



Shapley Value Decomposition of the Productivity Growth of the Indian Economy

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Abstract: In this paper we have examined the contribution of different sub-sectors to the overall inequality, divergence and the productivity growth of the Indian economy over the last forty years. Applying the Shapley Decomposition, the methodology can track the contribution of each subsectors of the economy like for example the contribution of the primary, secondary and tertiary to the overall productivity growth of the economy.

This is achieved because Shapley value of the player in coalitional game theory is the average of all the marginal contributions that this individual can make to all coalitions. Employing the same principal for the productivity analysis we have examined how the productivity and the different components of the productivity contributes to the overall growth of an economy

We have applied this methodology to trace the Inequality of GDP and Productivity growth of the different states of India and for different sub-sectors of the economy. The analysis employs the real per capita net state domestic product (NSDP) of the 15 major Indian States for the period 1960-61 to 2008-2009 at the aggregate and sectoral levels. We have considered three different sectors viz., primary (agriculture and allied sector), Secondary and Tertiary Sector for the purpose of our analysis. The NSDP series has been measured at constant (1993-94) prices. Applying the methodology, we find the following result: In the year 1960 the Gini index of the distribution of GDP among the 15 states is 0.2849 and the contributions of sectors are as follows: 46,44 % for the Primary sector; 21,09% for the Secondary sector; 32,46% for the tertiary sector. This means that the overall inequality in 1960 in India would have been 46,44% lower if the GDP of the Primary sector would have been equally distributed across Indian States. The methodology has been applied for the next 40 years and it was found that it is the Tertiary Sector that contributes most to the overall inequality of the economy. We also applied the method for the productivity of the economy and we have found that the contributions from sectoral productivity growth and contributions from employment shift across sectors is the principal cause for the increase in inequality for the states. While productivity growth in services and agriculture contributed significantly to the rise in the inequality of the economy; we find that the productivity growth in manufacturing and the contribut

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Introduction: Following the liberalisation of the Indian economy in 1991-92 and its fairly impressive growth over the past decade, led essentially by a certain number of Indian states, policy makers and researchers are concerned about the fact that some states are growing too slowly or not at all, and thus falling behind or failing to benefit from the opening up of the Indian economy and the dynamism of certain sectors and regions. In other words, apprehension about increased regional disparity has only heightened in recent years. To understand the disparity in the growth rates of the various regions of India, specialists of growth economics have also tried to verify in the context of large economies like India as to whether one of the predictions of growth theory, that less developed regions or countries will "catch up" with the more developed ones (through faster capital accumulation) is confirmed or not. This is often referred to as the "convergence" debate, and in the Indian context, this Convergence debate has also been addressed by a number of studies (Cashin and Sahay 1996a, 1996b; Dholakia, 1994; Patel, 2003; Nagaraj et.al., 1998, Islam, 1995, Sachs et al., 2002; Trivedi 2002, Kar, et, al., Bandhopadhyay, 2011, Ghosh et.al., 1998, 2013). Covering a period of 1961 and 1991 in 20 Indian states Cashin and Sahay (1996) first noticed the evidence of absolute convergence in India. Similar conclusion of convergence was also arrived at by Dholakia, 1994 and Patel 2003. However, Marjit and Mitra (1996) pointed out that factor flow is perfect within a country as compared to imperfect factor mobility between the countries. Hence, convergence should be instantaneous in the context of India. However in Cashin and Sahay (1996) the speed of convergence is only 1.5 percent. Ghosh et. al., (1998) pointed out that increasing returns to scale operate for the states in India. Hence region with higher capital-labour ratio will attract more capital due to higher return for capital leading to rise in divergence for Indian states. Rao et. al., (1999) has also find the existence of absolute and conditional divergence for Indian states and identified the unequal private investment as the source of such divergence. Evidence of divergence is also identified by the study of Sach et al (2002) with geographical factors as the source of such divergence. Nagaraj et al (1998) have also find no evidence of absolute convergence in the panel of 14 states for the period 1970 to 1994. The study however, find evidence of conditional convergence with the share of agriculture, infrastructure, political and institutional factor as the sources of conditioning variables. Evidence of conditional convergence is also noticed by the Aiyer et al (2001) with infrastructure, private investment and non-measured Institutional factors as the conditional factors. However, more recent studies by Ghosh (2008) find evidence of divergence and Singh et al (2003) find no uniform trend in divergence across the Indian states leading to inconclusive results.

In a major departure from the existing studies, a strand of literature also has examined whether the Indian states have converged to different steady states or not due to the differences in the initial conditions leading to 'convergence clubs' or polarization of income distributions. Using Kernel estimation an attempt to check polarization was first studied by Trivedi (2002) for 16 major states for the period 1960 to 1992. The study indicated the emergence of bipolarization for Indian states. Applying the distributional dynamics approach of Quah (1997), Bandhopadhyay (2006) examined the evidence of bipolarization of Indian states in early 1990 among the 17 major states of India. Using the data for the

Post reform period and the technique of stochastic and ergodic distribution Kar et al () have found that a class of middle income states is responsible for emergence of polarization of Indian States. According to their study middle income states like Gujarat, Andhra Pradesh, Tamilnadu, Kerala, West Bengal, Karnataka Himachal Pradesh have transited towards the higher income group of states and Assam, Madhya Pradesh, Rajasthan and others have fallen back towards the lower income group of states. The concept of stochastic convergence as outlined by Bernard and Durlouf (1995) and Chatterjee (1992) has also been applied in the context of India to study convergence. According to stochastic convergence approach if the GDP series is stationary then it is convergent. Applying the stochastic convergence approach Ghosh (2008) identified that only four out of fifteen states have a common steady state while the rest of the states have diverged from each other. A major limitation of the stochastic convergent approach is its low power when there is structural break in the data (Perron, 1989; Im et al., 2005; Kim and Perron, 2009). By addressing the problem of the above methodology Phillips and Sul (2007) have developed a novel approach that relaxes the assumption of stationarity of time series and can identify convergence and club convergence for panel data. Applying the Phillips and Sul (2007) methodology for the period of 1968 to 2008 Ghosh et al., (2013) have identified the presence of three clubs viz., rich, poor and middle club for the Indian states as compared to the other studies that have identified only two clubs.

In this paper, we also extend of polarization of NSDP across different regions in India. For our analysis we have taken 15 major Indian States, which represent around 90% of India's population and also its considerable social heterogeneity. To study the extend of polarization and inequality of the Indian economy we have applied the non-parametric approach of 'Classification and Regression Tree' method called GUIDE (Generalized, Unbiased, Interaction Detection and Estimation) discussed further below, to endogenously determine the clustering of states and have endogenously identified 3 "clubs" of Indian States - "rich", (R), "transitional" (T), and "poor", (P) even though these terms are very relative in terms of international comparison. The most striking element of our result is that over an important part of the period we are covering, there are three clubs and not two, and the presence of a transitional club with movements upwards and downwards might be a regular feature of large developing economies. As we will argue that the membership of states in the clubs in our study are more robust and convincing than the existing studies on club convergence analysis.

Beside in the context of our study we have also done the club convergence analysis at the sectoral levels; carrying out the club formation exercise at the sectoral productivity level enables us to reposition some fundamental questions of economic development, such as the role of agricultural growth (surplus) in fueling subsequent growth in industry or services, and the importance of having an industrial sector to start with. Further analysis is necessary to answer these questions in a detailed way, but this preliminary convergence analysis will enable us to analyze the importance of sectorial growth for subsequent growth of the states.

The paper is therefore structured in the following manner. The next section provides some stylized fact about the growth experience of Indian States. In Section 2 we will briefly recall the concepts and tests of convergence and the present GUIDE methodology for our study. Results from GUIDE methodology has been presented also in section 2. This is followed by the section on sectoral contribution to the productivity growth of the economy using the shapley value followed by section on conclusion.

Data base:

The analysis employs the real per capita net state domestic product (NSDP) of the 15 major Indian States for the period 1960-61 to 2008-2009 at the aggregate and sectoral levels. We have considered three different sectors viz., primary (agriculture and allied sector), Secondary and Tertiary Sector for the purpose of our analysis. The NSDP series has been measured at constant (1993-94) prices. The data base used in this study has been collected from the EPW Research Foundation (2003, 2004), Central Statistical Organization (CSO) of Government of India (2010) and the Reserve Bank of India (2009).

Section 2.1: Determination of Club Convergence Using Regression Tree method

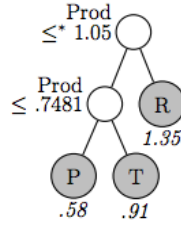
The regression tree analysis carried out minimizes the cross state variance in each club. To examine inequalities among states we divide the income of a state by the average income of all the states. A fall in the score of the state with its position in the poorer club implies its income relative to others has decreased. The variable used for splitting is also the NSDP productivity of the state divided by the mean income productivity of the year.

The variable used for splitting is also the labor productivity defined as the NSDP of the state divided by the labor employment for the state. The labor productivity is divided by the mean labor productivity for the year.

The dependent variable is therefore: $\hat{y}_{i,t} = \frac{y_{i,t}}{\sum_{i=1}^N y_{i,t} / N}$ and the splitting variable: $\hat{y}_{i,t}$ where $\hat{y}_{i,t}$ is the

labor productivity of the sector.

To execute the analysis we first pool the data from 1961 to 2009 for all the states. The regression tree methodology allow us to determine the clustering of the data points and the split variable endogenously. We therefore have in total 735 data point and based on the available statistics we also allow the regression tree to have a maximum of 3 variables. Since the data for the analysis is time series it is prone to business cycles. To avoid business cycles all the series has been smoothed using the Hodrick-Prescott Filter with smoothing parameter of equal to 100.



Using the productivity of the states as the variable for our analysis we find that there are again three clubs of states, rich, poor and transitory. For the aggregate productivity, we have for Club 1: 200 observations, Club 2: 232 observations, Club 3: 303 observations. There is again a striking difference in the aggregate productivity across the states. The mean income for club 3 which is also the rich club is 1.35 and the mean income for the club 2 the middle club is .92 and club 1 which is a poor club is .59. Thus the mean per-capita income of the rich club is almost 56 percent higher than middle club and 1.28 percent higher than the states from the poor club. Between the middle and poor club the difference is 55 percent. We next look at the distribution of the states in each club along the years. The summarized results are given in the table 1 below.

Table 1: Regression Tree using Productivity as the Variable for Analysis

Year	AP	ASS	BIH	GJT	HYN	KNK	KRL	MP	MHR	ORS	PJB	RJT	TN	UP	WB
1961	1	2	1	3	3	2	3	1	2	2	3	2	2	1	3
1962	1	2	1	3	3	2	3	1	2	2	3	2	2	1	3
1963	1	2	1	3	3	2	3	1	2	2	3	2	2	1	3
1964	1	2	1	3	3	2	3	1	2	2	3	2	2	1	3
1965	1	2	1	3	3	2	3	1	2	2	3	2	2	1	3
1966	1	2	1	3	3	2	3	1	2	2	3	2	2	1	3
1967	1	2	1	3	3	2	3	1	3	2	3	2	2	1	3
1968	1	2	1	3	3	2	3	1	3	2	3	2	2	1	3
1969	1	2	1	3	3	2	3	1	3	2	3	2	2	1	3
1970	1	2	1	3	3	2	3	1	3	2	3	2	2	1	3
1971	1	2	1	3	3	2	3	1	3	2	3	2	2	1	3
1972	1	2	1	3	3	2	3	1	3	2	3	2	3	1	3
1973	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1974	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1975	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1976	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1977	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1978	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1979	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1980	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1981	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1982	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1983	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1984	2	2	1	3	3	2	3	1	3	2	3	2	3	1	2
1985	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1986	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1987	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1988	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1989	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1990	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1991	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1992	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1993	2	2	1	3	3	2	3	1	3	1	3	2	3	1	2
1994	2	1	1	3	3	2	3	1	3	1	3	2	3	1	2

1995	2	1	1	3	3	2	3	1	3	1	3	2	3	1	2
1996	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
1997	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
1998	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
1999	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2000	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2001	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2002	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2003	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2004	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2005	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2006	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2007	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2008	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2
2009	2	1	1	3	3	3	3	1	3	1	3	2	3	1	2

Year	Rich Club	Middle Club	Poor Club
1961-70	GJT, HYN, KRL, MHR, PJB, TN, WB	AP, ASS, ORS, RJT, KNK	BIH, MP, UP
1971-80	GJT, HYN, KRL, MHR, PJB, TN	AP, ASS, KNK, ORS	BIH, MP, UP
1981-90	GJT, MHR, PJB, TN	AP, ASS, KNK, WB, RJT	BIH, MP, UP, ORS
1991-2000	GJT, MHR, PJB, TN,KNK	AP, WB, KRL, RJT	ASS, UP, BIH, MP
2001-2009	GJT, HYN, KRL, PJB, TN, KNK, MHR	AP, WB, RJT	ASS, UP, BIH, MP, ORS

We consider four sub-periods: 1960-1970, 1971-80, 1981-1990, 1991-2009, that is, around four decades that correspond to distinct period in India's growth. We obtain three clubs of states for all the period. For the first period, 1960-1970, we have only three states in the poor club namely Bihar, Madhya-Pradesh and Uttar-Pradesh and six states namely Haryana, Gujarat, Maharashtra, Kerala, Punjab and Tamilnadu in the rich club. The rest of the states like Andhra-Pradesh, Assam, Orissa, Karnataka, Rajasthan and West Bengal were in the middle club. The overall ranking of the states has not changed much, even if we consider the productivity of the states. We however found that the distributions of the states across the clubs are stable over the year and there is not much co-movement of the states across the clubs. States that have significantly improved their position are Tamilnadu and Karnataka. It is to be noted that Karnataka from the mid 90s makes a transition from the middle to the rich productivity clubs probably driven by the Information Technology sector. Tamilnadu has also improved its position from the middle state to rich state long back in the decade of seventies. Since then it has remained in the rich club. Andhra-Pradesh is another club that has improved its position from poor to middle state in the decade of seventies. Andhra Pradesh, in spite of the developments in information technology and services in urban agglomeration like Hyderabad and Vishakaptnam, does not show a more substantive acceleration to catch up with the rich group which was however, not the case for Karnataka.

States that have deteriorated their relative position are Orissa, West Bengal and Assam of which Orissa and Assam has dropped from the middle to poor state and West Bengal from rich state to middle state. West Bengal remained in the rich club till 1970 after which its position declined to middle club probably due to hostile ambience and bad governance that was detrimental for growth in the industries and services. Note that Bihar, U.P., Orissa, Assam and Madhya-Pradesh form the poorest group. In this group, it can be remarked that Bihar and Madhya-Pradesh (minerals) and Assam (timber, oil, tea) are resource rich yet undeveloped states like many countries in Africa. The fall in the position of Bengal is most probably explained by the rise in labor conflicts and the subsequent decline in Industrial strength. The decline in investment and investor confidence due to political conflict. The productivity decline of Assam and Orissa is more difficult to explain they are resource rich economics did not have the governance structure and the human resources needed to make the transition to the next level.

We see in the Indian context the use of regression tree method help us to identify clubs of States that apparently obey a common model. This would point to the fact that initial conditions play an important role in their trajectories, and also that the growth rate behaviour corresponds to multiple steady states. In this paper, we are not dealing with the determinants of growth - we are just tracing the evolution of per capita income of the States to see how they "club" together according to common characteristics, and notably to see the role of initial values of per capita income. A quick look at the descriptive statistics of each club therefore gives more insights about the details of the clubs. The table below furnishes the mean value of the principle variables for each group for different decades.

