OCCASIONAL PAPER

INDIA'S ECONOMIC GROWTH HISTORY: FLUCTUATIONS, TRENDS, BREAK POINTS AND PHASES

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1 INTRODUCTION[1]

How has the Indian economy performed since independence? Prof. Raj Krishna popularised the phrase 'Hindu rate of growth' in the seventies, during the period of increasing controls and slowing growth rate.[2] K N Raj (1984) however questioned this "so-called 'Hindu' rate of growth," hypothesis. Patnaik (1987) and Dhar (1988) discerned some acceleration of growth in the eighties, while Virmani (1989) asserted a break in the GDP growth rate from 1980–81. Nagaraj (1990) and Bhargava and Joshi (1990) did not find the break statistically significant. Dandekar (1992) concluded that the evidence of a break 'can not be rejected.' Ahluwalia (1995) also noted the increase in growth rate during the eighties.[3] Nevertheless there was a widespread belief in the general public, among Non-Resident Indians and foreigners that the Indian economy was stuck since independence in the 'Hindu rate of growth,' of about 3.5% per annum. This conventional wisdom prevailed throughout the eighties and perhaps into the nineties.[4]

The conventional wisdom changed again around the mid-nineties. The new conventional wisdom was that the 'new economic policy' introduced in 1991–92 had transformed the Indian economy and pushed it from the 'Hindu rate of growth' of 3.5% to a new higher rate that was variously estimated to lie between 5% and 6%. The latter has sometimes been referred to as the 'new Hindu rate of growth.' This new conventional wisdom was also immune to papers such as Virmani (1997a and 1997b) that demonstrated that the growth acceleration preceded the new economic policy. While Bhagwati (1998) acknowledges the higher growth rate of the eighties, he does not consider the 1980 as a new phase in Indian development because he believes that the unsustainable policies of the eighties led to the 1990-91 BOP crisis. Only recently has this been explicitly recognised [De Long (2001), Williamson and Zagha (2002), Acharya (2002)].[5] The

[1] This paper is based on Virmani (2004b). My thanks to Drs. K L Krishna and Surjit Bhalla for comments on earlier version of that paper.
[2] B P R Vithal was perhaps the first to refer to Hindu culture as in some way affecting economic development. My thanks to Y. V Reddy and Sanjaya Baru for this information.
[3] But did not try to prove it statistically.
[4] This was reflected in domestic and foreign newspapers & magazine articles.
[5] Virmani (2004b) & Wallack (2004) also formally showed the break in GDP and NNP series respectively.

paper confirms that, what the author has earlier dubbed, the "Bharatiya Rate of Growth" phase began around 1980-81.[6]

The most important innovation of the current is the use of a rainfall index to remove the confounding effect of large droughts. The current paper uses a consistent and better rainfall index than the indices used by the author in previous papers.[7] The second difference from other studies is the use of growth rates (as in author's earlier papers) rather than logs or log differences. The examines growth of total GDP as well as its major sub-aggregates (Agriculture, Manufacturing, Services) from 1950-1 onwards (growth rates from 1951-2), using the consistent GDP data from the new series of national accounts statistics.

The paper is structured as follows. Section 2 outline the simple methodology used in the paper. Section 3 analyses the historical growth experience of the Indian economy in terms of fluctuations and trends. Then it examines structural breaks in growth trends. These breaks define the border between different phases of growth. A new phase of growth, the Market Reform phase, started in 1980-81. Section 4 outlines the policy changes that characterise the two phases of economic growth. Section 5 concludes the paper.

2 METHODOLOGY

The analysis through out the paper is based on rates of growth. The annual rate of growth (GrY) is defined for any variable Y as, $GrY(t) = Y(t)/Y(t-1) - 1$. Trend growth rates are defined in three ways.

(a) By taking a moving average. Thus a five year moving average can be defined as $MA5Y(t) = [Y(t)+Y(t-1)+Y(t-2)+Y(t-3)+Y(t-4)]/5$. This moving average is centred on year t-2.
(b) By applying the Hoderick-Prescott filter to the basic series Y to get the filtered series Xhp and then determining its growth rate i.e. $GrYhp(t) = Yhp(t)/Yhp(-1) - 1$. GrYhp(t) then shows the trend rate of growth as against the actual annual growth rate GrY(t) .

[6] The word 'Bharatiya' was used as a counterpoise to 'Hindu' and has no other significance. An alternative term could be 'Indian' rate of growth though personally I would like to reserve that term for a future third phase in which India's growth rate is 7%+ on a sustained basis.
[7] Virmani (1989), Virmani(1997a) & Virmani(1997b).

(c) By fitting a polynomial of order 2 or 3 or more to the actual growth rate GrY(t) i.e. estimating the coefficients a, b, c (d etc.) in the equation $GrY(t) = a + bt + ct^2 \ (+ d\ t^3\ ) + ut$, where t is time or year and ut is a random error term.

We also use growth regressions to search for breaks in the growth performance of the economy. Conceptually the evolution of the economy can be defined by set of (endogenous) variables such as GDP, current account deficit, foreign exchange reserves, fiscal deficit, exports, imports, prices, money supply, employment etc. Each of the endogenous variables (vector Y) are functions of each other and of exogenous variables. The latter consist of policy variables P (e.g. tariff rates) and external environment Z (e.g. rainfall, world oil prices, world GDP growth). In reduced form we can write the endogenous variables as functions of the exogenous variables, Y = F (P, Z).

In the Indian context the most important exogenous variable Z is rainfall variation and we take account of this variable in examining GDP growth and growth of GDP from different sectors. Other exogenous variables such as oil price shocks have been thought to affect the growth of the economy, but the rate of growth of oil prices is found to be statistically in significant in the GDP growth regressions.[8] Therefore Y = F (P, rainfall). There are two difficulties that arise in directly introducing policy variables into the estimating equation. Firstly continuous series are not available from 1950 to the current time. For instance the average tariff rate is available from 1980 onwards, but not before. The second problem is that some variables may be either exogenous policy variables (P) or endogenous outcomes (Y) depending on the policy regime. Thus for instance in a controlled system the exchange rate and many interest rates are directly controlled policy variables set by the government while in a market system they are outcomes of market supply and demand. The difficulty is compounded if they are target variables even in the market situation. These technical problems can be dealt with by appropriate econometric techniques. In this paper, however, we take an alternative simpler route.

We assume that different periods (i) in India's history were characterised by different sets of policies Pi. For instance if there were four periods then i= 1, 2, 3, 4. To find out whether any set

[8] When growth rate of world oil prices is added to equation (1) of text, its t statistic is –1.4 and Probability 0.167, i.e. it is not significant at the 10% level of confidence.

of policies Pi had an effect on the growth rate we introduce a dummy variable Di into the equation to represent the policies during the period (the time subscript t is dropped):

$GrY = A + B*Drainm + Di + U$

Where Drainm is the per cent deviation of rainfall from mean and U is the error term.[9] We use the Parthasarthy et al (1995) all India rainfall index to take account of rainfall fluctuations. This is an area-weighted index of average rain during the monsoon months of June to September.

If Di for period i is statistically significant, we take this as a demonstration of a significant effect of the complex of policies Pi pursued during the period on the growth of Y during the period. The policies Pi are then analysed in a qualitative way. Formal modelling of the effect of policies on endogenous variables and its econometric estimation is left for subsequent papers.

As far as Y is concerned, it should be kept in mind that total GDP is by definition the sum of the GDP from different sectors (e.g. Agriculture, Manufacturing, Services). Thus a policy that affects even one sector will affect overall GDP growth through this sector. Some polices may affect more than one sector, with the relative effect on these sectors varying over time. A given policy may also affect one sector positively and another negatively. In this case the effect on overall GDP growth may be either positive or negative. A set of policies will in general have positive and negative effects on different sectors, with the net effect on overall GDP being an aggregation of these sectoral impacts. The dummy variable method will only indicate the net affect of all these policies and will not help us in identifying which policy has a positive and which a negative effect on a specific sector (or on aggregate GDP).

