51 to 1989/90						
(7)Secondary Sector@						
1964/65(t_1^*) 1981/82(t_2^*)	8.661 (429.0)	0.0656 (34.226)	-0.0233 (7.7257)	0.0219 (4.6856)	0.9985	1.5689

Note:

1. $D_j = 0$ for $t \leq t_j^*$

   $= 1$ for $t > t_j^*$; $j = 1,2$.
2. Figures in the parentheses are t-ratios for regression coefficients.
3. @ - the results reported are after correction for the problem of autocorrelation using Cochrane-Orcutt iterative procedure. The R^2 reported in such cases are based on the original variables and not transformed variables.

Table 10. Contribution of Primary, Secondary and Tertiary Sectors to Growth of GDP

Period	Growth Rate	Share in GDP(%) @	Contribution to GDP
Primary Sector			
1950/51 to 1964/65	2.24	53.06	33.77
1965/66 to 1980/81	2.24	43.00	27.36
1981/82 to 1989/90	3.14	36.30	21.13
Secondary Sector			
1950/51 to 1964/65	6.56	17.56	32.73
1965/66 to 1981/82	4.23	23.41	28.13
1982/83 to 1989/90	6.42	26.15	32.60
Tertiary Sector			
1950/51 to 1964/65	4.37	29.15	36.19
1965/66 to 1982/83	4.37	33.84	42.00
1983/84 to 1989/90	6.66	38.02	49.17

Note: 1. See notes for details of computations,
2. @ - Geometric mean of the annual shares in GDP,
3. Growth rates were obtained from table 9 as follows- primary sector from regression(1), secondary from (7), tertiary from (3) and overall GDP from (4).