Table 2: Description of the principle variables (mean value)

		Growth NSDP Rich	NSDP Per Capita Rich(in INR)	Growth Per capita(Total Productivity Effect) Rich	Growth Per capita Transitory	NSDP Per Capita Middle (in INR)	Growth Per capita(total productivity Effect) Transitory	Growth Per capita Poor	NSDP Per Capita (Poor)(in INR)	Growth Per capita(Total Productivity Effect) Poor
1960-69	Average	1.6054855	0.0514823	-0.8644136	0.6574251	0.0452530	1.3197448	0.2502514	0.0320192	0.4157981
1960-69	Max	3.3347696	0.0562988	2.8694598	1.3478594	0.0555800	2.5387705	0.1683214	0.0407726	1.0013899
1960-69	Min	0.1563117	0.0463615	-3.9528659	0.4040864	0.0406418	0.2113695	0.9116707	0.0208578	-0.5262463
1970-79	Average	2.9683628	0.0630710	-4.5770017	0.6983407	0.0441991	-5.0606553	0.7438685	0.0297277	-4.8902620
1970-79	Max	8.1615287	0.0727539	-3.5254313	1.3710260	0.0473127	-3.1377763	1.0406288	0.0342784	-4.6685753
1970-79	Min	0.4462664	0.0542760	-5.8809798	-0.0865162	0.0422576	-6.3642488	0.3968944	0.0208517	-5.2839538
1980-89	Average	2.0477235	0.0839126	-0.3916024	2.1934504	0.0504717	-0.8446017	1.7561786	0.0340048	-1.1605820
1980-89	Max	3.3596252	0.1117317	0.6532415	2.8962805	0.0560218	0.4785664	2.3308307	0.0407192	-0.3665333
1980-89	Min	1.3562228	0.0568990	-1.4532039	1.0115605	0.0442370	-2.2944053	1.0283095	0.0233190	-2.1784500
1990-99	Average	3.6723699	0.1074156	3.3492150	4.4243365	0.0756518	3.9626396	2.4925978	0.0475711	1.8858939
1990-99	Max	4.7629586	0.1291362	4.0323107	5.0077999	0.0827313	4.8061201	5.1263181	0.0572256	4.0922561
1990-99	Min	2.4220384	0.0804160	1.9350381	3.6766726	0.0706891	3.0806084	1.0001857	0.0262781	0.6590214
2000-10	Average	5.6893209	0.1650949	5.7637210	5.0646807	0.1170391	5.1487179	3.9130241	0.0656022	4.0906186
2000-10	Max	6.3558119	0.1952350	6.4771143	5.8136972	0.1262901	5.9849432	5.4253801	0.0851196	5.6798110
2000-10	Min	3.9766469	0.1374723	4.0922908	3.9152504	0.1018049	4.0917776	2.8231540	0.0395322	2.5741343

Certain interesting point comes out from the figures in table 2. First, differences in the NSDP per-capita between the rich and the middle club in the earlier decade of 1960s were not much. Simple calculation reveals that the per-capita income of the rich club was higher than the middle club by only 13 percent. On the other hand the differences in the per-capita income between the rich and poor club was 60

percent and 41 percent between middle and poor club. Over the years the per-capita income between the rich and poor club has magnified manifold and in recent decade the mean income of the rich club is 151 percent higher than the poor club. Between the rich and middle club the gap in the per-capita income has also increased. The gap was highest in the decade of eighties and per-capita income of the rich club was higher than the club middle club by about 66 percent. However, the decades following the liberalization of the economy the gap in the income between the rich and the middle has reduced and in the per-capita income of the rich club is higher than the middle club by 40 percent. Between the decade of eighties and nineties, the rich club has experienced growth in the per-capita income by 28 percent and the middle club by more than 49 percent and poor club by 39 percent. In the last two decade the per-capita income of the rich club has increased by 53 percent and the middle club by 54 percent. In contrast, the increase in the per-capita income of the poor club was 37 percent. Secondly; if we compare the growth rates in the NSDP we find that even the rich club had much higher growth rate than the middle and the poor club in the decade of sixties and seventies. In the next decade the growth rate of the middle club picked up and it was the highest among all the three clubs for two decade. In the recent decade, the growth rate of the NSDP of the rich club has again picked up and was the highest. The ranking of the clubs however changes when we evaluate them with the productivity growth. In the earlier decade of 1960s the productivity growth of the rich club was negative and lowest among all clubs. In contrast, the productivity growth of the middle and poor club was positive with the middle club having the highest productivity growth. In the next two decade the productivity growth of the clubs was negative although the intensity of the fall in the productivity growth for the rich club was the lowest. Productivity growth recovered and turned positive for all the clubs only after the opening up of the economy in the nineties. It started accelerating and the rich club overtook the middle and the poor club in the recent decade. It was 5.76 percent for the rich club in the recent decade followed by 5.06 percent for the middle and 4.09 percent for poor club. To summarize we find that it is the rich and the middle that has benefitted most from the opening up of the economy.

Table 3: Club with Productivity of Tertiary Sector

Year	AP	ASS	BIH	GJT	HYN	KNK	KRL	MP	MHR	ORS	PJB	RJT	TN	UP	WB
1961	1	1	1	3	1	1	2	2	3	3	2	3	2	1	1
1962	1	1	1	3	1	1	2	2	3	3	2	3	2	1	2
1963	1	1	1	3	1	1	2	2	3	3	2	3	2	1	2
1964	1	1	1	3	1	1	2	2	3	3	2	3	2	1	2
1965	1	1	1	3	1	1	2	2	3	3	3	3	2	1	2
1966	1	1	1	3	1	1	2	2	3	3	3	3	2	1	3
1967	1	1	1	3	1	1	2	1	3	3	3	3	2	1	3
1968	1	1	1	3	1	1	2	1	3	3	3	3	2	1	3
1969	1	1	1	2	1	1	2	1	3	3	3	2	2	1	3
1970	1	1	1	2	1	1	2	1	3	2	3	2	2	1	3
1971	1	1	1	2	1	1	2	1	3	2	3	2	2	2	3
1972	1	1	1	2	1	1	2	1	3	2	3	2	2	2	3
1973	1	1	1	2	1	1	2	1	3	2	3	2	2	2	3
1974	1	1	1	2	1	1	2	1	3	2	3	2	2	2	3
1975	1	1	1	2	1	1	2	1	3	1	3	1	2	2	3
1976	1	1	1	2	1	1	2	1	3	1	3	1	2	2	3
1977	1	1	1	3	1	1	2	1	3	1	3	1	2	2	3

1978	1	1	1	3	1	1	2	1	3	1	3	1	2	2	3
1979	1	1	1	3	2	1	2	1	3	1	3	1	2	3	3
1980	1	1	1	3	2	1	2	1	3	1	3	1	2	3	3
1981	1	1	1	3	2	1	2	1	3	1	3	1	2	3	2
1982	1	1	1	3	2	1	2	1	3	1	3	1	2	3	2
1983	2	1	1	3	2	1	1	1	3	1	3	1	2	3	2
1984	2	1	1	3	2	1	1	1	3	1	3	1	2	3	2
1985	2	1	1	3	2	1	1	1	3	1	3	1	2	2	2
1986	2	1	1	3	2	1	1	1	3	1	3	2	2	2	2
1987	2	1	1	3	2	1	1	1	3	1	3	2	2	2	2
1988	2	1	1	3	2	1	1	1	3	1	3	2	2	2	2
1989	2	1	1	3	2	1	1	1	3	1	3	2	2	2	2
1990	2	1	1	3	2	2	1	1	3	1	3	2	2	2	1
1991	2	1	1	3	2	2	1	1	3	1	3	2	2	1	1
1992	2	1	1	3	2	2	1	1	3	1	3	2	3	1	1
1993	2	1	1	3	2	2	1	1	3	1	3	2	3	1	1
1994	2	1	1	3	2	2	2	1	3	1	3	2	3	1	1
1995	2	1	1	3	2	2	2	1	3	1	3	2	3	1	1
1996	2	1	1	3	2	3	2	1	3	1	2	2	3	1	1
1997	2	1	1	3	2	3	2	1	3	1	2	2	3	1	1
1998	2	1	1	3	2	3	2	1	3	1	2	2	3	1	1
1999	2	1	1	3	2	3	2	1	3	1	2	2	3	1	1
2000	2	1	1	3	2	3	2	1	3	1	2	2	3	1	1
2001	2	1	1	3	3	3	2	1	3	1	1	2	3	1	1
2002	2	1	1	3	3	3	2	1	3	1	1	2	3	1	1
2003	2	1	1	3	3	3	2	1	3	1	1	2	3	1	1
2004	2	1	1	3	3	3	2	1	3	1	1	2	3	1	1
2005	2	1	1	3	3	3	2	1	3	1	1	2	3	1	2
2006	2	1	1	3	3	3	2	1	3	1	1	2	3	1	2
2007	2	1	1	3	3	3	2	1	3	1	1	2	3	1	2
2008	2	1	1	3	3	3	2	1	3	1	1	1	3	1	2
2009	2	1	1	3	3	3	2	1	3	1	1	1	3	1	2

Once again we find that the regression tree has generated three clubs, rich, poor and transitory. Maharashtra is the only state that has remained in the rich club for the service right from the decade of 1960. It is not surprised given the high concentration of the service related activities in the financial capital of India Mumbai. Gujarat is another state that was in the rich club in the decade. What turns out to be interesting is that poor state like Orissa and Rajasthan were in the rich club when we consider the productivity of the service sector and Karnataka which is now the IT hub of India was in the poor club. States that were in the middle club were West-Bengal, Punjab, Madhya-Pradesh, Tamilnadu and Kerala. The rest of the states were in the poor club. There was also some movement of the states from one club to another in the decade of sixties. Thus, West Bengal and Punjab improved their position from middle to rich club and Madhya-Pradesh deteriorated its position from rich to poor club and Rajasthan from rich club to middle club. Certain movements of the states between the clubs were also noticed in the next decade. Gujarat deteriorated its position from rich to middle club, Orissa from rich to middle to poor club and Rajasthan from middle to poor club. UP improved its position from poor to middle club and West Bengal from middle to rich club. By the end of the decade Gujarat also improved its position from middle to rich state. The distribution of the states has also changed in the decade of eighties. The states that have improved their position are Haryana, Rajasthan and Andhra-Pradesh from poor to middle state and states that have moved down are West Bengal and UP from rich to middle state and Kerala from middle to poor state. After the opening up of the economy in the decade of nineties the tertiary or service sector received a big impetus for growth. It was Karnataka that has benefitted most

from the IT growth. In less than a decade it has improved its position from poor to middle to rich club all because of its IT hub in Bangalore. The other state that had improved its position was Tamilnadu from middle to rich club and Kerala from poor to middle club. States that have fallen back in the decade of liberalization are West Bengal and Uttar-Pradesh from middle to poor state. In the last decade it was Haryana that has improved its position from middle to rich state and West Bengal from poor to middle state. Two states that have failed to keep its position are Punjab and Rajasthan that has moved down to poor club in the service sector.

Table 4: Clubs for Productivity in the Secondary Sector

Year	AP	ASS	BIH	GJT	HYN	KNK	KRL	MP	MHR	ORS	PJB	RJT	TN	UP	WB
1961	1	2	1	3	3	2	1	1	3	3	2	3	3	1	3
1962	1	2	1	3	3	2	1		3	3	2	3	3	1	3
1963	1	2	1	3	3	2	1	1	3	3	2	3	3	1	3
1964	1	3	1	3	3	2	1	1	3	3	2	3	3	1	3
1965	1	3	1	3	3	2	1	1	3	3	2	3	3	1	3
1966	1	3	1	3	3	2	1	1	3	3	2	3	3	1	3
1967	1	3	1	3	3	2	1	1	3	3	2	3	3	1	3
1968	1	3	1	3	3	2	1	2	3	3	2	3	3	1	3
1969	1	3	1	3	3	2	1	2	3	3	2	3	3	1	3
1970	1	3	1	3	3	2	1	2	3	3	3	3	3	1	3
1971	1	3	1	3	3	2	2	2	3	3	3	3	3	1	2
1972	1	3	1	3	3	2	2	2	3	3	3	3	3	1	2
1973	1	3	1	3	3	2	2	2	3	3	3	3	3	1	2
1974	1	3	1	3	3	2	2	2	3	2	3	3	3	1	2
1975	1	3	1	3	3	2	2	2	3	2	3	3	3	1	2
1976	1	3	1	3	3	2	2	2	3	2	3	2	3	2	2
1977	1	3	1	3	3	2	2	2	3	2	3	2	3	2	2
1978	1	3	1	3	3	2	2	2	3	2	3	2	3	2	2
1979	1	3	1	3	3	2	2	2	3	2	3	2	3	2	1
1980	1	3	1	3	3	2	2	2	3	2	3	2	3	2	1
1981	1	3	1	3	3	2	2	2	3	2	3	2	3	2	1
1982	1	3	1	3	3	2	2	1	3	2	3	2	3	2	1
1983	1	3	1	3	3	2	2	1	3	2	3	2	3	2	1
1984	1	3	1	3	3	2	2	1	3	2	3	2	3	2	1
1985	1	3	1	3	3	2	2	1	3	1	3	2	3	2	1
1986	1	3	1	3	3	2	2	1	3	1	3	2	3	2	1
1987	1	3	1	3	3	2	2	1	3	1	3	2	3	2	1
1988	1	3	1	3	3	2	2	1	3	1	3	2	3	2	1
1989	2	3	1	3	3	2	2	1	3	1	3	2	3	2	1
1990	2	3	1	3	3	2	2	2	3	1	3	2	3	2	1
1991	2	3	1	3	3	2	2	2	3	1	3	2	3	2	1
1992	2	3	1	3	3	2	2	2	3	1	3	2	3	2	1
1993	2	3	1	3	3	2	1	2	3	1	3	2	2	2	1
1994	2	3	1	3	3	2	1	2	3	1	3	2	2	1	1
1995	2	3	1	3	3	2	1	2	3	1	3	2	2	1	1
1996	2	3	1	3	3	2	1	2	3	1	3	2	2	1	1
1997	2	3	1	3	3	2	1	2	3	1	3	2	2	1	1
1998	2	3	1	3	3	3	2	2	3	1	3	2	2	1	1
1999	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1
2000	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1
2001	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1
2002	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1

2003	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1
2004	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1
2005	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1
2006	2	2	1	3	3	3	2	2	3	1	3	2	2	1	1
2007	2	1	1	3	3	3	1	2	3	1	3	2	2	1	1
2008	2	1	1	3	3	3	1	2	3	1	3	2	2	1	1
2009	2	1	1	3	3	3	1	2	3	1	3	2	2	1	1

The distribution of the states is however, not so stable when we run the regression tree with the productivity in the secondary sector and there has been instances of movement of states from one club to another. While Gujarat and Maharashtra still remained in the rich club, consistently from the decade of sixties, Tamilandu lost its position from rich to middle club in the decade of nineties. Another state that has consistently remained in the rich club was Haryana. States that have improved their position are Punjab and Karnataka from middle club. Punjab improved its position as early as the decade of seventies and Karnataka only after the liberalization of the economy. The case of Assam turned out to be interesting; it was in the middle club from 1961 to 1963, from 1964 to 1998 Assam was in the rich club. Its position fell from rich club to middle in 1999 and it further tumbled down in the poor club from 2007 onward. Given the instable political climate and its association in the poor group for long it is difficult to give a plausible explanation for high productivity in the secondary sector. The position of Kerala, Madhya-Pradesh and Uttar-Pradesh was quite volatile. From poor club Kerala improved its position to the middle club in the decade of late sixties and remained there till 1993; from 1993 to 1997 it fell back to poor club , recovered its position to the middle club which was however not lasting and it fell back to the poor club again in 2007. Uttar-Pradesh was in the poor club in the earlier decade of sixties and seventies; it recovered its position from poor to the middle club in mid seventies and slipped down to the poor club again from 1994 onward. Madhya-Pradesh was in the poor club in the early decade of sixties; it then improved its position and moved to the middle club in late sixties, it fell back to the poor club in 1982, recovered and stayed in middle club from 1990 onward. West Bengal was in the rich club in up to the decades of sixties; it slipped down to the middle club in the decade of early seventies and by late seventies in fell back in the poor club and never recovered from there.

Table 5: Clubs with Productivity from the primary sector

Year	AP	ASS	BIH	GJT	HYN	KNK	KRL	MP	MHR	ORS	PJB	RJT	TN	UP	WB
1961	2	1	1	3	3	2	3	1	1	2	3	1	2	1	2
1962	2	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1963	2	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1964	2	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1965	2	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1966	2	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1967	1	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1968	1	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1969	2	2	1	3	3	2	3	1	1	2	3	1	2	1	2
1970	2	2	1	3	3	2	3	1	1	2	3	2	2	1	2
1971	2	2	1	3	3	2	3	1	1	2	3	2	2	1	2
1972	2	2	1	3	3	2	3	1	1	2	3	2	2	1	2
1973	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1974	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1975	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1976	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1977	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2

1978	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1979	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1980	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1981	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1982	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1983	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1984	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1985	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1986	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1987	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1988	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1989	2	2	1	3	3	2	3	1	2	2	3	2	2	1	2
1990	2	2	1	3	3	2	3	1	2	1	3	2	2	1	2
1991	2	2	1	3	3	2	3	1	2	1	3	2	2	1	2
1992	2	2	1	3	3	2	3	1	2	1	3	2	2	1	2
1993	2	2	1	3	3	2	3	1	2	1	3	2	2	1	2
1994	2	2	1	3	3	2	3	1	2	1	3	2	2	1	2
1995	2	2	1	3	3	2	3	1	2	1	3	2	2	1	3
1996	2	2	1	3	3	2	3	1	2	1	3	2	2	1	3
1997	2	2	1	3	3	2	3	1	2	1	3	2	2	1	3
1998	2	2	1	3	3	2	3	1	2	1	3	2	2	1	3
1999	2	2	1	3	3	2	3	1	2	1	3	2	2	1	3
2000	2	1	1	3	3	2	3	1	2	1	3	2	2	1	3
2001	2	1	1	3	3	2	3	1	2	1	3	2	2	1	3
2002	2	1	1	3	3	2	3	1	2	1	3	2	2	1	3
2003	2	1	1	3	3	2	2	1	2	1	3	2	2	1	3
2004	2	1	1	3	3	2	2	1	2	1	3	2	2	1	3
2005	2	1	1	3	3	2	2	1	2	1	3	2	2	1	3
2006	2	1	1	3	3	2	2	1	2	1	3	2	2	1	3
2007	3	1	1	3	3	2	2	1	2	1	3	2	2	1	3
2008	3	1	1	3	3	2	2	1	2	2	3	2	2	1	3
2009	3	1	1	3	3	2	2	1	2	2	3	2	2	1	3

Consider now the NSDP from the primary sector, historically Punjab and Haryana were agriculturally rich state and they have always remained in the rich club for four decade. Gujarat undertook various institutional reforms to improve the agricultural produce right from historical times and it also remained in the rich club all along. States that have remained consistently in the poor club are again Bihar and Uttar-Pradesh and Karnataka and Rajasthan are the state that has remained in the middle club for four decades; for the rest of the states there have been movements across the groups. Consider, West-Bengal which has successfully initiated land-reform in the decade of seventies. However, in spite of the reform state has persistently remained in the poor club for three decades. It is only in the late eighties; West Bengal improved its position and moved to middle club. States that have lost their position are Kerela and Tamilnadu, Kerala moved from being a member of the rich club to middle club and in the end poor club. We get similar pattern for Tamilnadu and Assam .