Though the GDP series is far from perfect, its construction involves fewer ad hoc assumptions (of questionable economic validity) than other series such as NDP, GNP and NNP. In our analysis therefore Y is Gross Domestic Product at factor cost.

[9] I.e. (current-average)/average.

3 GDP GROWTH TRENDS

The section starts by showing the rainfall driven fluctuations in GDP growth. It then examines the growth trends in the Indian economy since independence to determine what if any breaks there have been in growth performance. It then goes on to statistically determine the break points, which form the dividing line between different phases of economic growth. Subsequent sub-sections investigate to what extent the break in overall growth trends was due to a break in the trend growth of agriculture, manufacturing and services.

3.1 Rainfall Fluctuations and Growth Trends

Figure 1 shows the links between rainfall fluctuation and fluctuations in GDP growth. It is clear that the latter can not be explained without taking account of the former. It also shows that in the first 30 years there were four years in which the annual rate of growth was negative, and another four in which it was between 0% and 2%. In the subsequent 22 years there was no year of negative growth and only one year in which economic growth was between 0% and 2%. The average growth rate was therefore higher during this second phase.

Figure 2 show the annual growth rate of the economy, the growth trend in the HP (Hodrick-Prescott) filtered GDP series and the moving average of the growth rates over the half century. Two phases are clearly discernible, with the second phase having a significantly higher rate of economic growth than the first. The five-year moving average is centred on the given year, while the 10-year moving average has five earlier and four later years. The growth trend as measured by the HP-filtered series reached a low point of 3.3% per annum during the first phase (1971–72 to 1973–74) and a highpoint of 6.1% per annum during the second phase (1994–95 to 1995–96). Thereafter, the trend growth rate has declined continuously (see HP filtered series). The 10-year moving average fluctuated between 3% and 4% during the first 30 years with occasional forays below (twice) and above (thrice) this band. Starting from 1978–79 there was a clear and unambiguous up trend in the 10-year moving average and it never fell below 4%. On the contrary it exceeded 5% from 1985–86 onwards (figure 2).