We get a clearer pattern by running the regression tree with the productivity of the primary sector. Haryana, Gujarat and Punjab still retained their position in the rich club, Bihar and Uttar-Pradesh in the poor club and Tamilnadu and Karnataka in the middle club. States that have improved their position are West Bengal from middle to rich club only after the mid nineties and Andhra-Pradesh from middle to rich club only in the recent years. States that have failed to maintain their position are Orissa. Orissa was in the middle club till mid-eighties, it then dropped in the poor club and recovered its position only the last two years 2008 and 2009. Assam was in the middle state for almost four decades and only lost its position in the recent decade of early twenties.

The sectorial convergence analysis also indicate the contribution of the three principle sectors to associate a state at the aggregate level with a particular income group. For a better in-depth analysis let us consider the states namely Gujarat, Haryana, Kerala and Punjab that are consistently associated with rich club always. States that have transited to rich club are Maharashtra which have moved from middle income group to rich group in 1966 and Tamilnadu in 1971. Consider now the associations of the states with the three principle sectors of the economy.

If we consider Gujarat, the analysis indicate that till 1969, service sector from Gujarat was associated with rich club. From 1970 onwards, it slipped to middle income group and from 1977 it again regained its position in rich club. The services sector contributed to the total productivity to about 28 % in the decades of 60-70. It increased to 33 to 40 percent from 1980 to 2000 and in recent year the contribution of the service sector to the total productivity is about 45 percent. As far as the secondary sector is concerned Gujarat is always associated with rich group. The contribution of the secondary sector to the total productivity of Gujarat steadily increased from 20 percent in 1960 to 26 percent in 1980 to 35 percent in recent years. As far as primary sector is concerned Gujarat is also associated with rich group. The contribution of primary sector was 53 percent in late 1960, it declined to 40 percent in 1980, 30 percent in 1990 and as low as 20 percent in recent decade. The Gujarat growth story follows the classical development paradigm whereby the primary sector provides the necessary surplus which propelled the growth of the secondary sector and service sector.

Consider now Haryana The association of Haryana as far as service sector is concerned was in low productivity group till 1980. It moved to middle income group from 1980 onwards and only from 2000 it was in rich club. The service sector contributed to about 23 percent to the aggregate productivity of the state in late 1960, it increased to 30 percent in 1970, 34 percent in 1990 and in recent year there was a jump to 50 percent. Haryana is also associated with rich club as far as secondary sector is concerned, however the contribution of the secondary sector to the total productivity of the state has increased marginally from 20 percent in 1960 to 24 percent in 2000. Even for primary sector Haryana was associated with rich club and it was a major contributor to the total productivity of the states. If we look at the figures we find that primary sector contributed to about 56 to 57 percent of the total productivity of the state in the decade of 60s and 70s. The contribution reduced to 47 percent in the decade 80s and 40 in 90s and in the recent time primary sector is contributing to the total productivity of the state by 30 percent. The primary sector therefore played a pivotal role to push the productivity growth of the state and provided the necessary surplus for the growth of the service sector. Even though the state was associated with rich club for secondary sector, the contribution is not substantial indicating that the growth trajectory of the state follows the usual model for India.

Consider now the neighboring state of Haryana, Punjab. For tertiary sector Punjab was associated with middle club in 1964, it moved to rich club and remained there till 1995. From 1995 to 2000 it dropped to middle club and from 2001 its position further deteriorated to poor club. The tertiary sector contributed to about 40 percent to the total productivity of the state. If we however, consider the primary

and secondary sector we notice that Punjab was associated with rich club for both the sectors. The contribution of the primary sector to the total productivity of the state is also substantial and even in recent years it is 36 percent. This is substantial compared to the all India average. In other words, Punjab growth story confer that its growth is majorly driven by a single sector which is the primary sector and the secondary sector also complimented the process.

The story of Kerala which is also in the high income group is different. Till 1982 the service sector of Kerala was associated with middle club, it dropped to poor club from 1983 to 1993 and again recovered its position to middle club. Productivity from service sector was never associated with rich club in the time span of our analysis. Services however contributed substantially for the total productivity of the state. It was 33 percent in the decades of 60s, increased steadily to 65 % in 2000. The contribution of the service sector to the total productivity of the state is one of the highest among all the states in India. If we consider the secondary sector it was associated with poor club in the decade of 70s moved up and was associated with middle income group again dropped to poor group for a short time period from 1994 to 1997 and regained its position in the middle club till 2006 and again dropped to poor club. In other words there was lot of movement of the state as far as the productivity of secondary sector is concerned. Moreover, between 1983 and 1993 even tertiary sector was associated with poor club. A natural question that arises in this context is what enabled the state to retain its position in the rich club? Between 1983 to 1993 the secondary sector of Kerala was associated with middle club and primary sector was associated with rich club. The primary and the secondary together contributed to about 55 percent of the total productivity of the state of which 36 percent was from primary sector and 11 percent from secondary sector. Hence It is the momentum of the productivity from the primary sector that enabled the state to retain its position in the rich club. On an average The contribution of the primary sector to the total productivity of the state was 54 percent in early decades of 60s. While it declined to 16 percent in recent years, but has remained as a major driver for the productivity growth for the rest of the years. The growth story of the Kerala indicates the importance of the primary sector to pull the state in rich group consistently.

States that have transited to rich group are Maharashtra, Tamilnadu and Karnataka. The movement of Maharashtra to rich club took place as early as 1965. Service sector turned out to be a major contributor of the productivity of the state. The productivity of the state from the service sector is also associated with rich club consistently. We also find similar trend for secondary sector. The contribution of the secondary sector is also on the higher side with about 27 percent in the recent year. With regard to primary sector we find that initially the state was associated with poor state till 1972 but moved to middle club and stayed there consistently. Thus for the two neighboring state located in the western part of India we find a more or less a balanced growth story with all the three sectors contributing to the productivity of the states.

If we now consider the case of Tamilnadu we find that from middle income group it moved to the rich group of states from 1970 onwards. A disaggregated figures for the three principle sectors of

the state indicate that till 1991, the tertiary sector or the service sector of the state was associated with middle club and then it moved to the rich club. The service sector contributed to about 30 to 35 percent of the total productivity of the state till 1980. In the decade of nineties and in the last decade its contribution increased to 44 percent to 60 percent to the total productivity of the state. As far as the secondary sector is concerned the state was associated with rich group till 1992 contributing to about 32 percent of the total productivity of the state. From 1993 onward it moved down to the middle income group with a reduced contribution to about 27 percent of the total productivity of the state. For primary sector Tamilnadu was always associated with middle income group with a contribution of about 40 percent to 35 percent till 1970s. Gradually the contribution from primary sector reduced till in recent decade it is as low as 15 percent. From the above figures we can conjecture that the growth story of Tamilnadu more or less follow the classical development paradigm, whereby it was predominantly agriculture in the early decades of 1960 and 1970s. It was then taken up by the secondary sector that propelled its growth and finally it is the service sector that is now contributing majorly to the productivity of the state.

Another state that has very recently moved in the rich club is Karnataka. Karnataka was associated with middle income group till 1995, and then it has improved its position to rich club. If we notice the sectorial association of the state with different clubs, we notice that for secondary sector Karnataka was associated with middle group till 1999 and then it improved its position and was associated with states that are in rich group. For primary sector the state was always associated with middle group. Contrary to the popular perception, for tertiary sector Karnataka was associated with poor club till 1989, it then improved its position to middle group in 1990 and further in the rich group from 1996 onwards. The primary sector also contributed significantly to the productivity of the state it was around 57 percent in the decades of sixties, 52 percent in the decades of seventies, 44 percent in eighties, 35 percent in nineties and 21 percent in the last decade. The secondary sector also contributes to about 25 percent of the total productivity of the state for the last two decades. The tertiary sector which now contributes about 54 percent of the total productivity of the state was contributing to only 27-28 percent in sixties and seventies. In eighties its contribution was 33 percent and in nineties 44 percent. This is much lower compared to Maharashtra where service sector has always contributed significantly to the productivity of the state. In Karnataka the role of the service sector as a major contributor to the productivity of the state was due to the Information Technology spark that took place at around mid-eighties and this is also evident from our analysis.

The growth story of the rich states indicates that except for Gujarat none of the three subsectors of the rich states were associated with rich club. In most cases the association of the state to rich club was either by one or two subsectors of the economy. Thus for Punjab and Kerala it was primarily primary sector, for Tamilnadu, Maharashtra and Karnataka it is service and secondary sector. Moreover, in a span of 40 years there has been switch in the roles of the subsector of the economy contributing to the productivity of the states. Thus in the decades of the sixties and seventies the primary sector played a

pivotal role to provide the necessary surplus for further productivity growth of almost all the state. Further the primary sector was never associated with poor club for the rich states.

Let us consider the states associated with middle income group. According to productivity analysis states that are associated with middle income group are Rajasthan, West Bengal and Andhra Pradesh. West Bengal was initially associated with rich club and then it lost its position and moved in the middle group from 1972 onwards. Andhra Pradesh was initially associated with poor group of states and moved to middle income group from 1973 onwards.

Consider first the case of Rajasthan, as far as the tertiary sector is concerned the association of the state is very chaotic. It was in rich club till 1970, slipped to middle from 1970 to 1974, further to poor group from 1974 to 1985, regained its position and moved to middle group but could not retain and dropped to poor group again in 2008. As far as secondary sector is concerned Rajasthan was associated with rich group from 1961 to 1994 and then it dropped its position to middle group and continued to remain in the same position. As far as the primary sector is concerned it was associated with poor group till 1969 and then it moved to middle income group. The primary sector contributed to about 50 to 45 percent to the total productivity of the state in the decade of seventies and eighties. In recent decade of nineties its contribution reduced to 38 percent and 28 percent in the decade of twenties. Thus primary sector still contributes significantly to the productivity of the state. The secondary sector contributes to about 21 to 26 percent to the total productivity of the state and the rest is contributed by the tertiary sector. Thus in spite of volatile performance in tertiary sector Rajasthan could retain its position in middle income group mainly because of its primary sector which was associated with middle group and secondary sector which was either associated with rich or with middle group.

Consider now the other two states, West Bengal and Andhra Pradesh. Andhra Pradesh moved from poor group of states to middle group from 1972 onward. If we look at the sectorial association of the state, we find that till 1982 the tertiary sector of the state was associated with poor group and it then moved in the middle group and stayed in that position. The secondary sector was also associated with poor group till 1988 and it then moved to middle group. As far as primary sector is concerned, Andhra Pradesh was primarily associated with middle group and moved to rich group recently in 2007. The question that arises in this context is what pulled the state from poor to middle income group from 1972 to 1982 when two of its subsectors was associated with poor group. If we look at the figures we find that till primary sector contributed to about 55 percent of the total productivity of the state, secondary 13 percent and rest 32 percent by tertiary. We can therefore conjecture that it is the primary sector that has majorly contributed to the productivity of the state and have pulled it out from the poor to the middle group.

Let us now consider West Bengal. West Bengal was associated with rich club until 1972, after which it lost its position and moved in middle income group of states. If we look at the sectoral contribution to the productivity of the state, we find that with tertiary sector West Bengal was associated with middle group till 1962, moved to rich group from 1965 to 1980, lost its position and was again in the middle

group from 1981 to 1987, lost its position further and was in the poor group from 1990 to 2005, recovered its position further in the middle group from 2006 to 2009. The picture is even grim when we consider secondary sector. The fall in West Bengal as the industrial hub of India is evident from the above table, till 1967 secondary sector of West Bengal was associated with rich group, it lost its position and was in middle group until 1977. Further decline in the secondary sector is noticed from 1978 onward with no sign of recovery. If we now, consider the primary sector we find that till 1994 the primary sector of West Bengal was associated with middle group. It improved its position in 1995 and moved in the rich group and continued to remain in that position. The contributions of the different sectors to the total productivity of the state indicate that primary sector was not the predominant sector to the total productivity of the state contributing to 36 percent to the total productivity of the state in the early decades of sixties and seventies. The service sector was also a major contributor to the total productivity of the state contribution which was around 36 percent in the decade of sixties and 38 percent in the decade of seventies. Its contribution increased though not significantly to 41 percent in decade of eighties and 44 percent in the decade of 1990. The share of the primary increased by 37 percent in the decade of eighties and reduced to 34 percent in 1980. Thus even though primary sector was not a significant contributor to the productivity of the state in the decade of sixties its share in the productivity of the state has remained the same even in the decades of nineties. Thus from 1990 to 2005 when the relative position of the tertiary sector was also in poor group and so was the position of the secondary sector, it was the primary sector that resisted the fall of the state from the middle to the poor group.

The growth story of the Indian states indicates certain interesting features. First, to be in the rich group, states must consistently lie in rich group for either of the two out of the three principle sectors. It has hardly been the case that the rich states have consistently outperforming in all the three sectors. Secondly, if it is associated with rich group in either of the three sectors, then for the other two it must lie in the middle group at least for a significant period of time. The study all also indicate that primary sector has played a pivotal role to drive the growth of the states. Thus in many instances it is the contribution from the primary sector that has pulled the state in the rich club or has enabled the state to remain the middle club in the decades of sixties, seventies and eighties. Only from mid-nineties tertiary sector has played a significant role to contribute to the productivity of the state. Lastly, the secondary sector also played an important role for many states like Haryana, Punjab, Maharashtra, Gujarat, and Tamilnadu and Karnataka.

If we now, consider the growth trajectories of states that are in poor club our conjecture about sectorial contribution to the productivity of the states is even more reinforced. Let us first consider the three states that are consistently associated with poor group, Bihar, Uttar Pradesh and Madhya Pradesh. Consider Bihar, all three sectors of Bihar are connected with poor club and that too for all the years invariably putting the state in poor club. Moreover, it is predominantly agriculture in nature with agriculture contributing to about 50 percent to the total productivity of the state. The share of the secondary sector is insignificant and only 10 percent. The rest all is contributed by the tertiary sector.

Consider now its neighboring state Uttar Pradesh (UP). As far as service sector is concerned, UP was underperforming and was in poor club till 1969, it improved its position and was in middle and rich group from 1970 to 1985. It again lost its position and was in middle club till 1989. From 1990 onwards it was again in poor club. The tertiary sector contributed to about 35 percent to the total productivity of the state when it was performing relatively good. What about secondary sector? UP was associated with poor group with secondary till 1974, it then improved its position and could stay in the middle income group from 1975 to 1992. It again lost its position and was in poor club from 1993 to 2009. However, even in its heyday the contribution of secondary sector to the total productivity of the state was only 18 percent. If we now, consider the productivity from the primary sector we find that UP was always associated with poor group of state and agriculture contributed to about 57 to 35 percent of the total productivity of the state. Thus, from 1975 to 1990 when both tertiary and secondary sector was in the middle or rich income group, the poor performance in primary sector has actually pulled down the state in poor club. Another state that was consistently in the low productivity group and located in the central India is Madhya Pradesh. If we consider the tertiary sector Madhya Pradesh was associated with middle group till 1965 and it slipped down in the poor group and continued to remain there till 2009. Madhya Pradesh host a number of large scale industrial town mainly related to mines and minerals like Bhilia and Bhopal and consequently the secondary sector was associated with middle income 1968 to 1981 and from 1990 to 2009, for the rest of the year the secondary sector of Madhya Pradesh was associated with poor group of states. The contribution of secondary sector has also increased from 17 percent to 24 percent from the decades of sixties to the last decade. As far as the primary sector is concerned MP was always associated with poor group, however, its contribution to the total productivity to the state was significant. In the early decades of sixties, primary sector contributed to about 62 percent of the total productivity of the state and in recent decades though its contribution has reduced to 42 percent in nineties and 32 percent in the last decade but it is still on the higher side. Hence it is again ascertained that the low productivity in the primary and tertiary sector has pulled down the state in the poor group.

Two more states which were initially with middle income group and then lost its position in poor group are Orissa and Assam. Consider first Orissa; the state was associated with middle group till 1984. If we look at productivity from tertiary sector, till 1969 it was associated with rich group. Its contribution to the total productivity of the state was very modest and only 25 percent, from 1970 to 1974 it was in middle group and then it lost its position further and was in poor group throughout. The contribution of tertiary sector has increased from 25 percent to 50 percent in recent decade, though its relative position has never improved. Consider now the secondary sector, till 1973 the secondary sector was associated with rich club, it then lost its position and was in middle club until 1983. Further decline is noticed from 1983 onwards and secondary sector was associated with poor group. The contribution of secondary sector to total productivity of the state is as low as 17 to 15 percent. Lastly consider the primary sector, till 1988 it was associated with middle group lost its position and was with poor group till 2007. In the

last two years it again regained its position in middle income group. Once again Orissa could maintain its position in the middle income group from 1974 to 1984 even though the tertiary sector was associated with poor group was because of primary sector. In fact, till 1985 in Orissa the primary sector contributed to about 55 percent of the total productivity of the states. Its contribution reduced in the subsequent year and Orissa lost its position in poor club. Once again it reinforces our understanding about the importance of primary sector for the growth trajectory of the state. Lastly let us consider Assam. Assam lost its position from middle to poor income group in 1993. As far as the sectorial association of the state is concerned, Assam was always associated with poor group with regard to tertiary sector. The contribution of the tertiary sector was as low as 26 percent in the decade of sixties, increased to 30 percent in the next decade and in the decade of nineties it is as high as 40 percent and 50 percent in the recent decade. As far as secondary sector is concerned Assam was majorly associated with rich group from 1964 to 1998. It lost in position and was in poor group only in the recent years of 2007 to 2009. In spite of its position, the contribution from secondary sector to the total productivity of the state is only 14 percent and in recent decade it has even reduced further to 11 percent. As far as the primary sector is concerned Assam was in middle income group till 1999 and the contribution from primary sector was 47 percent. Thus Assam could retain its position in the middle income group till 1993 was because of the contribution from the primary sector. However, as there has been a transformation in the economy and the role of the primary sector reduced with a corresponding rise in tertiary sector Assam lost its position from the Middle to the poor income group.

Club with Sectoral NSDP and NSDP at aggregate level

The sectorial convergence analysis also indicates the contribution of the three principle sectors to associate a state at the aggregate level with a particular income group. With three different sectors primary, secondary and tertiary and three different ranking namely rich, middle and poor we can have 27 different combinations with which a state can be associated . If all the three sectors are in the rich club or in poor club indeed a state will be in the rich or poor group in an aggregate sense. However, interesting situations arises in the intermediary cases. For a better in-depth analysis let us consider the Gujarat, Haryana, Kerala and Punjab that are consistently associated with rich club. States that have transited to rich club are Maharashtra which have moved from middle income group to rich group in 1966 and Tamilnadu in 1971. Consider now the associations of the states with the three principle sectors of the economy.

If we consider Gujarat, the analysis indicates that till 1969, tertiary sector from Gujarat was associated with rich club. From 1970 onwards, it slipped to middle income group and from 1977 it again regained its position in rich club. The tertiary's sector contributed to the total productivity to about 28 percent in the decades of 60-70. It increased to 33 to 40 percent from 1980 to 2000 and in recent year the contribution of the tertiary sector to the total productivity is about 45 percent. As far as the secondary sector is concerned Gujarat is always associated with rich group. The contribution of the secondary

sector to the total productivity of Gujarat steadily increased from 20 percent in 1960 to 26 percent in 1980 to 35 percent in recent years. As far as primary sector is concerned Gujarat is also associated with rich group. The contribution of primary sector was 53 percent in late 1960, it declined to 40 percent in 1980, 30 percent in 1990 and as low as 20 percent in recent decade. The Gujarat growth story follows the classical development paradigm whereby the primary sector provides the necessary surplus which propelled the growth of the secondary sector and tertiary sector. We also find the balanced growth story for Gujarat with all round development for all the three principle sectors.

Consider now Haryana The association of Haryana as far as tertiary sector is concerned was in low productivity group till 1980. It moved to middle income group from 1980 onwards and only from 2000 it was in rich club. The tertiary sector contributed to about 23 percent to the aggregate productivity of the state in late 1960, it increased to 30 percent in 1970, 34 percent in 1990 and in recent years it is 50 percent. Haryana is also associated with rich club as far as secondary sector is concerned, however the contribution of the secondary sector to the total productivity of the state has increased marginally from 20 percent in 1960 to 24 percent in 2000. Even for primary sector Haryana was associated with rich club and it was a major contributor to the total productivity of the states. If we look at the figures we find that primary sector contributed to about 56 to 57 percent of the total productivity of the state in the decade of 60s and 70s. The contribution reduced to 47 percent in the decade 80s and 40 in 90s and in the recent time primary sector is contributing to the total productivity of the state by 30 percent. The primary sector therefore played a pivotal role to push the productivity growth of the state and provided the necessary surplus for the growth of the tertiary sector. Even though the state was associated with rich club for secondary sector, the contribution is not substantial. However, primary along with the secondary sector pulled the state in rich club contributing more than 60 percent of the total productivity of the state even when the tertiary sector of the state was associated with poor group until 1980.

Consider now the neighboring state Punjab. For tertiary sector Punjab was associated with middle club in 1964, it moved to rich club and remained there till 1995. From 1995 to 2000 it dropped to middle club and from 2001 its position further deteriorated to poor club. The tertiary sector contributed to about 40 percent to the total productivity of the state. If we however, consider the primary and secondary sector we notice that Punjab was associated with rich club for both the sectors. The contribution of the primary sector to the total productivity of the state is also substantial and even in recent years it is as high as 36 percent. This is substantial compared to the all India average. In other words, Punjab growth story confer that its growth is majorly driven by a single sector which is the primary sector with the secondary sector complimenting the process.

The story of Kerala which is also in the high income group is different. Till 1982 the tertiary sector of Kerala was associated with middle club, it dropped to poor club from 1983 to 1993 and again recovered its position to middle club. Productivity from tertiary sector was never associated with rich club in the time span of our analysis. Tertiary sector however contributed substantially for the total productivity of the state. It was 33 percent in the decades of 60, s, increased steadily to 65 % in 2000. The contribution

of the tertiary sector to the total productivity of the state is one of the highest among all the states in India. If we consider the secondary sector it was associated with poor club in the decade of 70s moved up and was associated with middle income group again dropped to poor group for a short time period from 1994 to 1997 and regained its position in the middle club till 2006 and again dropped to poor club. In other words, there was lot of movement of the state as far as the productivity of secondary sector is concerned. Moreover, between 1983 and 1993 even tertiary sector was associated with poor club. A natural question that arises in this context is what enabled the state to retain its position in the rich club? Between 1983 to 1993 the secondary sector of Kerala was associated with middle club and primary sector was associated with rich club. The primary and the secondary together contributed to about 55 percent of the total productivity of the state of which 36 percent was from primary sector and 11 percent from secondary sector. Hence It is the momentum of the productivity from the primary sector that enabled the state to retain its position in the rich club. On an average, the contribution of the primary sector to the total productivity of the state was 54 percent in early decades of 60s. While it declined to 16 percent in recent years, but has remained as a major driver for the productivity growth for the rest of the years. The growth story of the Kerala indicates the importance of the primary sector to pull the state in rich group consistently.

States that have transited to rich group are Maharashtra, Tamilnadu and Karnataka. The movement of Maharashtra to rich club took place as early as 1965. Tertiary sector turned out to be a major contributor of the productivity of the state. The productivity of the state from the tertiary sector is also associated with rich club consistently. We also find similar trend for secondary sector. The contribution of the secondary sector is also on the higher side with about 27 percent in the recent year. With regard to primary sector we find that initially the state was associated with poor state till 1972 but moved to middle club and stayed there consistently. Thus for the two neighboring state located in the western part of India we find a more or less a balanced growth story with all the three sectors contributing to the productivity of the states.

If we now, consider the case of Tamilnadu we find that from middle income group it moved to the rich group of states from 1970 onwards. A disaggregated figures for the three principle sectors of the state indicate that till 1991, the tertiary sector of the state was associated with middle club and then it moved to the rich club. The tertiary sector contributed to about 30 to 35 percent of the total productivity of the state till 1980. In the decade of nineties and in the last decade its contribution increased to 44 percent to 60 percent to the total productivity of the state. As far as the secondary sector is concerned the state was associated with rich group till 1992 contributing to about 32 percent of the total productivity of the state. From 1993 onward it moved down to the middle income group with a reduced contribution to about 27 percent of the total productivity of the state. For primary sector Tamilnadu was always associated with middle income group with a contribution of about 40 percent to 35 percent till 1970s. Gradually the contribution from primary sector reduced till in recent decade it is as low as 15 percent. From the above figures we can conjecture that the growth story of Tamilnadu

more or less follow the classical development paradigm, whereby it was predominantly agriculture in the early decades of 1960 and 1970s. It was then taken up by the secondary sector that propelled its growth and finally it is the tertiary sector that is now contributing majorly to the productivity of the state.

Another state that has very recently moved in the rich club is Karnataka. Karnataka was associated with middle income group till 1995, and then it has improved its position to rich club. If we notice the sectorial association of the state with different clubs, we notice that for secondary sector Karnataka was associated with middle group till 1999 and then it improved its position and was associated with states that are in rich group. For primary sector the state was always associated with middle group. Contrary to the popular perception, for tertiary sector Karnataka was associated with poor club till 1989, it then improved its position to middle group in 1990 and further in the rich group from 1996 onwards. The primary sector also contributed significantly to the productivity of the state it was around 57 percent in the decades of sixties, 52 percent in the decades of seventies, 44 percent in eighties, 35 percent in nineties and 21 percent in the last decade. The secondary sector also contributes to about 25 percent of the total productivity of the state for the last two decades. The tertiary sector which now contributes about 54 percent of the total productivity of the state was contributing to only 27-28 percent in sixties and seventies. In eighties its contribution was 33 percent and in nineties 44 percent. This is much lower compared to Maharashtra where tertiary sector has always contributed significantly to the productivity of the state. In Karnataka the role of the tertiary sector as a major contributor to the productivity of the state was due to the Information Technology spark that took place at around mid-eighties and this is also evident from our analysis.

The growth story of the rich states indicates that except for Gujarat none of the three principle sectors of the rich states were associated with rich club. In most cases the association of the state to rich club was either by one or two subsectors of the economy. Thus for Punjab and Kerala it was primarily primary sector, for Tamilnadu, Maharashtra and Karnataka it is tertiary and secondary sector. Moreover, in a span of 40 years there has been switch in the roles of the subsector of the economy contributing to the productivity of the states. Thus in the decades of the sixties and seventies the primary sector played a pivotal role to provide the necessary surplus for further productivity growth of almost all the state. Further the primary sector was never associated with poor club for the rich states.

Let us consider the states associated with middle income group. According to productivity analysis states that are associated with middle income group are Rajasthan, West Bengal and Andhra Pradesh. West Bengal was initially associated with rich club and then it lost its position and moved in the middle group from 1972 onwards. Andhra Pradesh was initially associated with poor group of states and moved to middle income group from 1973 onwards.

Consider first the case of Rajasthan, as far as the tertiary sector is concerned the association of the state is very chaotic. It was in rich club till 1970, slipped to middle from 1970 to 1974, further to poor group from 1974 to 1985, regained its position and moved to middle group but could not retain

and dropped to poor group again in 2008. As far as secondary sector is concerned Rajasthan was associated with rich group from 1961 to 1994 and then it dropped its position to middle group and continued to remain in the same position. As far as the primary sector is concerned it was associated with poor group till 1969 and then it moved to middle income group. The primary sector contributed to about 50 to 45 percent to the total productivity of the state in the decade of seventies and eighties. In recent decade of nineties its contribution reduced to 38 percent and 28 percent in the decade of twenties. Thus primary sector still contributes significantly to the productivity of the state. The secondary sector contributes to about 21 to 26 percent to the total productivity of the state and the rest is contributed by the tertiary sector. Thus in spite of volatile performance in tertiary sector Rajasthan could retain its position in middle income group mainly because of its primary sector which was associated with middle group and secondary sector which was either associated with rich or with middle group.

Consider now the other two states, West Bengal and Andhra Pradesh. Andhra Pradesh moved from poor group of states to middle group from 1972 onward. If we look at the sectorial association of the state, we find that till 1982 the tertiary sector of the state was associated with poor group and it then moved in the middle group and stayed in that position. The secondary sector was also associated with poor group till 1988 and it then moved to middle group. As far as primary sector is concerned, Andhra Pradesh was primarily associated with middle group and moved to rich group recently in 2007. The question that arises in this context is what pulled the state from poor to middle income group from 1972 to 1982 when two of its subsectors was associated with poor group. If we look at the figures we find that till primary sector contributed to about 55 percent of the total productivity of the state, secondary 13 percent and rest 32 percent by tertiary. We can therefore conjecture that it is the primary sector that has majorly contributed to the productivity of the state and have pulled it out from the poor to the middle group.

Let us now consider West Bengal. West Bengal was associated with rich club until 1972, after which it lost its position and moved in middle income group of states. If we look at the sectoral contribution to the productivity of the state, we find that with tertiary sector West Bengal was associated with middle group till 1962, moved to rich group from 1965 to 1980, lost its position and was again in the middle group from 1981 to 1987, lost its position further and was in the poor group from 1990 to 2005, recovered its position further in the middle group from 2006 to 2009. The picture is even grim when we consider secondary sector. The fall in West Bengal as the industrial hub of India is evident from the above table, till 1967 secondary sector of West Bengal was associated with rich group, it lost its position and was in middle group until 1977. Further decline in the secondary sector is noticed from 1978 onward with no sign of recovery. If we now, consider the primary sector we find that till 1994 the primary sector of West Bengal was associated with middle group. It improved its position in 1995 and moved in the rich group and continued to remain in that position. The contributions of the different sectors to the total productivity of the state indicate that primary sector one of the predominant sector contributing to 36 percent to the total productivity of the state in the early decades of sixties and seventies. The tertiary

sector was also a major contributor to the total productivity of the state contribution which was around 36 percent in the decade of sixties and 38 percent in the decade of seventies. Its contribution increased though not significantly to 41 percent in decade of eighties and 44 percent in the decade of 1990. The share of the primary increased by 37 percent in the decade of eighties and reduced to 34 percent in 1980. Thus the contribution of the primary sector and its share in the productivity of the state has remained the same even in the decades of nineties. Thus from 1990 to 2005 when the relative position of the tertiary sector was also in poor group and so was the position of the secondary sector, it was the primary sector that was in the rich club that resisted the fall of the state from the middle to the poor group.

The growth story of the Indian states indicates certain interesting features. First, to be in the rich group, states must consistently lie in rich group for either of the two out of the three principle sectors. It has hardly been the case that the rich states have consistently outperforming in all the three sectors. Secondly, if it is associated with rich group in either of the three sectors, then for the other two it must lie in the middle group at least for a significant period of time. The study all also indicate that primary sector has played a pivotal role to drive the growth of the states. Thus in many instances it is the contribution from the primary sector that has pulled the state in the rich club or has enabled the state to remain the middle club in the decades of sixties, seventies and eighties. Only from mid-nineties tertiary sector has played a significant role to contribute to the productivity of the state. Lastly, the secondary sector also played an important role for many states like Haryana, Punjab, Maharashtra, Gujarat, and Tamilnadu and Karnataka.