Figure 1: Rainfall Variation and Annual GDP Growth Rate fluctuation

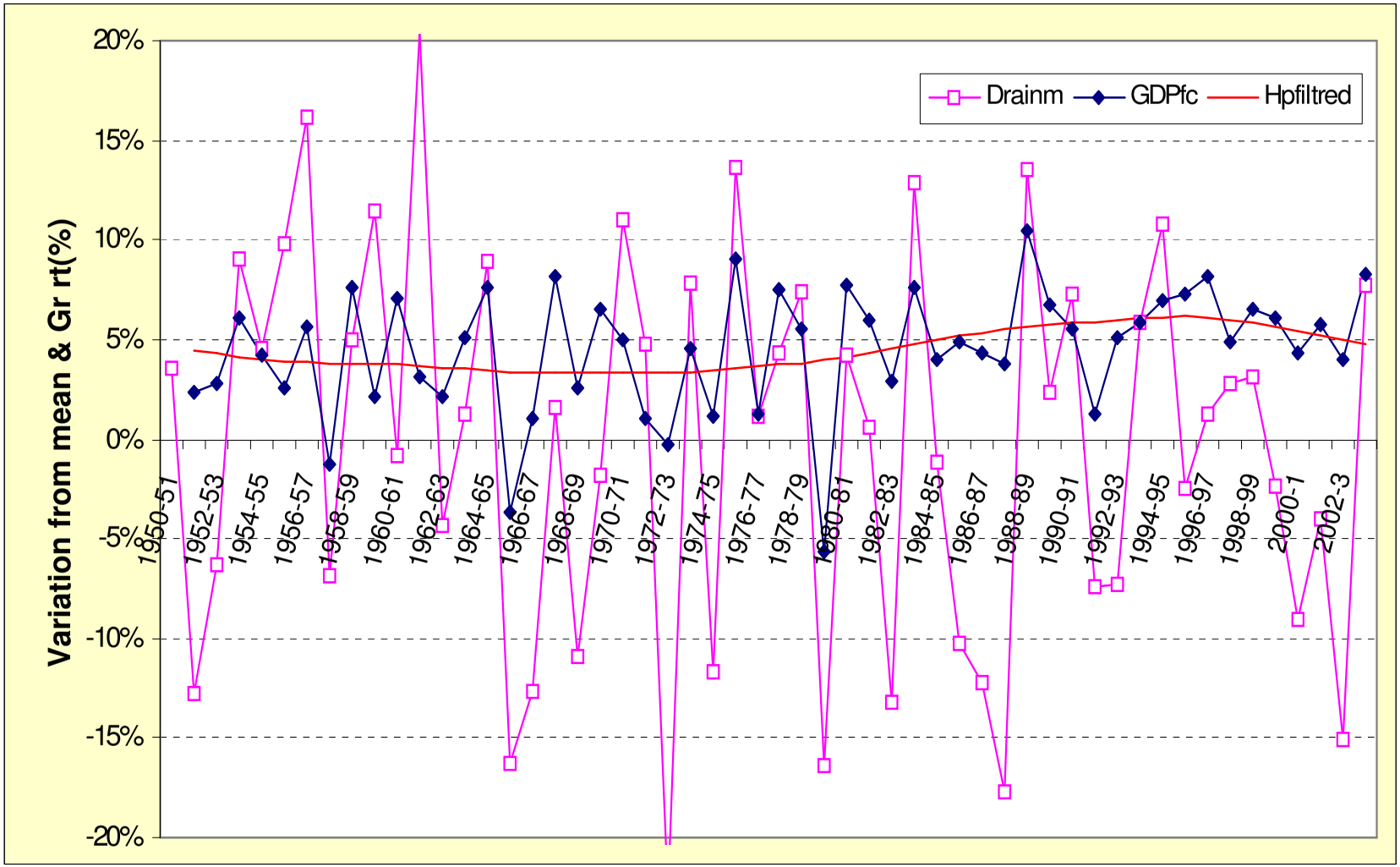


Figure 2: GDP Growth Rates - Moving average & Hodrick-Prescott filtered series

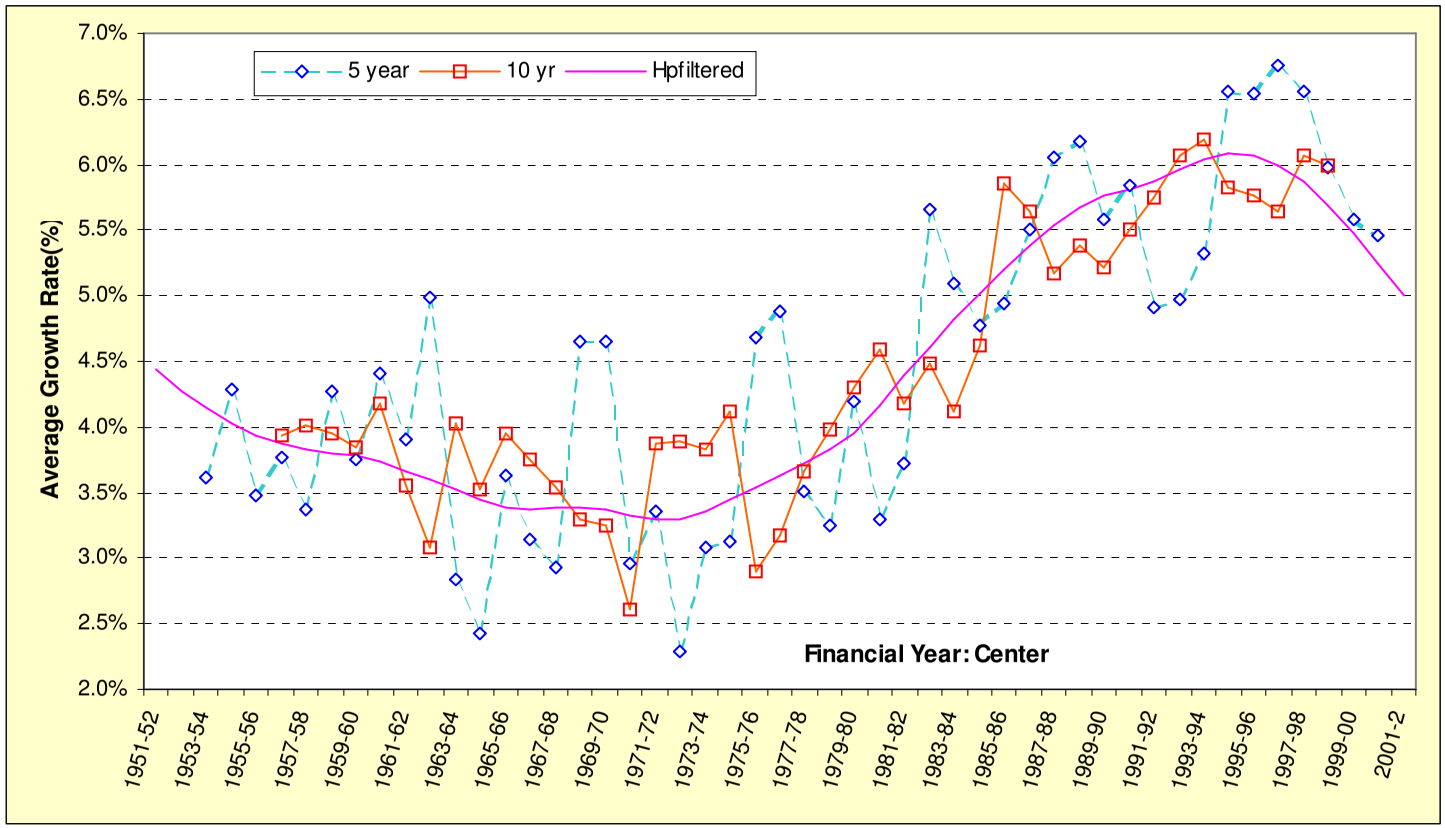
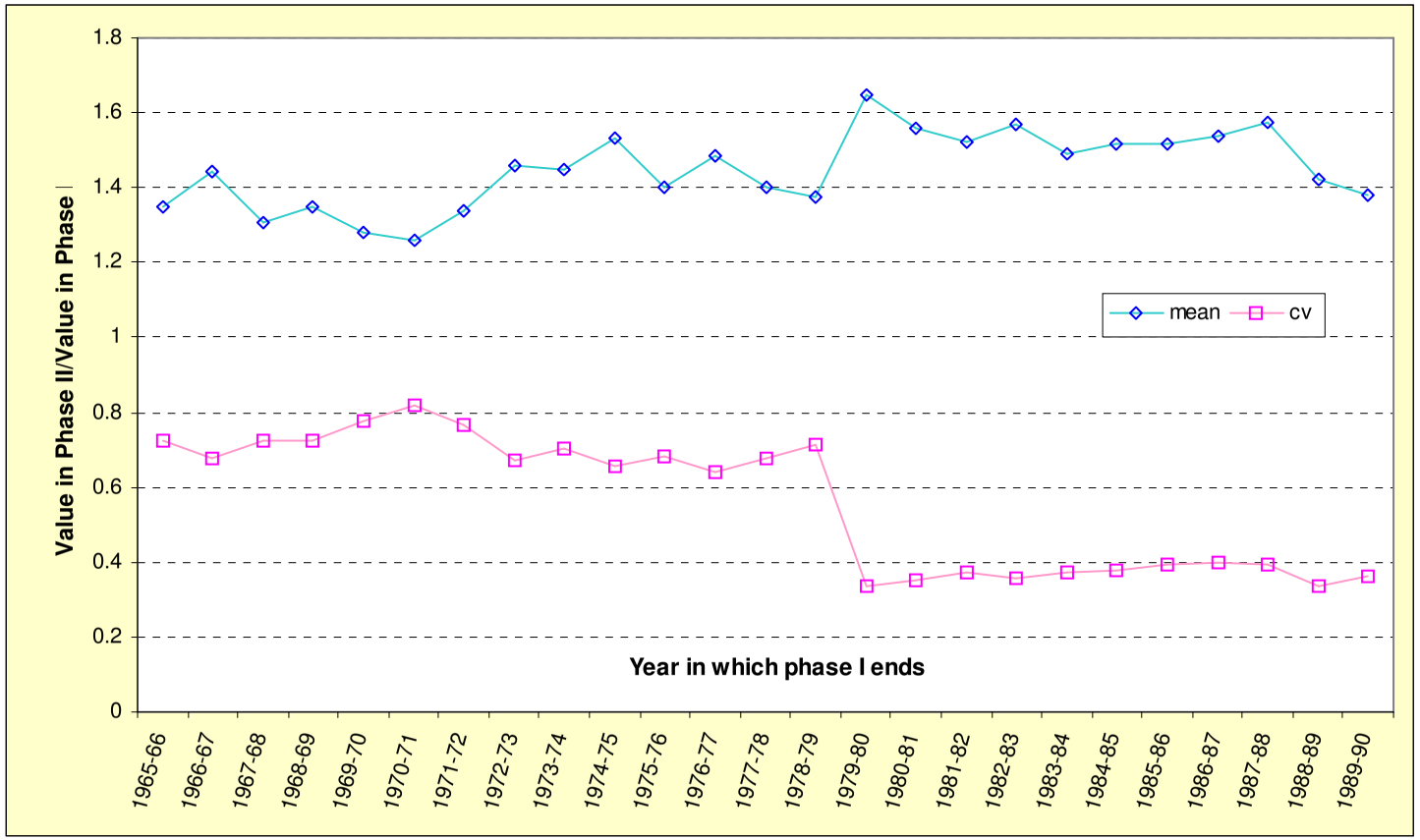


Figure 3: Variation of Mean & CV of Phase I Relative to Phase II with Dividing Year T



To find the precise dividing line between these two phases (the year T in which the first phase ended) one can look at the nature of the prevailing development regime or the nature of the growth experience or a combination of both. First, consider what happens to the average growth rate and the co-efficient of variation (CV) of the growth rates of phase I (1950–01 to T) relative to phase II (T to 2002–03) as we change the year T (Figure 3).[10] There is a clear break in both the mean and CV if phase I ends in 1978–79. The relative CV falls sharply from 0.7 if T = 1978–79 to 0.3 if T = 1979–80. The relative mean correspondingly rises from 1.4 to 1.65. This is the lowest relative CV and the highest relative mean seen in Figure 3, suggesting that phase I ends in 1978–79.

3.2 Break points in GDP growth

Given this picture of fluctuations and trends, the most important requirement is to purge the growth data of the effects of rainfall fluctuations. In this paper we do this by running growth regressions and testing for changes in growth rate. The chow test can also be applied to the coefficients obtained in these regressions.

Equation (1) presents the results for a standard regression for the period 1950–2002, with the growth rate of the GDP at factor cost (GrGDPfc) on the left-hand side. The severe droughts of 1965-66 and 1966-67 and 1979-80 can lead to misleading results if rainfall is not accounted for. We therefore introduce the deviation of current rainfall from the mean for the entire period, Drainm as an exogenous variable on the right hand side of the growth regression.

Separating the effect of trends in rainfall allows a more accurate determination of underlying growth trends, particularly if the end point is a drought year.

$$GrGDPfc = 0.045 + 0.161*DrainM - 0.117*DrainM(-1) \quad (1)$$

(13.8) (5.0) (-3.5)

R^2 = 0.447, R^2 (adjusted) = 0.425, DW = 2.029, and the numbers in parentheses are t-statistics. ***This is a rather remarkable result. It says that about 45% of the variation in India's GDP growth is explained by the fluctuations in rainfall.*** Only 55% of the growth fluctuation remains to be explained by the conventional set of exogenous shocks and policy variables.