If we now, consider the growth trajectories of states that are in poor club our conjecture about sectorial contribution to the productivity of the states is even more reinforced. Let us first consider the three states that are consistently associated with poor group, Bihar, Uttar Pradesh and Madhya Pradesh. Consider Bihar, all three sectors of Bihar are connected with poor club and that too for all the years invariably putting the state in poor club. Moreover, it is predominantly agriculture in nature with agriculture contributing to about 50 percent to the total productivity of the state. The share of the secondary sector is insignificant and only 10 percent. The rest all is contributed by the tertiary sector. Consider now its neighboring state Uttar Pradesh (UP). As far as tertiary sector is concerned, UP was underperforming and was in poor club till 1969, it improved its position and was in middle and rich group from 1970 to 1985. It again lost its position and was in middle club till 1989. From 1990 onwards it was again in poor club. The tertiary sector contributed to about 35 percent to the total productivity of the state when it was performing relatively good. What about secondary sector? UP was associated with poor group with secondary till 1974, it then improved its position and could stay in the middle income group from 1975 to 1992. It again lost its position and was in poor club from 1993 to 2009. However, even in its heyday the contribution of secondary sector to the total productivity of the state was only 18 percent. If we now, consider the productivity from the primary sector we find that UP was always associated with poor group of state and agriculture contributed to about 57 to 35 percent of the total

productivity of the state. Thus, from 1975 to 1990 when both tertiary and secondary sector was in the middle or rich income group, the poor performance in primary sector has actually pulled down the state in poor club. Another state that was consistently in the low productivity group and located in the central India is Madhya Pradesh. If we consider the tertiary sector Madhya Pradesh was associated with middle group till 1965 and it slipped down in the poor group and continued to remain there till 2009. Madhya Pradesh host a number of large scale industrial town mainly related to mines and minerals like Bhilia and Bhopal and consequently the secondary sector was associated with middle income 1968 to 1981 and from 1990 to 2009, for the rest of the year the secondary sector of Madhya Pradesh was associated with poor group of states. The contribution of secondary sector has also increased from 17 percent to 24 percent from the decades of sixties to the last decade. As far as the primary sector is concerned MP was always associated with poor group, however, its contribution to the total productivity to the state was significant. In the early decades of sixties, primary sector contributed to about 62 percent of the total productivity of the state and in recent decades though its contribution has reduced to 42 percent in nineties and 32 percent in the last decade but it is still on the higher side. Hence it is again ascertained that the low productivity in the primary and tertiary sector has pulled down the state in the poor group.

Two more states which were initially with middle income group and then lost its position in poor group are Orissa and Assam. Consider first Orissa; the state was associated with middle group till 1984. If we look at productivity from tertiary sector, till 1969 it was associated with rich group. Its contribution to the total productivity of the state was very modest and only 25 percent, from 1970 to 1974 it was in middle group and then it lost its position further and was in poor group throughout. The contribution of tertiary sector has increased from 25 percent to 50 percent in recent decade, though its relative position has never improved. Consider now the secondary sector, till 1973 the secondary sector was associated with rich club, it then lost its position and was in middle club until 1983. Further decline is noticed from 1983 onwards and secondary sector was associated with poor group. The contribution of secondary sector to total productivity of the state is as low as 17 to 15 percent. Lastly consider the primary sector, till 1988 it was associated with middle group lost its position and was with poor group till 2007. In the last two years it again regained its position in middle income group. Once again Orissa could maintain its position in the middle income group from 1974 to 1984 even though the tertiary sector was associated with poor group was because of primary sector. In fact, till 1985 in Orissa the primary sector contributed to about 55 percent of the total productivity of the states. Its contribution reduced in the subsequent year and Orissa lost its position in poor club. Once again it reinforces our understanding about the importance of primary sector for the growth trajectory of the state. Lastly let us consider Assam. Assam lost its position from middle to poor income group in 1993. As far as the sectorial association of the state is concerned, Assam was always associated with poor group with regard to tertiary sector. The contribution of the tertiary sector was as low as 26 percent in the decade of sixties, increased to 30 percent in the next decade and in the decade of nineties it is as high as 40 percent and 50 percent in the

recent decade. As far as secondary sector is concerned Assam was majorly associated with rich group from 1964 to 1998. It lost in position and was in poor group only in the recent years of 2007 to 2009. In spite of its position, the contribution from secondary sector to the total productivity of the state is only 14 percent and in recent decade it has even reduced further to 11 percent. As far as the primary sector is concerned Assam was in middle income group till 1999 and the contribution from primary sector was 47 percent. Thus Assam could retain its position in the middle income group till 1993 was because of the contribution from the primary sector. However, as there has been a transformation in the economy and the role of the primary sector reduced with a corresponding rise in tertiary sector Assam lost its position from the Middle to the poor income group.

Section 3: Shapley Value contribution of the Sectoral Growth to the NSDP growth and the productivity growth of the state.

In this section we have applied the Shapley value of the Cooperative Game theory to compute the relative contribution of the different sectors to the total growth of the economy. The Shapley decomposition is interesting because it allows the contribution of the various sub-sectors of the GDP. Thus for example if the decomposition of the growth of the GDP between year T and T+1 indicates that the contributions are the following: Primary -15%, Secondary **35%** and Tertiary 80%. This means that the growth of the GDP would have been 15% larger if the GDP of the Primary sector would have not change (i.e. would have not decrease) everything else unchanged or the growth of the GDP would have been 35% lower if the GDP of the Secondary sector would have not change (i.e. would have not increase) everything else unchanged, similar interpretation can be given for Tertiary Sector.

Since the GDP of the country is composed of primary, secondary and Tertiary sector the framework implemented here considers that the growth of the GDP of a given state can be decomposed into three components, which are the contribution of the three sectors. To do so, we consider that the contribution of a given sector will be a weighted sum of its marginal contribution to all possible subsets of sectors. The contributions of the three sectors are then derived calculating the Shapley value of this function V. Note that the weights used correspond to the probability of the occurrence of the subsets. Consequently, for a given NSDP distribution the contribution of a sector j to the overall GDP growth can be defined by the following formula:

$$Sh_j = \sum_{S \subset K, j \in S} \frac{(s-1)!(k-s)!}{k!} [G(Y(S)) - G(Y(S - \{j\}))]$$

Here G is the NSDP and or productivity growth of the economy, and K is the set of different sources of NSDP Growth and or productivity Growth, k is the cardinality of K and S a subset of different sources of Growth, s is the cardinality of S. and Y(S) the distribution of NSDP or productivity growth from different sources.

In our case, since we have three sectors, we must consider 2^3 possible subsets: The characteristic function (which is a concept of cooperative games theory) of our problem is a function that assigns to each subset of sectors the value of the growth of the GDP in the considered state if the GDP of sectors that do not belong to the subset considered remains the same.

Hence, the function is defined as follows:

$V(\text{empty set}) = 0$ by definition

$V(\text{Primary})$ = the value of the growth of the GDP in the considered state when the GDP in the Secondary and the Tertiary sectors do not change

$V(\text{Secondary})$ = the value of the growth of the GDP in the considered state when the GDP in the Primary and the Tertiary sectors do not change

$V(\text{Tertiary})$ = the value of the growth of the GDP in the considered state when the GDP in the Primary and the Secondary sectors do not change

$V(\text{Primary, Secondary})$ = the value of the growth of the GDP in the considered state when the GDP in the Tertiary sector does not change

$V(\text{Primary, Tertiary})$ = the value of the growth of the GDP in the considered state when the GDP in the Secondary sector does not change

$V(\text{Secondary, Tertiary})$ = the value of the growth of the GDP in the considered state when the GDP in the Primary sector does not change

$V(\text{Primary, Secondary, Tertiary})$ = the value of the growth of the GDP in the considered state = the real value

The marginal contribution of primary to the total NSDP growth is therefore given contribution of the primary sector to the different possible coalition with the probability of its occurrence

$\frac{1}{3}V(\text{Primary}) + \frac{1}{6}[V(\text{Primary, Tertiary}) - V(\text{Secondary})] + \frac{1}{6}[V(\text{Primary, Tertiary}) - V(\text{Tertiary})] + \frac{1}{3}[V(\text{Primary, Tertiary, Secondary}) - V(\text{Tertiary, Secondary})]$. In the analogous manner we can also calculate the contribution of the secondary and tertiary sector to the total NSDP growth.

The figures in the Table (Appendix B, C) and diagram (Appendix A, D) capture the contribution of the three principle sectors for the NSDP growth and the productivity growth of the states in India.

Consider first the states from the rich club and the Shapley value of the marginal contribution of the primary, secondary and tertiary sector to the NSDP growth of the states.

Let us first consider Gujarat and the marginal contribution of the primary sector over the decades. We find that the marginal contribution of the primary sector has reduced from 44 percent of the early decade to as low as 9 percent in the recent years. Interpreted in the language of Shapley contribution other things remaining same the NSDP growth of the Gujarat would have been 9 percent lower if there has been no change in the NSDP from the primary sector. In other words, the importance of primary sector for the growth of the state has reduced significantly over the years. On the other hand, for the secondary sector marginal contribution has increased from 21 to 38 percent, indicating that the growth of the NSDP of the state will be 38 percent lower if the NSDP from of the secondary sector do not grow. The contribution of the Tertiary sector has also increased from 31 percent to 52 percent for Gujarat. If we consider the productivity growth, we find the productivity growth of the primary sector as high as 90 percent in the 60s and 70s and in recent times it is reduced to 3 percent. Correspondingly, the contribution of the productivity growth of the secondary sector to the total productivity growth of the state in recent times is as high as 40 percent and for services it is 57 percent. Another surprising trend to notice for Gujarat is the negative contribution of the secondary and tertiary sector in the decade of eighties and nineties that is compensated by the positive contribution of primary sector.

We also observed similar scenario for Punjab. It is widely believed that primary sector plays a major role for the NSDP growth of the state. In terms of share in total NSDP its contribution in recent years is as high as 35 percent. However, the marginal contribution to the total NSDP growth is 16 percent. In terms of productivity growth, it is surprisingly high and even in recent times it is close to 30 percent. The diagram and the figures in the table indicate that it was it was more than 55 percent in the early sixties but in recent year the contribution from secondary and tertiary sector played a major role to boost the NSDP growth of the state. Thus, in recent time the secondary sector contributed to about 40 percent of the total NSDP growth of the state and tertiary sector contributed to 46 percent. However, in terms of productivity growth, the secondary sector contributed to about 27 percent to the total productivity growth of the state and tertiary sector contributed to about 42 percent. It is interesting to note that the tertiary sector contributed negatively to about -66 percent for the productivity growth of the state and in the decade of eighties both the tertiary and secondary

contributed negatively to the productivity growth of the state. The sectoral contribution of Punjab is different from the growth story of India for which the primary and secondary sector played a significant role. Thus, Gujarat and Punjab are the only states in India for which the contribution of the secondary sector is close to 40 percent of the total NSDP growth of the state. In terms of productivity growth of the state, the primary sector still a major contributor, followed by tertiary and secondary sector.

For other states from the Rich club, like Maharashtra, Haryana and Tamilnadu, it is tertiary sector that contributes most to the NSDP growth of the state. In Haryana, the contribution of the primary in the early decades was as high as 55 percent but it gradually reduced to 10 percent. The contribution for Secondary has more or less fluctuated at around 20 percent over the years and it is the tertiary sector that has contributed most to the NSDP growth of the state. For productivity growth, the contribution of primary, secondary and Tertiary sector is even for interesting. Thus, in the early decades the contribution of the primary sector was 81 percent, and in recent time it is 8 percent. On the other hand, the contribution of tertiary sector was as low as 5 percent and in recent it increased to 84 percent. The rest of the productivity growth is contributed by the productivity of the secondary sector. Another interesting feature to notice is that in the decade of eighties and nineties the contribution of the primary sector was negative and it was as high as 249 percent and 21 percent. Interpreted in the language of Shapley value, the productivity growth of the state would be 249 percent or 20 percent higher had there been no fall in the growth of the primary sector. In the decade of eighties, it is the secondary sector that contributed to the productivity growth by 226 percent and tertiary sector by 122 percent. The contribution of the secondary sector reduced to 40 percent and in recent times it is as low as 8 percent. The transformation of Haryana from an agricultural sector to a service oriented state is quite remarkable and contrary to the growth experience of India.

For Maharashtra and Tamilnadu the contribution of primary sector to the total NSDP growth of the state is as low as 4 percent and 2 percent. In other words, the NSDP of the growth of the states will be 4 percent and 2 percent low if there was no growth in the primary sector for those states. Maharashtra and Tamilnadu was the hub of secondary sector for India for the last three decades as it is evident from the table in the appendix and from the diagram. However, its contribution has declined in the recent decade and it is the Tertiary sector that has taken up the major role to the NSDP growth of the states. As far as the productivity growth is concerned, we find that in the early decades, secondary sector contributed to about 78 percent, primary sector 14 percent and tertiary sector is 7.8 percent in the early decade of sixties. The secondary sector contributed negatively of around 16 percent in the decade of seventies and it was compensated by the growth of primary and tertiary sector. If we

look at the trend of the marginal contribution of primary and tertiary sector, we find that the contribution of primary sector declined and in recent times it is even negative. Correspondingly, the contribution of secondary and tertiary sector increased and contributed positively to the productivity growth of the state. If we look at the productivity growth of the Tamilnadu, we find that in the early decades of sixties, the secondary sector has positively contributed to 97 percent and primary sector 32 percent to the total productivity growth of the state. Over the decades, the contribution of primary sector declined with the corresponding rise in tertiary and secondary sector.

For other states in rich club like Kerala and Karnataka we find similar trend. However, it is interesting to note that till the last three decades, it is the primary and secondary sector that has contributed mostly to the NSDP growth of the state. However, the tertiary sector contribution has been substantial only in the last decade. For Kerala the tertiary sector contributes substantially to the total NSDP growth of the state and it is close to 80 percent. The negative figures of primary sector from 1998 onward indicate that the NSDP growth of the Kerala would have been 2-3 percent higher if the growth of the primary sector would not have declined. If we look at the productivity growth of Karnataka we find in the decade of sixties and seventies, its contribution was 80 to 90 percent. From the decades of eighties, it contributed negatively to the productivity growth of the state. There was a corresponding rise in tertiary sector and secondary sector and in recent year it is close to 74 percent for tertiary sector and 26 percent for secondary sector. Figures for Kerala indicate, that in the early decades, the primary sector was a major contributor to the productivity growth of the state and in recent decades its contribution declined substantially. There was a corresponding rise in tertiary and secondary sector.

Let us now consider the contribution of the primary, secondary and Tertiary sector to the total NSDP growth of the Middle Income states. Let us first consider West Bengal. In the early decades of 1960 and 1970, primary sector contributed 26 to 37 percent of the total NSDP growth of the states. In the decades of eighties its contribution was close to 40 percent probably because of land reform but its contribution reduced from the decades of eighties and in the recent decade it is only 9 percent. It is interesting to note that secondary sector contributed to about 15 percent in the recent decade and it was never substantial for West Bengal fluctuating at around 15 to 20 percent. As far as the productivity growth of West Bengal is considered, we find that immediately after Land reform, in the decades of seventies and eighties, the primary sector contributed to about 70-75 percent of the productivity growth of the state. West Bengal was also the hub of secondary sector and this is also evident from the contribution of the productivity of the secondary sector to the total productivity growth of the state. Thus, in the early decade of sixties, seventies it contributed substantially for the productivity growth of the state and till eighties it contributed

upto 40 percent. In recent times, its contribution has reduced to as low as 9 percent and it is the tertiary sector that has taken up the position.

Consider now Andhra Pradesh, which transited from the poor club of state to middle club of states. In the early decades of sixties and seventies primary sector contributed to about 34 percent, 37 percent to the total NSDP growth of the state. However, from the decades of eighties, its contribution reduced and it is around 22 percent. It is interesting to note that primary sector still contributes to about 20 percent of the total NSDP growth of the state. As far as secondary sector is concerned, it has continued to contribute to about 20 percent of the total NSDP of the state. The rest is contributed by Tertiary Sector. If we look at the productivity growth of the state and the contribution of the different sub-sectors, we find that primary, secondary propelled the growth of the state and finally it was taken over by the Tertiary sector. Even in recent times the primary sector contributed to 19 percent of the total productivity growth of the state and the tertiary sector contributed to 74 percent and secondary 20 percent.