[10] CV = Standard deviation/Mean.

The *Chow test* on this equation clearly reveals ***a break in the growth rate in 1980-81*** with the null hypothesis rejected at an F value of 5.562 (probability 0.0024). 1981-82 is however a close second with an F of 5.347 (Pr=0.003). The log likelihood ratio is 16.1 & 15.6 for 1980-1 and 1981-2 break respectively. A 1979-80 break is much less plausible as the F value is much lower at 2.88 (Pr=0.045) for 1979-80.

We now add a dummy for 1980-81 onwards (D80+) on the right-hand side to get

$$\begin{aligned} GrGDPfc = {} & 0.0345 + 0.023*(D80+) + 0.190*DrainM - 0.104*DrainM(-1) - 0.303*AR(1) \\ & (12.0) \quad (5.2) \qquad (6.7) \qquad (-3.6) \qquad (2.1) \end{aligned} \tag{2}$$

$R^2 = 0.623$, R^2 (adjusted) = 0.590, DW =2.054.

Regression (2) confirms that the growth rate increased from 1980–81. We also define Drainm80 = Drainm*D80+ and estimate the following equation to test for changes in the coefficients from 1980-81 onwards.

$$\begin{aligned} GrGDPfc = {} & 0.0349 + 0.023*(D80+) + 0.218*DrainM - 0.124*DrainM(-1) - 0.339*AR(1) \\ & (12.2) \quad (5.2) \qquad (5.9) \qquad (-3.5) \qquad (-2.3) \\ & - 0.072*Drainm80 + 0.060*Drainm80(-1) \\ & (-1.23) \qquad (+0.98) \end{aligned} \tag{3}$$

$R^2 = 0.638$, R^2 (adjusted) = 0.589, DW =2.044.

The two new variables are found to be insignificant, while all variables present in equation (2) remain significant with their coefficients virtually unchanged. Thus we conclude that ***there is no break in the effect of rainfall on the growth rate from 1980-81 onwards*** and we can use equation (2) for further analysis. Before doing so however, let us consider one puzzle that this gives rise to.

We know that the share of GDP from agriculture has been declining continuously since independence. Then how is it possible that the effect of rainfall on GDP has remained unchanged for over five decades. We confront this question directly by taking agricultures share of GDP and regressing it on time to determine the time trend of the decline. We then multiply

Drainm by this forecast share of agriculture (Sagf say) to get Drainm(adj) = Sagf*Drainm. If equation 1, 2 and 3 are re-estimated using this variable instead of Drainm (4, 5 and 2'a say) the R^2 is marginally lower in every case but the results are virtually identical.[11] It is therefore clear that (from 3 & 2'a) that there is no break in the impact of rainfall variation on growth of GDP. The equations 4 & 5, in contrast to 1 & 2, however show that the impact of rainfall variation has been declining with the share of agriculture in GDP.

$$GrGDPfc = 0.0449 + 0.4137*Drainm(adj) - 0.294*Drainm(adj)(-1) \quad (4)$$

(13.6) (4.8) (-3.4)

$R^2 = 0.436$, R^2 (adjusted) = 0.412, DW = 2.09.

$$GrGDPfc = 0.0345 + 0.0227*D80 + 0.50*Drainm(adj) - 0.28*Drainm(adj)(-1) - 0.316*AR(1) \quad (5)$$

(11.7) (5.1) (6.5) (-3.6) (2.24)

$R^2 = 0.61$, R^2 (adjusted) = 0.58, DW =2.07.

Though statistically we cannot distinguish between 1 and 4 or 2 & 5, if rainfall was affecting aggregate GDP only through the agriculture supply channel we would have expected the R^2 and fit to be better for 4 and 5 than for 1 & 2 respectively. The result suggests that while the supply (production) side impact is declining the demand side effects are increasing and offsetting this factor. As agricultural income rises above subsistence we expect the demand for non-agricultural goods by those whose primary income source is agriculture to rise sharply. This is reflected in the rising share of manufactured goods and services in the consumption basket. Another channel through which rainfall affects GDP is through other sectors such as electricity (hydro) and this could also be a contributory factor.

A significant experiment with coalition government ended in 1979–80 and the Congress(I) party returned to power in 1980–81. The recognition that the controls and subsidies introduced by the Congress governments during the earlier phase were not serving their intended

[11] As Sag averaged 0.366 from 1950 to 2003, we expect the co-efficients on Drainm*Sag to be 2.7 times those on Drainm. As 2'a is identical to the others it is not printed (to save space).

purpose, had gradually dawned on the establishment during the late seventies.[12] The new government gradually initiated a new approach to economic management. We, therefore, take 1979-80 as the end of the first development phase and 1980-81 as the start of the next.

The issue of stagnation or deceleration in Indian growth after 1965–66 has been the subject of much debate and analysis. According to Bhagwati and Srinivasan (1984), Narayana and Srinivasan (1977), was the first paper "to analyse the growth stagnation of the Indian economy since the mid-sixties." Other papers papers to discuss these issues were Bhagwati and Srinivasan (1984), Chakravarty (1984), Raj (1984), Dhar (1988), Nagaraj (1990), Bhargava and Joshi (1990). We therefore investigate the possibility of a break in the sixties. Chow stability tests on equation (1) show a possible break point around 1963-4 with an F value of 2.09 (prob=0.11) and a log likelihood ratio of 6.64 (probability 0.084) with marginally lower values of F and log likely hood in 1962-3 and 1964-5. These values are however much lower than for the breakpoint at 1980-1(above). A joint Chow test for 1980-1 and 1963-4 (etc.) yields a singular matrix.

We therefore use growth regression analyses equation (2) and introduce another dummy for 1965-6 to 1979-80.[13] Dummies with a starting year of 1963-4 etc were also tried. All these dummies turn out to be non-significant. Other papers have suggested breaks in the seventies. Dummy variables for potential breaks in 1971–72 and 1975–76 are however found to be even less significant. To summarise, ***there are no statistically significant breaks in GDP growth from 1951-52 to 1979-80 once the 1980-81 break is accounted for***. This result implies that any policy conclusions drawn on the basis of presumed slowdown in the sixties and/or seventies are likely to be wrong! Further, studies on the determinants of India's growth based on old data could be highly misleading from the current perspective. Only policy analysis for this period that takes account of the rainfall fluctuations and reduced rainfall during 1965-6 to 1979-80 will be credible.

[12] The Dagli committee on Controls and Subsidies, set up by the coalition government which was aware of the problem, submitted its report in 1979-80

[13] We continue to use equation (2) as a base equation in preference to 2a because it is the simpler and straight-forward one and has a marginally better fit. Introduction of dummy for 1965-1979 into 2a gives identical results.