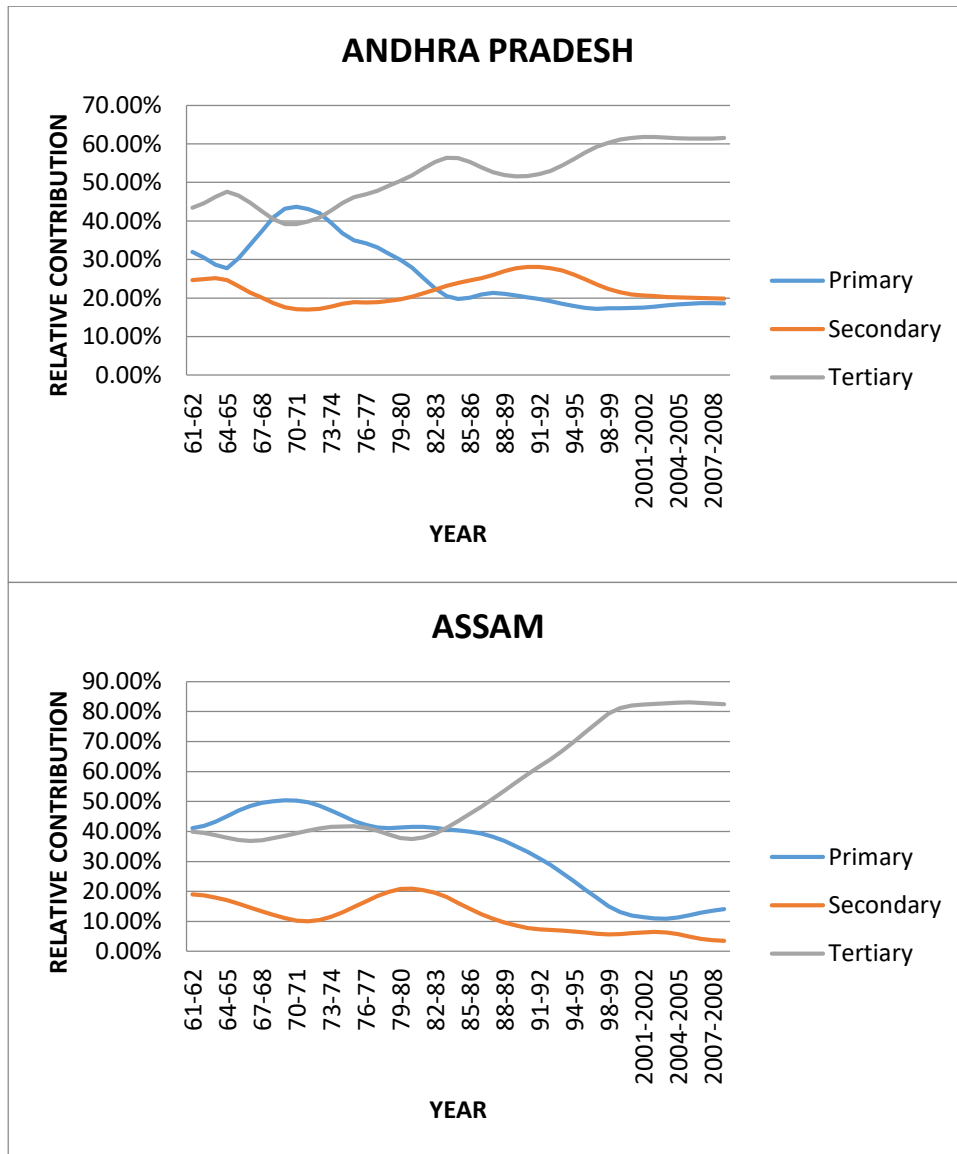
Consider now Rajasthan, the Shapley value decomposition indicates that for Rajasthan, all three sectors played some role to contribute to the NSDP growth of the state. Thus, in the early decade's primary sector played a major role with about 50 percent share to the total NSDP growth of the state, followed by Tertiary (30 percent) and Secondary sector (20 percent). In recent year, its share has reduced to 14 percent and the share of secondary sector has increased to 30 percent and for tertiary sector it is 56 percent. We find similar trend for productivity growth of primary sector.

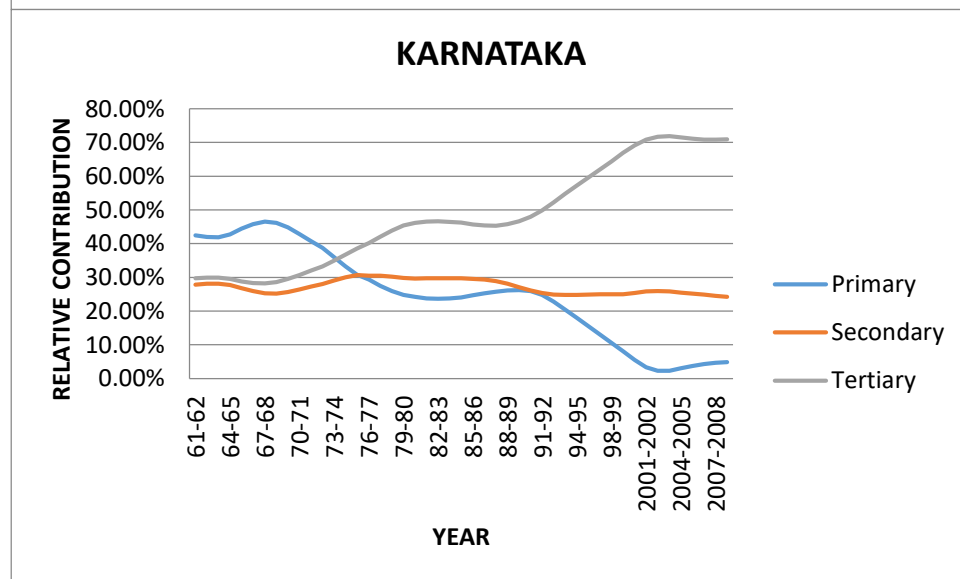
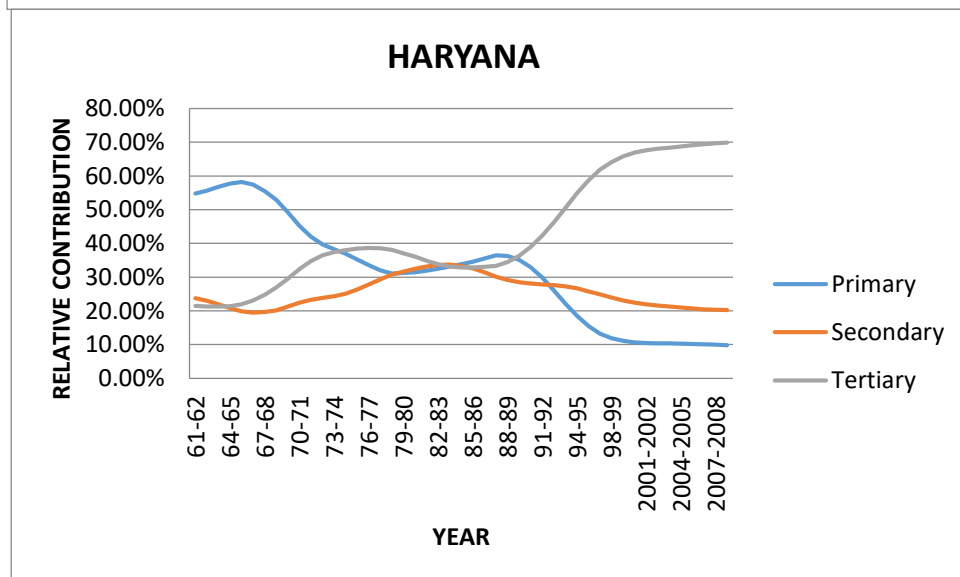
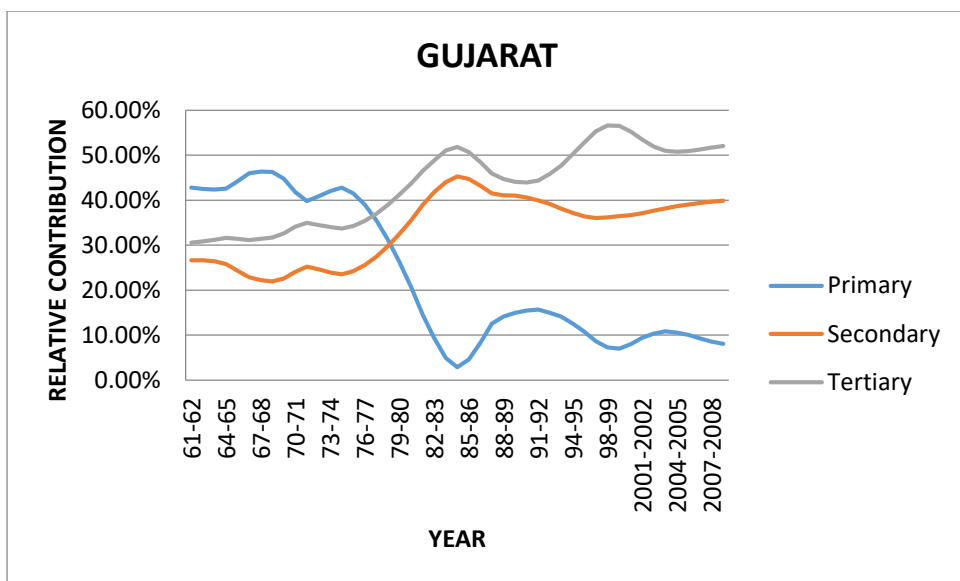
As far as states from the poor club is concerned, we noticed that primary sector still contributes substantially for the total NSDP growth of the states. Thus even in recent decade the contribution is around 20 percent. In terms of productivity growth, the contribution of primary sector is 25 percent in recent decade, and for Orissa is 27 percent. However, for Madhya Pradesh, and UP it is close to 10 percent and in Assam it is negative. In other words, the productivity of Assam would be 10 percent higher if there will be no decline the productivity growth of the Assam. The secondary also contributes to around 20 percent to the NSDP growth of the states and with some vibration with the productivity growth of the secondary sector of the states. The tertiary also plays a major role to contribute to the NSDP growth of the state. For Assam its contribution is close to 83 percent and for Orissa and Bihar it is 63 percent and similar trend is noticed for productivity growth of tertiary sector.

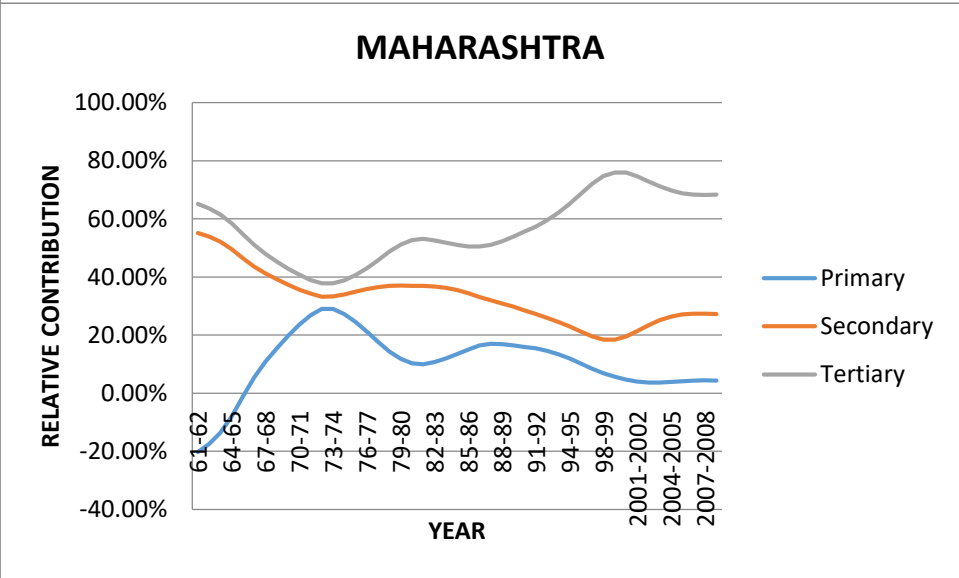
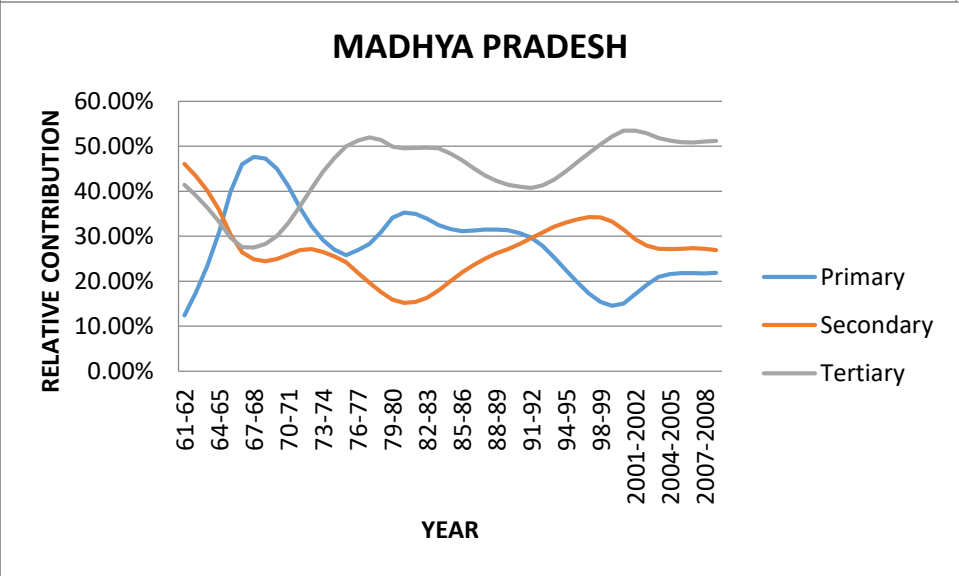
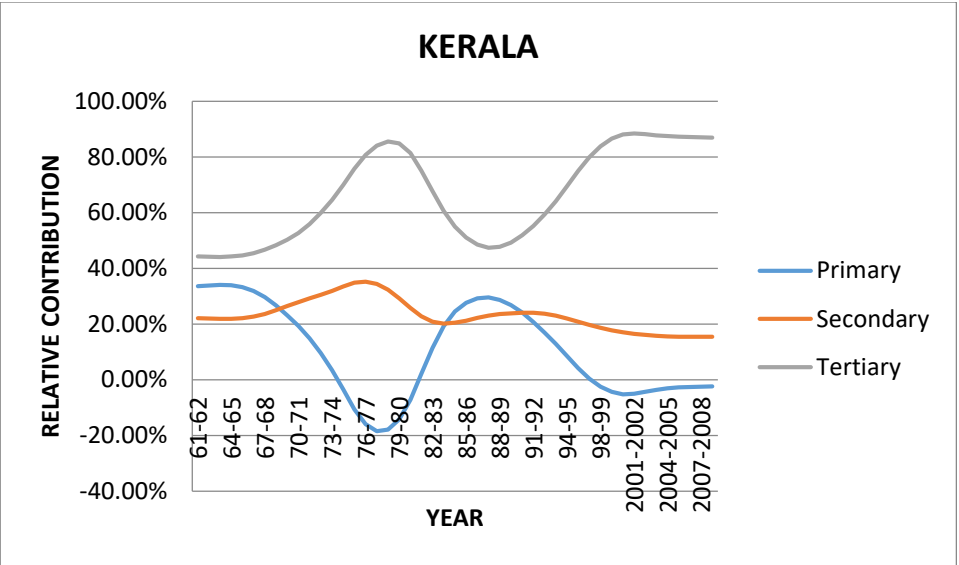
Conclusion: Our objective in this paper was to do an empirical analysis of the income movements of the Indian States over a recent period of around 37 years. The principal interest of this analysis from the point of view of modern growth theory lies in the fact that a first round of reforms in the 1980s followed by a major reform program that India carried out in the early 1990s considerably enhanced its growth rate, but different States and regions of India have not inserted themselves in the same way into this growth process. Contrary to what has

been often affirmed, India is not a uniform picture of divergence. Both before and after reforms, rich States have stayed rich, , but after reforms, there have been evolutions in growth with a general upward movement of the transitional club, except for two states, which have fallen behind, and one state that has moved into the rich club. It is the transitional states that benefit most from growth in the post-reform period, and the poor states that benefit least. There are three distinct clubs with convergence within the clubs, and divergence between the clubs and this tendency persists for almost every year, which points to the possibility of multiple regimes depending on initial conditions and multiple steady states with possibilities of movements between the clubs. The shapley value decomposition also enabled us to identify the contribution of the different sectors to the overall growth of the economy and the different states of India. The analysis indicate that divergent growth process of the different regions of the country. The search for the precise role of the initial conditions and for the structural determinants of growth using this regression tree framework will be the object of another paper.