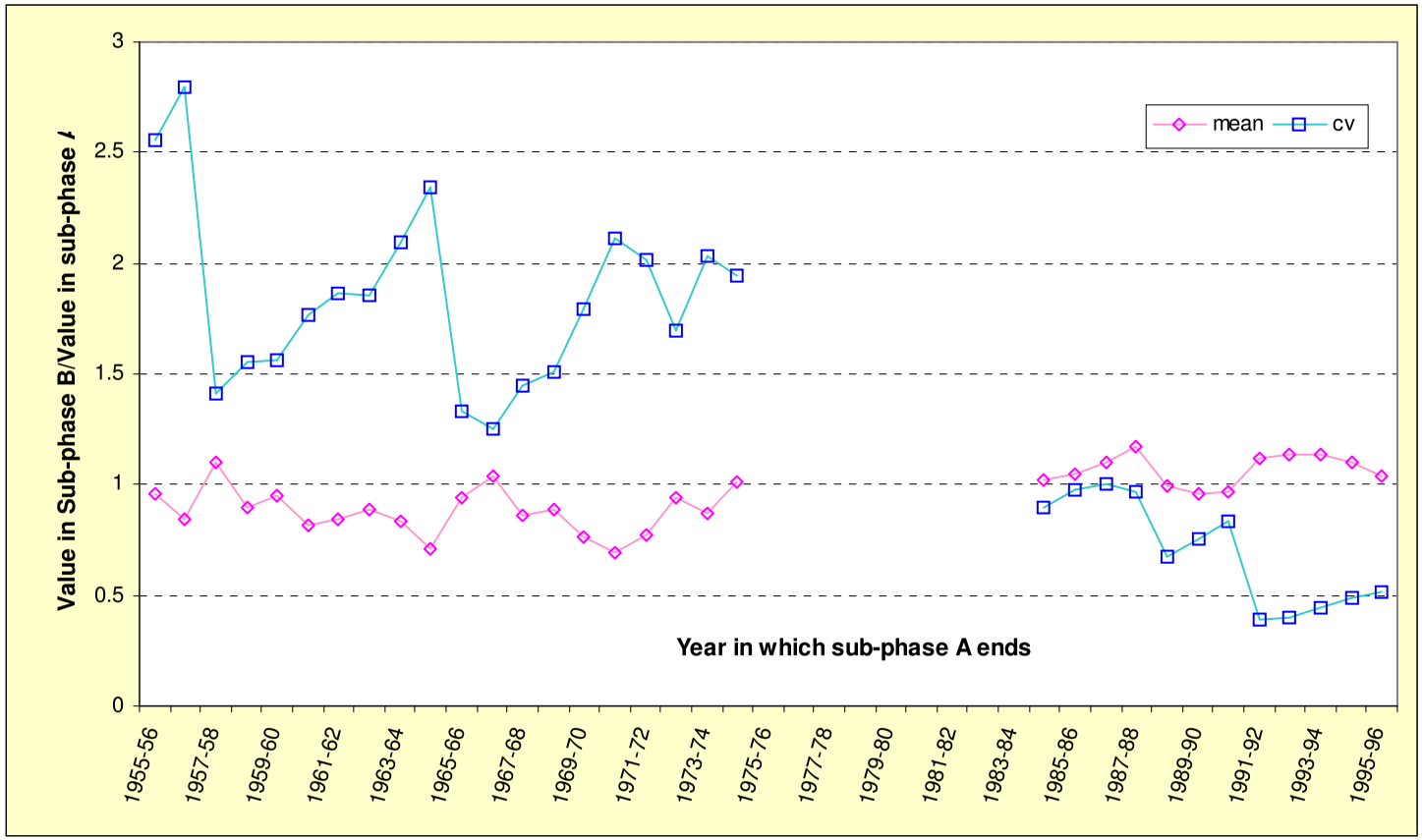
Figure 4 indicates why this may be so. If we divide the entire period of phase I into two sub-phases ending in different years, and measure the relative CV of the two sub-phases we find a sharp change in 1965–66. The CV of sub-phase IB relative to that of sub-phase IA falls from 2.3 if the end-year for sub-phase IA is 1964–65 to 1.3 if the end-year is 1965–66. The relative mean, however, changes by a very small amount. Thus, the break is more in terms of the degree of variability of growth rather than in terms of the mean growth rate (Figure 4).

The economic reforms in 1991-1992 and the high growth rates that followed thereafter led to widespread speculation and assertion that India had entered a new phase of growth and development with enactment of radical new economic policy framework in 1991-92.[14] It is therefore important to determine whether a new phase started in 1991 or 1992 or whether the phase that started in 1980–81 continues till today. We therefore investigate for a possible break at the end of the eighties/beginning of the nineties using equation (1). The chow test shows a significant value for F and Log likelihood ratio in 1989-90 and 1992-3 but these values are lower than for the 1980-81 break. Thus for the potential 1989-90 breakpoint the F value is 3.22 (probability 0.031) and likelihood 9.934 (probability 0.019). Both these fall sharply in 1990-91 and 1991-2 and then rise in 1992-93 to 3.37 (prob =0.026) and 10.3 (prob=0.015). When however the Chow test is used on equation (2) i.e. along with the 1980-81 dummy it yields a singularity (near singular matrix).

We therefore have to test for breaks using equation (2) with an additional dummy for the period 1991–92 to 2002–03 (D91+) or for the period 1992–93 to 2002–03 (D92+). In each case the additional dummy is found to be non-significant while D80 (1980-1 to 2002-3) remains strongly significant (as are others starting in 1990-1). An alternative formulation with D80 replaced by two dummies for 1980-1 to 1991-2 and 1992-93 to 2002-3 shows that the coefficients on these are virtually identical. Therefore ***we find no additional breakpoint in the nineties, once the breakpoint in 1980-81 is accounted for***.

[14] For instance in Investment Bank research reports and economic newspapers and magazine.

Figure 4: Pattern of Change of Relative Mean & CV (sub-phases) with Dividing Year T



3.3 Agricultural Slow down or Green Revolution?

There has been a suspicion that the drop in GDP growth from 1965-66 is due to the fall in agricultural growth from the mid-sixties. Further it was felt that the introduction of the Green revolution thereafter (around the early seventies) led to a fundamental change in the growth potential of agriculture. We therefore test statistically for break points using the following equation for the growth rate of GDP from agriculture (GrGDPag):

$$GrGDPag = 0.03 + 0.36*Drainm - 0.34*Drainm(-1) \quad (6)$$

(4.8) (5.9) (-5.3)

$R^2 = 0.58$, R^2 (adjusted) = 0.56, DW = 2.93.

The chow test using this equation reveals a potential breakpoint at 1964-65, with an F = 3.583 (probability 0.0207) and Log likelihood ratio = 10.921 (probability (0.031). The F is also above 3 for 1963-4 and 1962-3, while the Log likelihood ratio is above 10 for 1963-4. These values are much higher than found for a breakpoint for GDP around these years. However, when we introduce a dummy for 1964-5 onwards (or for 1950-1 to 1963-4) we find that it is insignificant.

Because of the significant auto-correlation in equation (6), we also estimate an alternative specification as follows:

$$GrGDPag = 0.029 + 0.3885*Drainm - 0.372*Drainm(-1) - 0.492\ AR(1) \quad (7)$$

(8.0) (7.26) (-6.67) (-3.93)

$R^2 = 0.686$, R^2 (adjusted) = 0.666, DW = 2.27

The chow test using this equation reveals a potential breakpoint at 1962-63, with an F = 3.31 (probability 0.0189) and Log likelihood ratio = 11.59 (probability (0.021). The F is 1.47 for 1961-2 while the Log likelihood ratio is above 6.55. The value for 1962-63 is much higher than found for a break point for GDP in the mid-sixties. However, when we introduce a dummy for

1962-63 onwards (or for 1950-1 to 1961-2) we find that it is insignificant. Alternative dummys for 1963-4, 1964-5 etc. are also insignificant. If we apply the Chow test for these years, we find that the F value falls to about 1 for 1967-8 to 1980-81 and is lower than one for any potential break points thereafter (up to the 1990s).[15] Thus ***we do not find any statistical break in the growth of GDP from agriculture during the 53-year period, once the variations in rainfall are accounted for***.

When Drainm80 and its lagged value are introduced into the right hand side of equation (7) their coefficients are found to be insignificant. This confirms that there is ***no statistically significant change in the effect of rainfall variations on GDP from agriculture even after 1980-81***.

3.4 Manufacturing

The same exercise was repeated for the manufacturing sector with similar results. The basic equation with GrGman as the rate of growth of GDP from manufacturing, is as follows:

$$GrGman = 0.059 + 0.127*Drainm \quad (8)$$

(12.2) (2.68)

$R^2 = 0.126$, R^2 (adjusted) = 0.108, DW = 1.63.