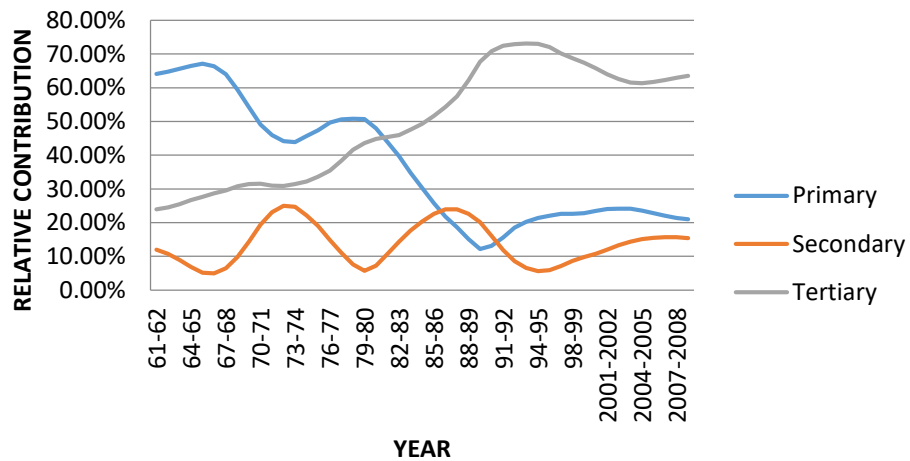
Appendix A



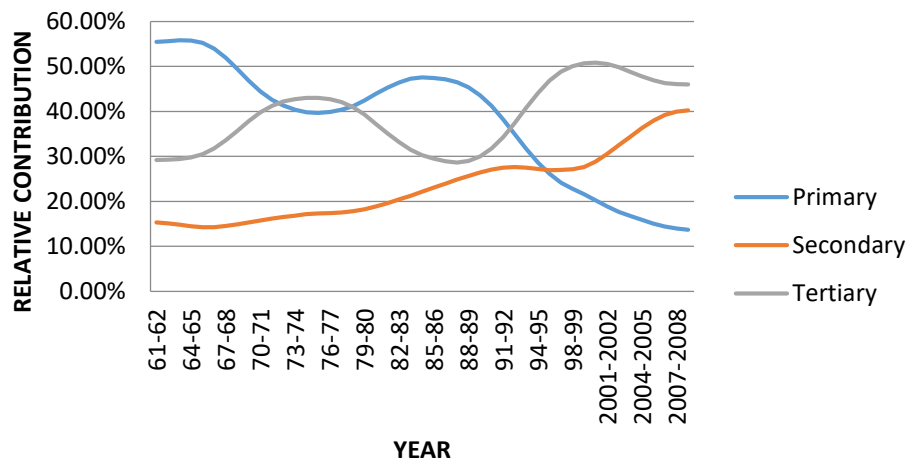




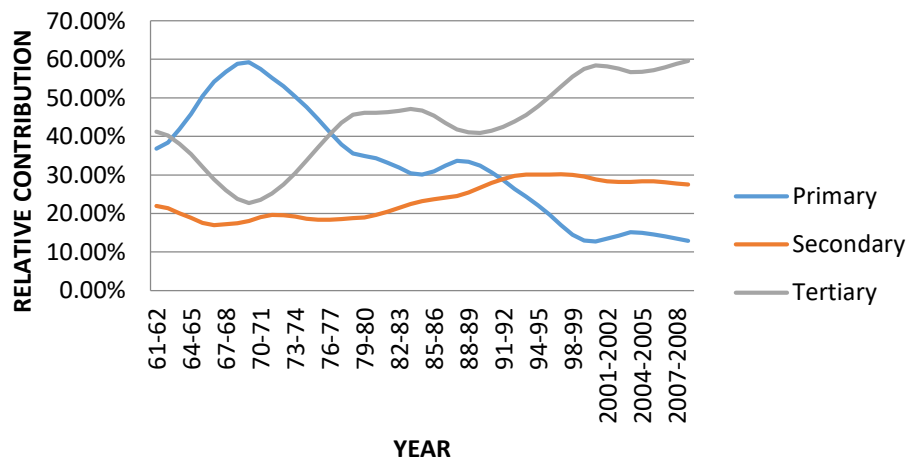
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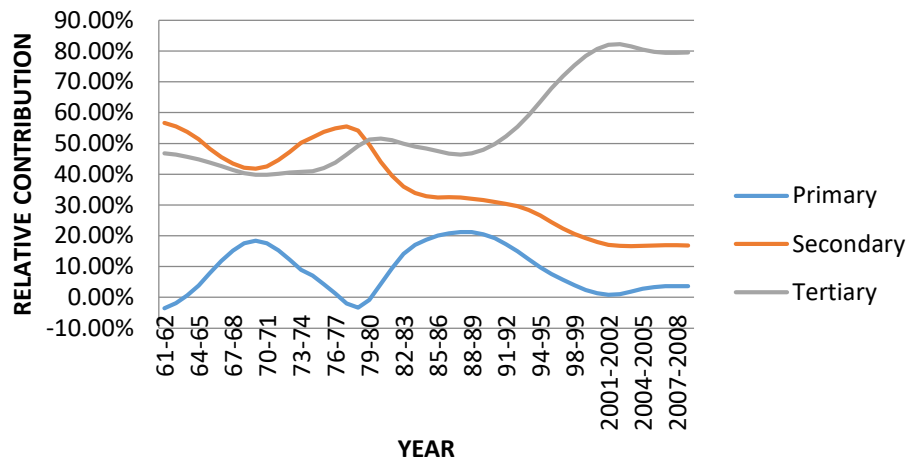
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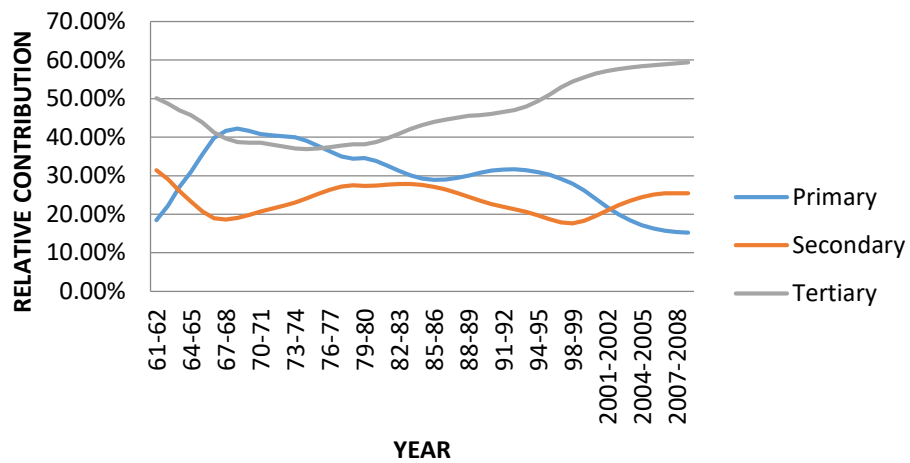
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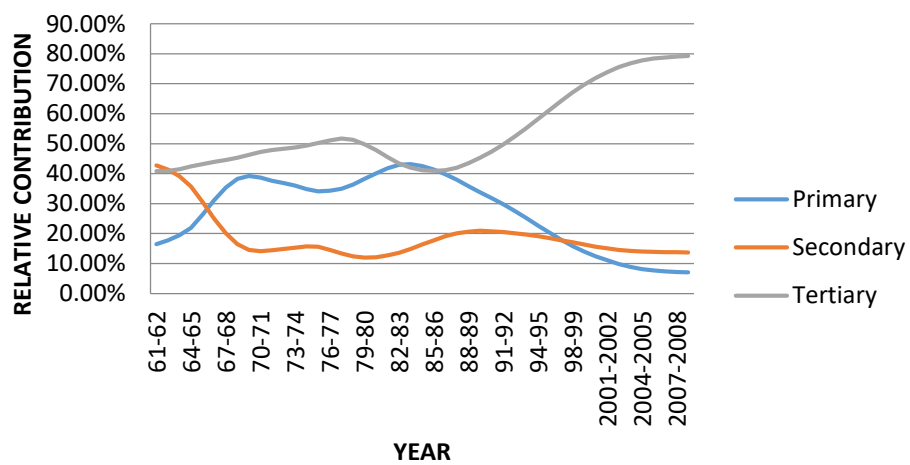
TAMILNADU



UTTAR PRADESH



WEST BENGAL



Appendix B

Results of GDP Growth Decomposition

State	Sector	60-70	70-80	80-90	90-2000	2000-2009
AP	Primary	0.34	0.37	0.22	0.18	0.18
	Secondary	0.22	0.18	0.24	0.25	0.20
	Tertiary	0.44	0.45	0.54	0.56	0.62
ASSAM	Primary	0.46	0.45	0.39	0.23	0.12
	Secondary	0.16	0.15	0.15	0.07	0.05
	Tertiary	0.38	0.40	0.45	0.70	0.83
Bihar	Primary	0.30	0.41	0.31	0.13	0.21
	Secondary	0.24	0.12	0.13	0.08	0.16
	Tertiary	0.45	0.47	0.57	0.79	0.63
Gujarat	Primary	0.44	0.38	0.11	0.12	0.09
	Secondary	0.24	0.26	0.42	0.38	0.38
	Tertiary	0.31	0.36	0.48	0.50	0.52
Haryana	Primary	0.55	0.37	0.34	0.20	0.10
	Secondary	0.21	0.26	0.32	0.26	0.21
	Tertiary	0.24	0.37	0.34	0.54	0.69
Karnataka	Primary	0.44	0.33	0.25	0.18	0.04
	Secondary	0.27	0.29	0.29	0.25	0.25
	Tertiary	0.29	0.38	0.46	0.57	0.71
Kerala	Primary	0.31	-0.03	0.19	0.09	-0.03
	Secondary	0.23	0.32	0.22	0.22	0.16
	Tertiary	0.46	0.71	0.58	0.69	0.88
MP	Primary	0.34	0.31	0.32	0.23	0.20
	Secondary	0.33	0.23	0.21	0.32	0.28
	Tertiary	0.33	0.46	0.47	0.45	0.52
Maharashtra	Primary	-0.01	0.23	0.14	0.11	0.04
	Secondary	0.47	0.35	0.34	0.23	0.25
	Tertiary	0.55	0.42	0.52	0.66	0.71
Orissa	Primary	0.64	0.48	0.29	0.20	0.23
	Secondary	0.09	0.17	0.18	0.09	0.14
	Tertiary	0.28	0.35	0.53	0.71	0.63
Punjab	Primary	0.53	0.41	0.46	0.30	0.16
	Secondary	0.15	0.17	0.23	0.27	0.36
	Tertiary	0.32	0.42	0.31	0.43	0.48
Rajasthan	Primary	0.49	0.46	0.32	0.22	0.14
	Secondary	0.19	0.19	0.23	0.30	0.28
	Tertiary	0.32	0.35	0.45	0.49	0.58
Tamilnadu	Primary	0.08	0.06	0.17	0.10	0.02
	Secondary	0.49	0.50	0.35	0.26	0.17
	Tertiary	0.44	0.43	0.49	0.64	0.81

UP	Primary	0.33	0.38	0.31	0.30	0.18
	Secondary	0.23	0.25	0.27	0.20	0.24
	Tertiary	0.44	0.38	0.43	0.50	0.58
WB	Primary	0.27	0.36	0.40	0.23	0.09
	Secondary	0.29	0.14	0.17	0.19	0.14
	Tertiary	0.43	0.50	0.43	0.58	0.77
ALL	Primary	0.32	0.32	0.26	0.18	0.10
	Secondary	0.28	0.26	0.27	0.25	0.24
	Tertiary	0.39	0.42	0.47	0.58	0.67

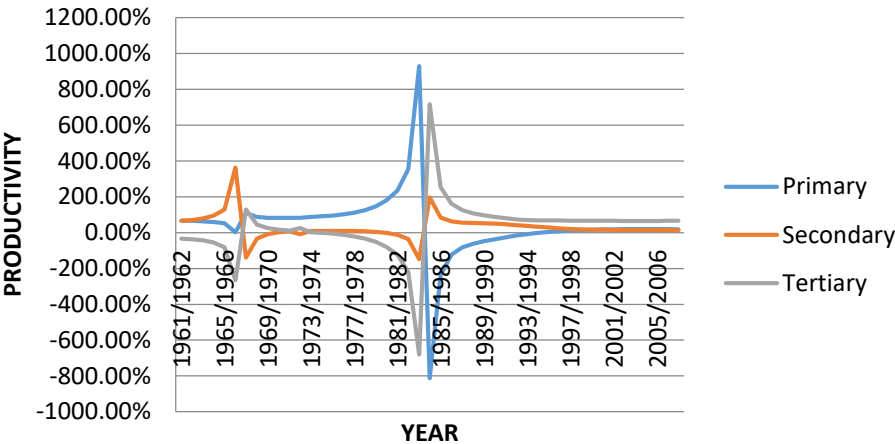
Appendix C

		60-70	70-80	80-90	90-2000	2000-2009
AP	Primary	65.48%	100.86%	33.51%	-3.35%	19.39%
	Secondary	69.32%	6.12%	30.71%	31.61%	14.78%
	Tertiary	-34.80%	-6.98%	35.78%	71.73%	65.83%
Assam	Primary	74.33%	88.76%	145.32%	258.82%	-10.30%
	Secondary	13.81%	-1.69%	-11.67%	-38.69%	-3.08%
	Tertiary	11.86%	12.92%	-33.65%	-120.13%	113.38%
Bihar	Primary	62.05%	103.86%	146.91%	27.03%	25.06%
	Secondary	-89.50%	-0.11%	1.37%	2.03%	11.91%
	Tertiary	127.45%	-3.75%	-48.28%	70.94%	63.03%
Gujarat	Primary	85.47%	91.07%	607.79%	-23.22%	3.81%
	Secondary	-14.61%	4.20%	-244.98%	55.33%	40.32%
	Tertiary	29.14%	4.73%	-262.81%	67.89%	55.87%
Haryana	Primary	81.02%	95.94%	-249.48%	-20.98%	7.78%
	Secondary	14.01%	-6.70%	226.86%	40.69%	8.26%
	Tertiary	4.97%	10.76%	122.62%	80.28%	83.96%
Karnataka	Primary	82.78%	90.52%	-401.50%	-4.67%	-0.59%
	Secondary	-10.27%	4.14%	165.28%	30.67%	26.16%
	Tertiary	27.49%	5.34%	336.22%	74.01%	74.43%
Kerala	Primary	75.53%	74.08%	89.39%	1.07%	9.83%
	Secondary	-79.73%	6.85%	11.64%	12.79%	6.46%
	Tertiary	104.20%	19.07%	-1.03%	86.15%	83.71%
MP	Primary	75.23%	95.89%	250.81%	17.74%	13.82%
	Secondary	28.61%	0.48%	-28.37%	32.34%	23.75%
	Tertiary	-3.84%	3.64%	-122.44%	49.92%	62.43%
Maharashtra	Primary	13.99%	99.56%	50.50%	-11.99%	-5.44%
	Secondary	78.21%	-15.87%	15.08%	25.05%	28.51%
	Tertiary	7.80%	16.31%	34.43%	86.94%	76.93%
Orissa	Primary	-312.60%	80.95%	157.60%	29.42%	26.91%
	Secondary	-57.49%	9.66%	-1.21%	-8.22%	8.76%
	Tertiary	470.09%	9.39%	-56.39%	78.80%	64.34%
Punjab	Primary	71.81%	91.34%	233.18%	10.60%	30.24%
	Secondary	94.64%	1.40%	-92.50%	33.23%	27.55%
	Tertiary	-66.45%	7.27%	-40.68%	56.18%	42.21%
Rajasthan	Primary	79.06%	84.50%	305.77%	-22.83%	10.57%
	Secondary	17.09%	6.53%	-41.66%	37.74%	15.00%
	Tertiary	3.85%	8.96%	-164.11%	85.09%	74.43%
Tamil Nadu	Primary	31.45%	85.58%	31.38%	2.70%	3.91%
	Secondary	96.78%	1.31%	27.27%	20.25%	11.05%
	Tertiary	-28.23%	13.10%	41.36%	77.05%	85.04%
	Primary	-389.73%	114.91%	499.91%	243.80%	7.01%