This is tested using the chow test for the years from 1979 to 1987. We find a potential break point at 1981 [F=2.02 (Pr=0.14)]. To confirm this we introduce D81 the dummy for 1981-2 to 2002-3 into this equation:

$$GrGman = 0.051 + 0.019*D81 + 0.14*Drainm \quad (9)$$

(8.3) (2.03) (3.03)

[15] A similar equation is also estimated for manufacturing growth: Using this equation Chow tests for growth break for 19800-81 shows an F = 1.653 (0191) and LLR = 5.33 (0.149). The values become even less significant for 1979-80 and 1981-2.

$R^2 = 0.194$, R^2 (adjusted) = 0.181, DW = 1.75.

This shows that the growth rate of manufacturing accelerated after 1980-81. This contributed to the acceleration of the rate of growth of GDP from 1981-82.[16]

Ahluwalia (1985, 1991) has analysed the stagnation in growth of value added in the registered manufacturing sector (ASI & IIP) since the mid-sixties and the turnaround in growth in early eighties in terms of trends in TFPG growth in this sector. In the current context we can therefore find out whether there was a statistically significant decline in the growth of (total) GDP from manufacturing between the mid-sixties and the and end seventies. A dummy for the period 1965-6 to 1979-80 (D6579) is introduced into equation (8). Its co-efficient is found to be significant at the 10% level. The best fit is however found with the dummy for 1965-6 to 1980-81 (D6580) whose co-efficient is highly significant:

GrGman = 0.066 + -0.0252*D6580+ 0.114*Drainm (10)

(12.1) (-2.54) (2.53)

$R^2 = 0.228$, R^2 (adjusted) = 0.196, DW = 1.74.

This equation establishes that there was a reduction of 2.5% per annum in the growth rate of manufacturing during 1965-6 to 1980-81. In general this could have been due either to the policies we followed or to external/exogenous factors. *In our view the policies followed during 1965-6 to 1979-80 (combined with the accumulating costs of policies followed earlier) reduced the rate of growth of manufacturing by 2.5% points during the period 1965-6 to 1980-81.*

If we compare this equation with (9) containing the dummy D81 (1981-2 to 2002-3) we find that the (10) has greater explanatory power. Further when both dummys are included simultaneously D6580 has greater significance than D81.[17] This suggests that the removal of

[16] The contribution of manufacturing growth to overall growth is quantified below.

[17] T= 1.57 (prob=12.3%) versus t=0.67 (prob=50%)

some of the constraints/barriers to growth imposed during 1965-6 to 1979-80 had a greater role in the acceleration of manufacturing growth from 1981-82 than the stimulation of new growth impulses from 1981-82 onwards. We will examine this issue below in greater detail.

3.5 Services

Virmani (2002) showed that non-tradable services have played an important role in the growth of the Indian economy since 1950. It is useful to investigate a potential break out in the growth of non-tradable services (GrGntrdbl). To ensure that the changes are not due to government administration or the way these are measured we also use non-tradable services excluding GDP from government administration (GrGserv). The basic equation is

$$GrGntrdbl = 0.058 + 0.039*Drainm + 0.501\ AR(1) \quad (11)$$

(11.8) (1.82) (4.00)

$R^2 = 0.287$, R^2 (adjusted) = 0.257, DW = 2.10.

The Chow test using equation (11) reveals potential breakpoints in every year from 1980-1 to 1985-6. The highest probability of a break is however found for 1985-86 with an F = 5.28 (probability 0.003) and Log likelihood ratio = 15.37 (probability 0.0015). These values and probabilities are similar to those found for the GDP growth break point in 1980-81. In this case, however the F value is higher than 4 and log likelihood ratio higher than 12 for all years from 1980-81 to 1985-6. To confirm the break point for non-tradable services in 1985-86 we add a dummy for 1985-86 onwards into (5a);

$$GrGntrdbl = 0.0475 + 0.027*D85 + 0.068*Drainm \quad (12)$$

(18.3) (6.1) (3.26)

$R^2 = 0.465$, R^2 (adjusted) = 0.443, DW = 1.67.

This confirms that *there is a breakout in the rate of growth of non-tradable services in 1985-86. Alternative equations with D80, D81 etc still show high (but lower) statistical significance but have lower explanatory power (R^2).*

The equation for GrGerv is very similar but has even higher explanatory power because of stronger effect of variations in rainfall. The chow tests on this equation also show the same pattern with 1985-6 as the post probable breakpoint [F=5.15(Pr=0.003), LLR=15.06 (Pr 0.0018)] and 1984-5 a very close second [F=5.14 (Pr=0.003), LLR=15.06(Pr=0.002)]. The final equation corresponding to (12) is,

$$GrGserv = 0.0463 + 0.028*D85 + 0.083*Drainm \quad (13)$$

(17.5) (6.16) (3.78)

$R^2 = 0.498$, R^2 (adjusted) = 0.477, DW = 1.82.

The analysis of this section suggests that ***the acceleration in the growth of GDP from services was a gradual process from 1980-81 to 1985-86, and it became firmly established in 1985-86***.

3.6 Summary Conclusions

The rate of growth of agriculture as well as the effect of rainfall on it remained unchanged during the entire period of over 50 years. Though the effect of rainfall variation on GDP supply (agriculture GDP) declined with the share of GDP in agriculture, demand side effects (demand for non-agricultural goods from agriculture income) seems to have grown. Thus there was little change in the marginal impact of rainfall variation on economic growth. Manufacturing growth, however, started reviving in 1980-1 and was soon joined by services. This led to a significant acceleration in overall growth starting 1980-1. Subsequently around 1984-85 or 1985-86 there was an additional (sustained) growth impulse arising from the service sector.

This section also shows that there were only two statistically significant phases in Independent India's growth history. The first phase was from independence to 1979-80 and the second was from 1980-81 to the current time. As we show in the next section these two phases can be identified with two different policy regimes, that may be termed, "The Indian Version of Socialism," and "Experiments with Market Reform" respectively. Previous authors have

referred to the average GDP growth rate that prevailed during these two phases as the 'Hindu Rate of Growth,' and the 'Bharatiya Rate of growth.'

4 FROM HINDU TO BHARATIYA RATE OF GROWTH

The purpose of this section is to briefly flesh out the policy regimes that underlay the two phases of growth identified in the previous section.

4.1 Phase I: Indian Version of Socialism

The period of 30 years from 1950–51 to 1979–80 was the phase of socialist experimentation, in which the Indian version of socialism was developed. Chakravarty (1987) presents a detailed exposition of the underlying economic rationale and documents some of the ideological and political factors. In this phase the economy averaged a rate of growth of 3.5% per annum (Table 1) and average income, measured by per capita GDP, grew at 1.3% per annum. Growth during this period was fairly volatile, with a co-efficient of variation of 1.

Table 1: Macro-Economic Growth Parameters during Different Phases

	Phase I (1951-52 to 1979-80)			**Phase II (1980-81 to 2001-02)**		
		Sub-phase			***Sub-phase***	
	Phase I	***I A*** *(1951-64)*	***I B*** *(1965-79)*	***Phase II***	***II A*** *(1980-91)*	***II B*** *(1992-2001)*
Growth rate (%)						
GDP (market prices)	3.6%	4.4%	2.9%	5.7%	5.5%	6.0%
GDP (factor cost)	3.5%	4.1%	2.9%	5.2%	5.5%	6.1%
GDP at factor cost (HP filtered)	3.7%	3.9%	3.5%	5.5%	5.2%	5.8%
Per capita GDP at market prices	1.4%	2.3%	0.6%	3.6%	3.3%	3.9%
Per capita GDP at factor cost	1.3%	2.0%	0.6%	3.6%	3.2%	4.1%
Private consumption (PFCE)	3.2%	3.7%	2.8%	4.7%	4.5%	4.9%
Government consumption (GFCE)	5.8%	6.6%	5.1%	6.3%	6.0%	6.6%
Investment (GDCF)	6.1%	7.9%	4.5%	6.3%	5.0%	7.8%
Machinery & equipment	6.6%	9.7%	3.7%	8.9%	9.9%	7.9%
Private GFCF	3.6%	3.5%	3.8%	8.5%	8.4%	8.6%
Goods and Services Export	3.8%	0%	10.2%	9.5%	8.4%	10.8%
Oil Import			37.1%	9.8%	6.9%	13.2%
Coefficient of Variation (Std/mean)						
GDP at Market prices	0.9	0.5	1.4	0.3	0.4	0.2
GDP at Factor cost	1.0	0.6	1.5	0.3	0.5	0.2

Sources: CSO (Series at 1993-94 prices); RBI (Series converted using implicit price deflator for GDP).

Notes: Data on the GDP is till 2002–03 and on other aggregates it is till 2001–02.

Though our focus is on the post colonial period it should be noted that this GDP growth rate was five times the average rate of growth of 0.7% per annum during the 30 year period from 1917 to 1946. It also represented a major jump from the –0.3% per growth of per capita GDP during these 30 years.[18] This was however a very difficult period in world history, with the two World Wars bracketing it and the great depression in between. The Indian economy grew at 1.5% per annum during 1900 to 1913 which was less than half the rate during phase I of the post-independence period.

This phase was characterised by a conscious effort to increase the role of the state in the economy. This was perhaps a reflection of what Chakravarty (1987) calls a "profoundly interventionist economic philosophy" prevailing at the time among Nehru and other intellectuals. He states that given similar perceptions of the reasons for India's "structural backwardness", which he presents, "even a more pragmatically inclined politician than Nehru could well have opted for the same set of arrangements for promoting economic development." There was an inherent assumption that market failure was a serious underlying problem, that the private sector could not be trusted and that the public sector would produce economic and socially superior outcomes. The expansion of the State's role took place through multiple channels including nationalisation of selected production activities, increased public investment in infrastructure and other production activities, and legislative measures to control and direct private activity and economic agents. Though the mix of measures used varied over the phase, the concept of modern regulation as against bureaucratic control was sorely missing through out the first phase of economic growth.

In this phase Investment grew strongly at 6.1% per annum led by the growth of government fixed investment at 7.2% per annum. Rapid growth of Government consumption at 5.8% also far exceeded economic growth. In contrast the growth rate of private consumption was a very modest 3.2% per annum a rate slower than that of GDP. Though initially government investment and consumption may have led private consumption at some point during this phase it started substituting for and crowding out private investment and consumption.

[18] Based on data in Sivasubramonian (2000).

From the supply side, a noticeable feature of this growth was the fact that the tradable goods sector – manufacturing, mining, and agriculture – grew at about half the rate (2.8% per annum) of the non-tradable services sector (Virmani(2004b)). Electricity production was the leading sector in this growth (9.6% per annum)). Other sectors with relatively robust growth were Banking and Insurance (6.7% per annum), Communication (6.7%), Other transport (6.3%) and registered/modern manufacturing (6.1% per annum).

The share of production (GDP) originating in the public sector increased rapidly over most of this phase. The share of public investment on the other hand initially increased rapidly but then fell. Despite the fall in investment during the latter years of this phase, the government's share of production continued to increase fairly rapidly because of nationalisation of certain sectors. In addition the pace of control of activities accelerated through the passage of new legislation and the introduction of more stringent rules and more elaborate procedures.

During this 30-year period of 'socialism with an Indian face' we can discern some change in emphasis between two sub-phases. Till about 1964-65 the leadership was infused with moral righteousness and developmental enthusiasm based on the philosophical background of Fabian socialism and the experience of Soviet state socialism. The best and brightest development economists in the world journeyed to India to advise on how to accelerate development and growth and some of them even worked in the Indian government or the Planning Commission to convert ideas into practical policy.[19] Starting from 1965–66 and ending in 1979–80, both the moral fervour and the academic certainties gradually seeped away. The policies were driven more by immediate crisis and political expediency than by economic logic. A less secure leadership struggling to establish itself was much more inclined to use economic policy as a political tool for besting its rivals[20] As Dhar (1990) points out, this period saw "incoherence in the policies of the government." Socialistic legislation was presented as a policy for improving the lot of the poor while its main outcome was the suppression of market responses through quantitative controls implemented by an increasingly self-serving politico-bureaucratic system. Bhagwati (1993) analysed the failure of strategies adopted for Indian development prior to the

[19] See Bhagwati and Chakravarty (1969) for a survey of some of the technical literature and Chakravarty (1987) and the first chapter in Bhagwati (1993) for general expositions

nineties' reforms. He argued that the extensive controls and the inward-looking policies, which hobbled private sector efficiency, along with the substantial and inefficient public sector were the three broad factors that stifled Indian growth in the seventies and, to a lesser extent, in the eighties. He states that "the weak growth performance reflects, not a disappointing savings performance, but rather a disappointing productivity performance." [21]

4.2 Phase II: Experiments in Market Reform

This was the phase of market experimentation. The second phase of economic growth started at the beginning of the eighties. The high growth rates during 1994-95 to 1996-97 led to widespread speculation and assertion that India had entered a new phase of growth and development with enactment of radical new economic policy framework in 1991-92.[22] We have earlier shown that there was no break-point in 1991 or 1992 and therefore the phase that started in 1980–81 continues till today. The 1994-1996 period is however found to be a growth spurt that could not be sustained.

During the period 1980–81 to 2002–03 economic growth averaged 5.7% per annum (Table 1). This rate is 1.2 percentage point higher than that during the first phase of development. It is 2.8 percentage points higher than that in the sub-phase IB. Economic growth during this phase has been remarkably stable with a CV of only 0.3, one-third of the CV during the first phase of development (Table 1). We call this the 'Bharatiya rate of growth', to distinguish it from the 3.5% average rate of growth during the first phase of development, a rate that has come to be associated in most peoples minds as the 'Hindu rate of growth,' but is more accurately called the "Indian-socialist" phase. Per capita income has been growing at 3.6% per annum during the Bharatiya rate of growth phase, more than double the per capita income growth of 1.3% per annum during the Hindu-socialist rate of growth phase.

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[20] Patel (2002), in his fifth chapter, describes a failed attempt by economists to ensure political stability and a strong and united leadership for the troubled period after 1965.

[21] The fact that India's growth rate did not rise significantly, despite an impressive savings performance, and the implications thereof for future growth strategies has been much analysed and debated such as by Chakravarty (1984) and Bhagwati and Srinivasan (1984).

[22] For instance in Investment Bank research reports and economic newspapers and magazine.

The Market reform phase has been characterised by recognition of the harmful effects of industrial and other controls on distribution, production, and investment and the need to remove the distortions created by government policy on the industry and exports. There was much more gradual and hesitating recognition of the problem of government and public sector failure. This was reflected in the 0.5% point step up in the rate of growth of government consumption to 6.3% (from 5.8%).

The step up in the growth rate during the market reform phase has been led, on the demand side, by an increase in private consumption, whose growth accelerated to 4.7% per annum from 3.2% per annum in the Indian socialist phase. The acceleration of export growth to 9.5% per annum, over 2½ times the earlier growth rate of 3.8% per in Indian socialist phase contributed to the acceleration, even though part of this may have been offset by higher oil import bill due to rising prices. Investment growth remained virtually unchanged at 6.3% per annum relative to 6.1% earlier. The fact that growth accelerated despite this small change implies that the efficiency of investment must have improved during the Market Reform phase. This is supported by a change in the structure of investment towards machinery and investment, whose growth accelerated to 8.9% per annum during the Market Reform phase from 6.6% per annum during the Indian Socialist phase. The rate of growth of private fixed investment more than doubled from 3.6% in the Indian Socialist phase to 8.5% per annum in the Market reform phase. With completely different objective function of profit maximisation (versus political support maximisation in public sector) this would have contributed to the efficiency of capital use.