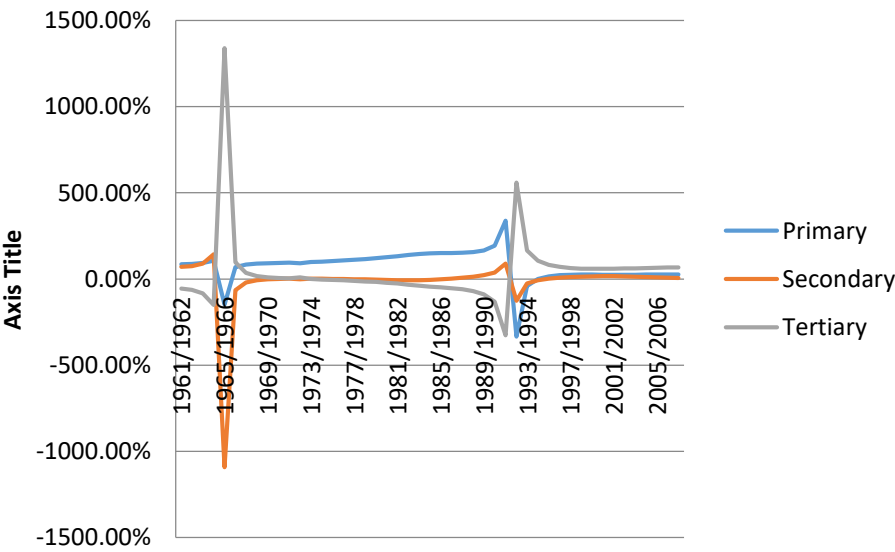
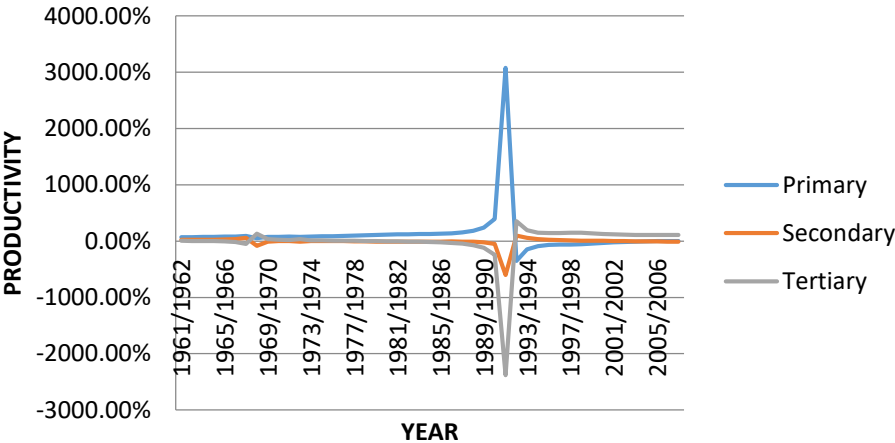
Uttar Pradesh	Secondary	144.99%	-3.13%	-131.59%	-50.54%	12.36%
	Tertiary	344.75%	-11.79%	-268.32%	-93.26%	80.63%
West Bengal	Primary	-47.73%	70.08%	76.82%	15.80%	6.24%
	Secondary	298.72%	27.96%	39.89%	17.32%	8.82%
	Tertiary	-150.99%	1.96%	-16.71%	66.88%	84.93%

Appendix D

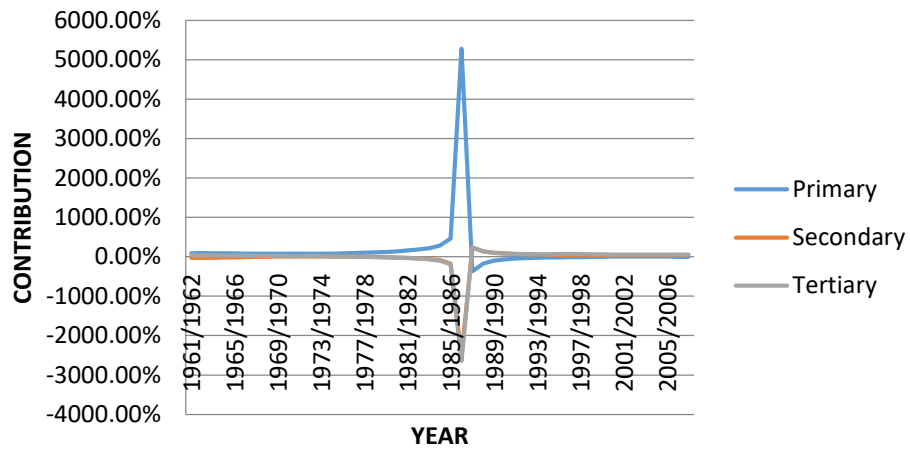
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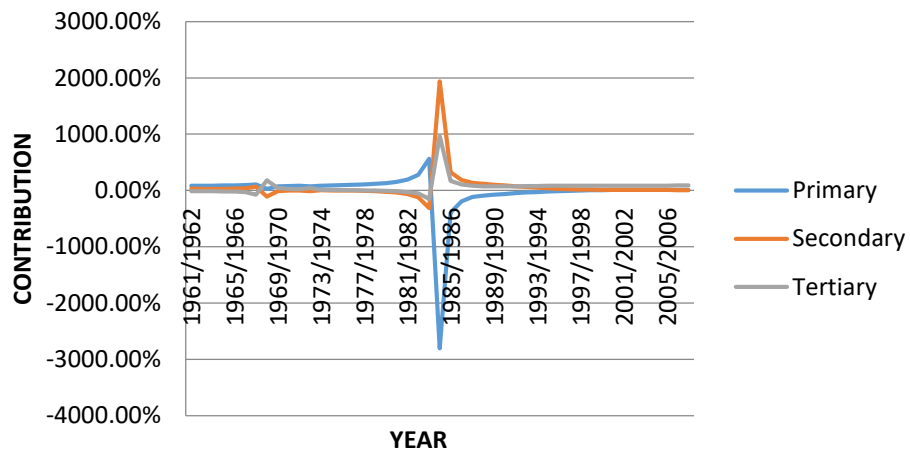
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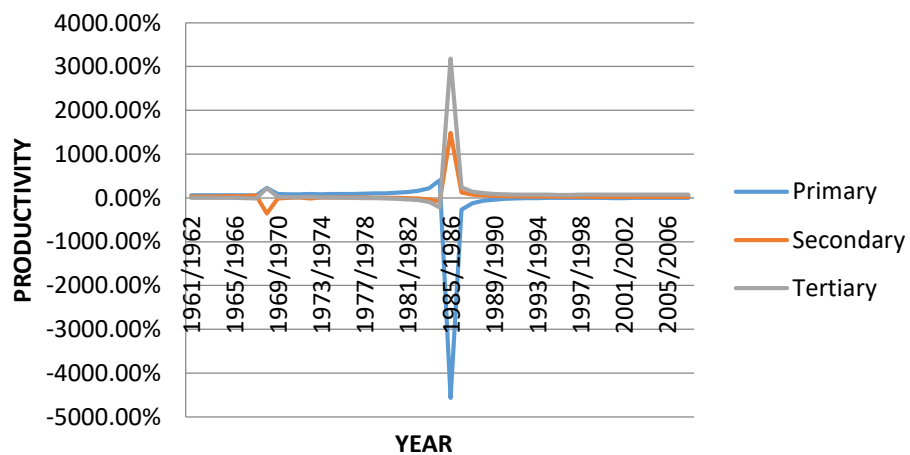
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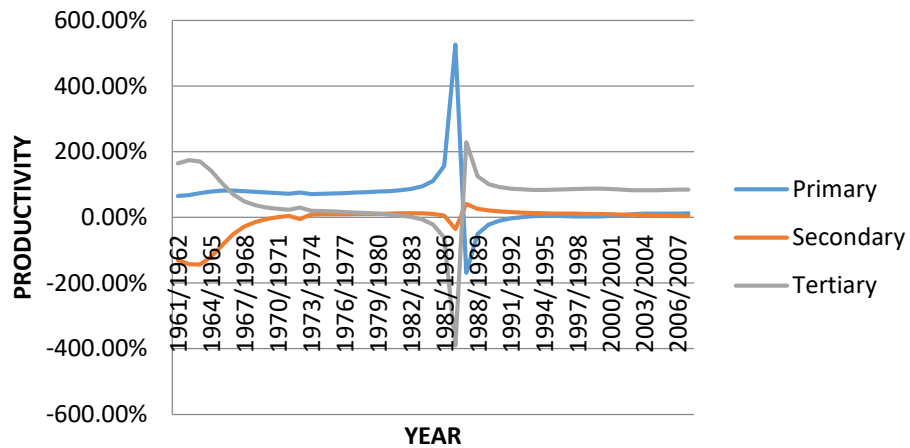
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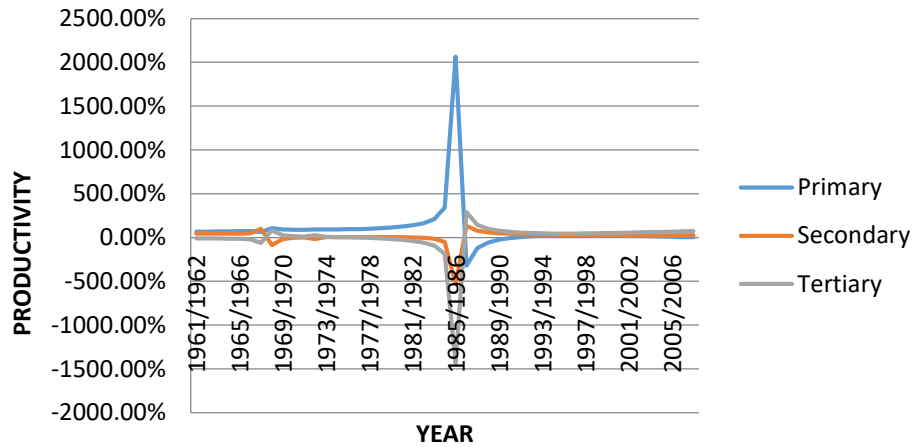
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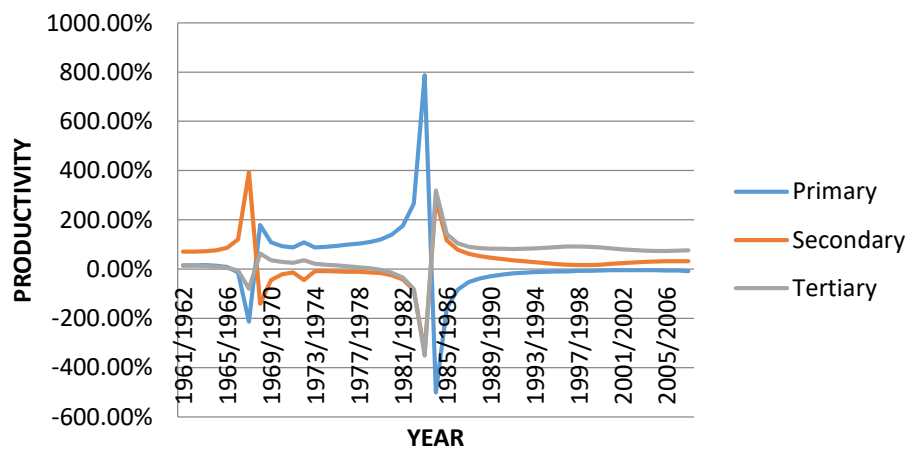
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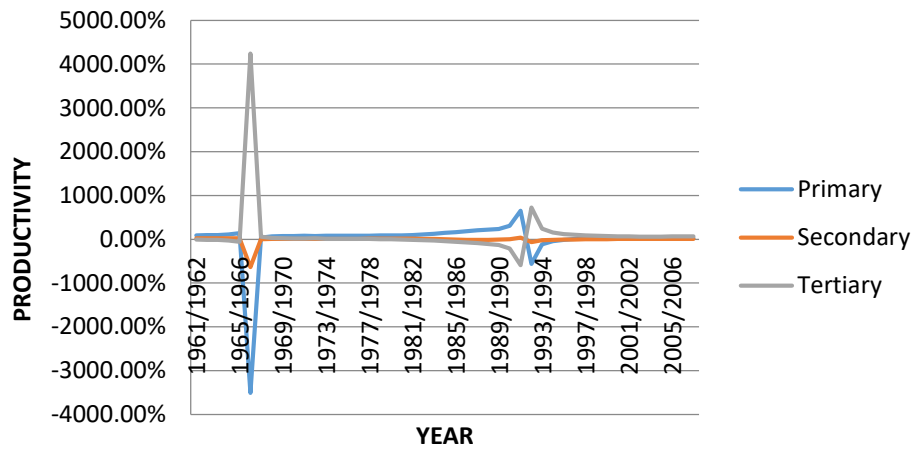
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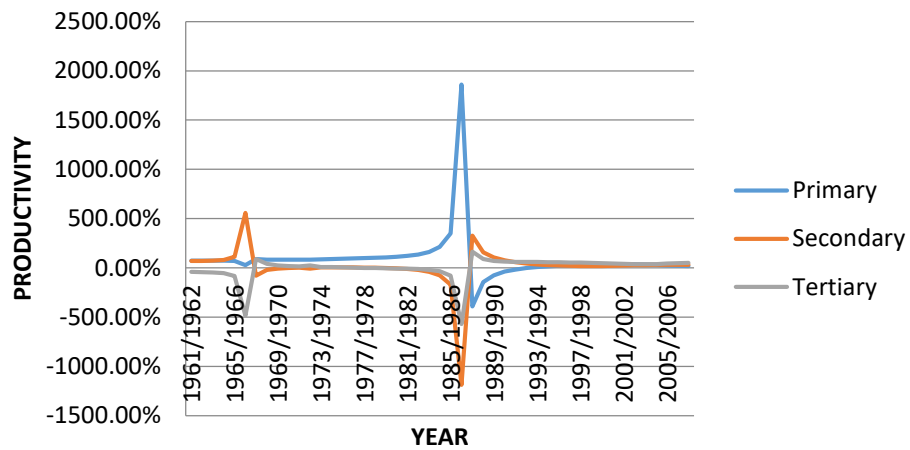
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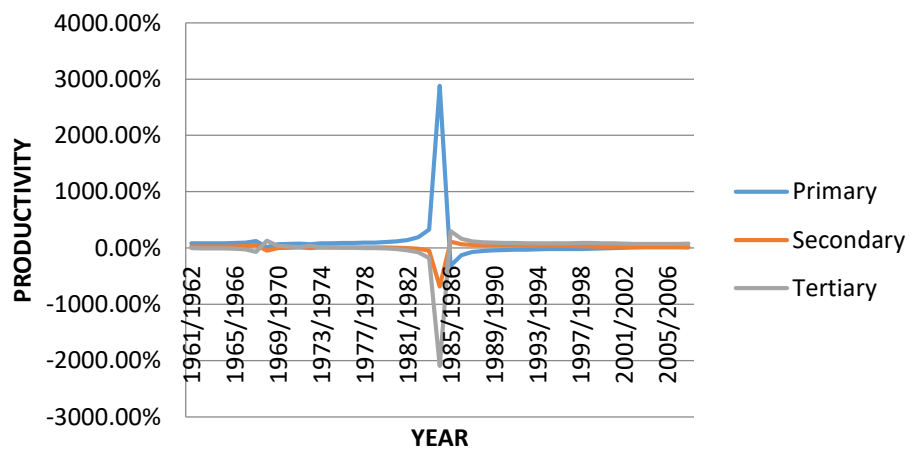
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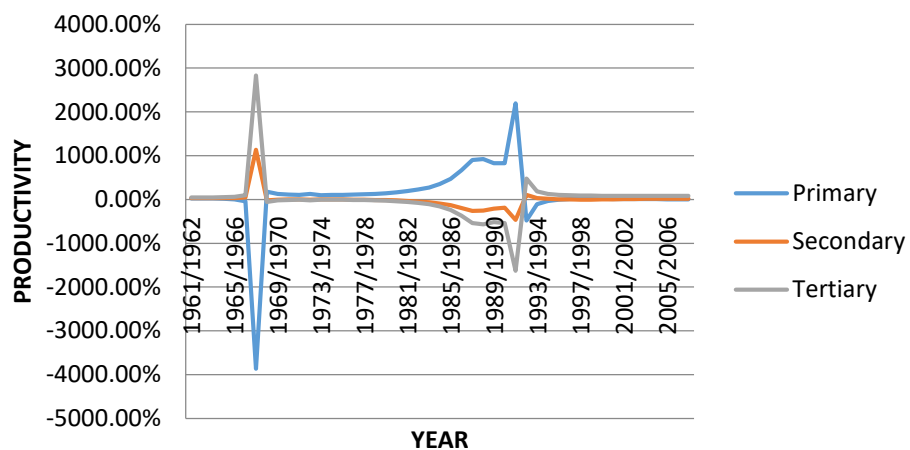
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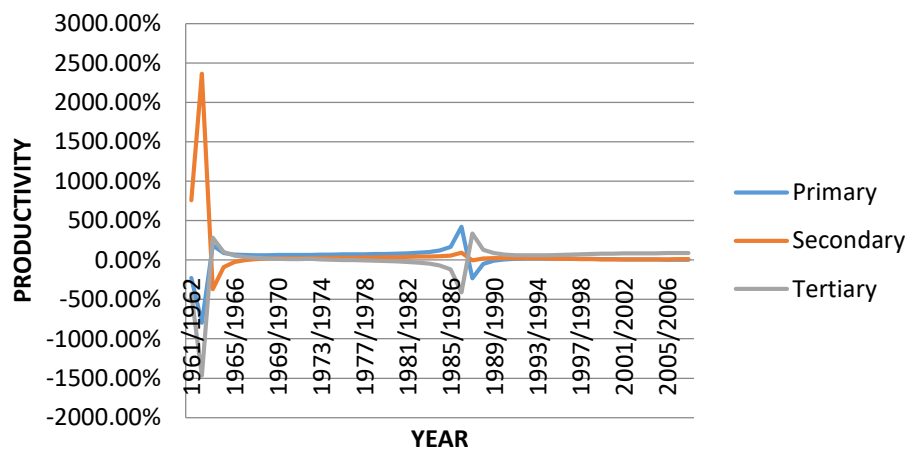
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UTTAR PRADESH



WEST BENGAL



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