4.2.1 Growth Impulse

To test the statistical significance of the (temporary) growth boom during the mid-nineties, we estimate equation (2) for the period 1980-1 to 2002-3 (phase II) by dropping the dummy for 1980-1+ and inserting a dummy for 1994-5 to 1996-7:

$$\underset{}{GrGDPfc} = \underset{(19.9)}{0.0559} + \underset{(2.1)}{0.016}*D9496 + \underset{(5.1)}{0.139}*DrainM - \underset{(-2.9)}{0.083}*DrainM(-1) \quad (14)$$

$R^2 = 0.892$, R^2 (adjusted) = 0.644, DW =1.68.

The dummy is found to be significant at the 10% level of confidence. The confidence level falls to 10% if D9496 is replaced by a dummy for 1994-4 to 1999-2000 (or 1998-99).[23] Alternative dummy variables starting from 1993-4 are not found to be significant at the 10% level. Interestingly the dummy D9497 for 1994-5 to 1997-98 is insignificant, indicating that something happened during 1997-98 to bring the boom to a halt. One possibility is that the change of government during the year undermined the credibility of reforms.[24] This is not surprising given the fall of a government widely perceived as reform oriented and its replacement with one in which many members still used the rhetoric of phase IB socialism. There was apparently some recovery thereafter as another government that was traditionally perceived as relatively pro-market/anti-Statist came to power.[25]

We also estimate equation (2) for the entire period with a dummy for 1994-5 to 1996-7:

$$GrGDPfc = 0.035 + 0.02*D80 + 0.018*D9496 + 0.185*Drainm - 0.083*Drainm(-1) \quad (15)$$

(12.6)***(4.5)*** (1.8)* (6.7)*** (-4.1)***

$R^2 = 0.65$, R^2 (adjusted) = 0.62, DW =2.08

The confidence level on the coefficient for D9496 drops to 10%.

We repeat this exercise by inserting the same dummy(s) into the growth equation 9 for manufacturing.

$$GrGman = 0.063 - 0.0216*D6580 + 0.046*D9496 + 0.106*Drainm \quad (16)$$

(11.5) (-2.25) (2.41) (2.46)

$R^2 = 0.31$, R^2 (adjusted) = 0.268, DW = 1.92.

D9496 the dummy for the period 1994-5 to 1996-97 is very significant but D9497, D9498 and D9499 are not.

[23] These dummy when introduced into equation (2) and estimated for the full 52 year period are not however statistically significant at the 10% level.
[24] United front coalition government.
[25] National Democratic Alliance (NDA) led by the Bharatiya Janta Party (BJP).

Similarly in the equation for non-tradable service growth equation (12), D9496 is not significant but the dummy D9599 for the period 1995-6 to 1999-2000 is highly significant.

$$GrGntrdbl = 0.0475 + 0.022*D85 + 0.017*D9599 + 0.063*Drainm \quad (17)$$
$$(19.1) \quad (4.6) \quad (2.25) \quad (3.09)$$

$R^2 = 0.516$, R^2 (adjusted) = 0.486, DW = 1.67.

This is however no longer true if we use (13) the equation for government administration (GrGerv). None of these dummies are found to be significant.

These results suggest that ***the economic reforms of the early nineties imparted an additional growth impulse to the manufacturing sector. This led the growth boom of Indian economy during 1994-95 to 1996-7. The boom however petered out in 1997-8.*** The reasons for this are explored in (Virmani(2004b)).

5 CONCLUSION

This paper has reviewed the growth performance of India since 1950-51. It is widely believed that the Indian economy has become less dependent on the weather over the last half century of independence. This paper shows that there is a statistically insignificant reduction of the impact of rainfall on Indian agriculture and of rainfall on the Indian economy (as a whole). In other words agriculture is as dependent on rainfall in the fourth quarter of the century as it was in the third. On the overall impact of rainfall on GDP the expected decline in the supply side effect (share of agriculture in GDP) seems to have been offset by demand side effects.

The paper also shows that Indian economic growth has been remarkably stable. We are statistically able to distinguish only two phases of growth during its post-colonial history. The first phase characterised as the 'Indian version of socialism' starts after independence and lasts to the end of the seventies. The second phase, which starts thereafter (1980–81) is still going on and is characterised by 'Experiments in Market Reform.' There was a sharp and statistically significant acceleration in the growth rate during the market reform phase. During the first *socialist phase* the economy averaged a growth of 3.5% per annum with per capita growth averaging 1.3% per annum. Growth accelerated to

an average of 5.7% per annum during the *market reform* phase with per capita income growing at an average rate of 3.6% per annum.

We also find a (statistically) significant acceleration in the rate of growth of services during the market reform phase. In the case of manufacturing the higher growth rate during the eighties was more in the nature of a recovery from the oppressive hand of socialist controls & public monopolies and a closing of the gap between actual and potential output that had opened as a consequence. As a consequence the share of GDP from services does not show any abrupt change (discontinuity) and has been rising slowly but steadily over the past half century.

With a change in orientation of the government from socialism to market there was a change in the rhetoric of the government and of intellectuals and consequently in the atmosphere/environment in which private agents and investors operate. This change in orientation started in the late seventies when the still 'socialist' oriented Mrs Gandhi broke the railway strike in 1976. The change continued with the coming to power of so called 'right-wing' political parties such as the Congress (O) and the BJP (though some of the coalition partners were Indian socialists). There was consequently an acceleration of GDP growth from 2.6% per annum during 1965-6 to 1979-80 to 5.6% annum during 1980-81 to 1991-92.

One 'puzzle' is how such a significant growth impulse resulted from what appear prima facie to be modest changes in the control regime relative to what happened in 1991-92. The paper has argued that the economic reforms introduced during the 1980s had a great deal of credibility. As a result the rate of growth of private investment accelerated and the structure of investment moved towards machinery & equipment and the quality of machinery and equipment improved because of greater access to imported capital goods. This played an important role in the growth acceleration. In addition, the output gap had opened up during the Socialist Growth sub-phase due to the (policy resultant) suppression of economic growth below its potential was closed during the 'modest reform' sub-phase. This gap was eliminated during the first half of the market reform phase, partly because of the supply side stimulus provided by slower growth of oil prices and the demand side stimulus provided by the rising fiscal deficit. Thus the acceleration of growth in the market reform phase had a substantial element of temporary acceleration above its potential, a catch-up process that bridged the output gap by around 1990-91.

There was also a small increase in the growth rate during 1992-93 to 2003-4 (over and above this 'gap closing' acceleration) following the introduction of broader reforms. The paper showed that these reforms gave rise to a statistically significant spurt in the growth rate of manufacturing, which was reflected in a spurt in overall growth. Among the likely reasons for (a) The economy's inability to sustain this growth spurt are the large gaps in policy reforms relating to agriculture, mining, (private good) infrastructure (e.g. electricity, railway) and labour-intensive manufacturing. (b) The failure of public monopolies to provide critical infrastructure services like electricity and rail transport. (c) The deterioration of government supply (quantity & quality) of public and quasi-public goods (security & safety, roads). (d) The dissension within the ruling coalition / party / organisation that undermine credibility of reform.

We seem currently to be stuck at the 'Bharatiya' rate of growth of around 5.8% per annum.[26] In fact the trend rate in 2002-3 appeared to be about 1% point lower than this because of the very sharp cyclical decline in growth that occurred in 2002-3. With the cyclical recovery of the economy to over 8% in 2003-4 and a forecast of 6% to 6.5% growth rate in 2004-5, the economy is returning to the 'Bharatiya' rate of growth trend of 5.8% per annum. If the pace of reforms is maintained at the average rate seen since 1991-2, there is a good possibility of the trend growth rate creeping up to 6 to 6.5% range. Shift to a sustained growth rate of 7% to 7.5% will require faster reforms. This includes, (a) a much deeper and more dedicated effort to hack away the jungle of controls than has been seen so far. (b) A reversal of the deteriorating trend in the quality of governance with respect to the supply of public (de-criminalization of politics, a police force that implements the law) & quasi-public goods and services.

[26] Based on CSO data. The WDI data gives a lower average of 5.6%..

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