REGIONAL DIVERGENCE IN INDIA DURING THE ERA OF LIBERALISATION : A SECTORAL DECOMPOSITION

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Abstract

The objective of this paper is to understand and measure the contribution of various sectors towards the divergence of regional output in India in the era of liberalisation. We have first described a framework that enables us to decompose the rate of divergence into the contribution made by various sectors. Next, we have used this framework to focus on the role of the agricultural, industrial and the services sectors of the Indian economy in bringing about changes at the level of regional inequality in the period following the liberalisation of the economy. The results show that while the services and industrial sectors are largely responsible for the divergence during this period, the agricultural sector offset some of this divergence.

I. INTRODUCTION

According to the neoclassical growth model, the per capita income of economies continuously converges towards their steady state levels, resulting in a reduction in income inequality among these economies over time. This proposition has been extensively tested in the 'Endogenous Growth' literature using both cross-country data as well as data from regions within a single economy. In the cross-country studies, the results did not indicate (unconditional) convergence. However, studies based on regional economies (particularly for developed countries) provided stronger support to the convergence hypothesis. It is in this context that - beginning with Cashin and Sahay (*1996)* - a number of studies have tried to look at the possibility of convergence among the sub-national regions of the Indian economy. In particular, some of these studies have looked at the trends in regional inequality following the liberalisation of the

economy in the early nineties and a number of them have confirmed that the Indian economy exhibited regional divergence during this period.[1] Clearly, a high rate of regional divergence can create economic and political problems for any country and hence it is important to understand the factors underlying these trends.[2]

One useful way to understand these underlying factors is to look at the role played by various sectors in which production is taking place, leading to the divergence of the regions. This is particularly important in a developing economy like India, where for example, the agricultural, industrial and the services sectors exhibit very distinct growth patterns and are influenced by distinctly different sets of factors. Thus, in order to understand the dynamics of trends in inequality, it is more meaningful to focus on the contribution of each of these sectors towards the divergence of aggregate output. It is the objective of this paper to assess the contribution of various sectors towards the regional divergence in India during the nineties, i.e., the period following the liberalisation of the Indian economy. This calls for a framework that enables us to decompose the rate of divergence, giving the contribution of each sector. In the first part of the paper, we have described such a framework and focused on the role of the agricultural, industrial and the services sectors of the Indian economy in bringing about changes in the level of regional inequality during the period under consideration. Section II reviews the literature. Section III describes the framework that is used to measure sectoral contribution to changes in income inequality. Section IV presents some empirical results. Section V concludes the paper.

II. ARE THE REGIONAL ECONOMIES MOVING CLOSER?

A particular branch of the literature on convergence has focused on the convergence of regions within a single economy. In this section, we start with a brief discussion of some of these studies that have looked at this issue for various countries. Next, we present a detailed discussion of studies that concentrate on the Indian experience. Finally we look at studies that have looked at some of the sectoral aspects in this context.

Evidence across the world

A number of studies have looked at the possibility of convergence of regions within developed economies (*Barro and Sala-i-Martin, 1992; Barro and Sala-i-Martin, 1995)*. In many of these studies the authors find evidence of convergence over long sample periods (100 years for states in USA and 60 years for Japanese prefectures) and also over much shorter sub-periods within the same sample. De la Fuente (*2002)* records evidence of convergence across Spanish regions in each of the three decades between 1965 and 1995. On the other hand, empirical evidence on convergence from developing countries has been much less encouraging. Juan-Ramon and Rivera-Batiz (*1996)* study the states of Mexico over the period 1970 to 1993, and report convergence in incomes between 1970 and 1985 and divergence thereafter. Another study by Jian, Sachs, and Warner (*1996)* look at the provinces of China between 1952 and 1993, and finds evidence of divergence in real per capita incomes, except for the period 1978 to 1990.

The Indian experience

In the recent past, a number of contributions have dealt with the issue of convergence or divergence of the states of the Indian economy. Here we shall classify these in terms of the methodology that they have used to analyse this issue. These contributions can be broadly divided into two groups, i.e., (a) regression-based approach (b) approaches based on measures of inequality. The regression-based approach is a corollary of the neoclassical growth theory, which argues that due to diminishing returns to capital, regional economies (which are assumed to have similar rates of savings and technical progress) should exhibit convergence over time. In other words, this approach defines convergence as a process through which the poorer regions grow at a faster rate compared to the richer regions, and hence have a tendency to catch up with them. This is also known in the literature as beta convergence. One of the earliest papers in this area by Cashin and Sahay *(1996)*, which puts to test the hypothesis of *beta* convergence for Indian states over the period 1961 to 1991. Their estimation results suggest that absolute *beta* convergence was observed during this period due to initially poor states catching up with initially richer states in India. Marjit and Mitra (*1996)* also focus on the convergence hypothesis in the context of the Indian states. Although the authors do not explicitly fit a regression, they focus on the negative relationship between initial incomes and subsequent growth rates, which is a basic characteristic of the regression-based approach. Their results suggest that there is no evidence of convergence among Indian states for the period under study. Nagaraj, et al. (*1998)* also uses the regression-based approach but tests for conditional convergence instead of absolute convergence by including independent variables like agriculture's share in the states output, etc apart

from initial values of per capita output for the state. The results of their study show a negative coefficient of the initial per capita output and hence validate the conditional convergence hypothesis for the states of the Indian economy. Rao, Shand and Kalirajan (*1999)* test the hypothesis of convergence among Indian states for the period 1965-66 to 1994-95 using regression equations. Their empirical analysis show that the initial level of per capita output is positively associated with the growth of per capita output in states, suggesting that per capita output diverged across states during the period under consideration. Interestingly, the observed positive relationship appears to have strengthened during the reform process of the 1990s. Another paper Singh, et al. (2003) that uses the regression-based approach tests for absolute convergence of per capita consumption expenditures and finds that there is absolute divergence during the 1980s and 1990s.

There is an alternative approach to convergence that defines it as a reduction in the inequality of regional incomes over time. The simplest way to measure a reduction in regional income inequality is in terms of a fall in the standard deviation of the logarithm of regional (per capita) incomes. This standard deviation-based approach is also known in the literature as *sigma* convergence (*Barro and Sala-i-Martin, 1995)*. Cashin and Sahay *(1996)* use this approach and find that the value of this measure of dispersion increases from 0.292 in 1961 to 0.333 in 1991, indicating *sigma* divergence. Rao, Shand and Kalirajan *(1999)* also compute standard deviation of per capita SDP across states from the mid-1960s to mid-1990s. The estimated dispersion shows a steady rise from 0.22 in 1965-66 to 0.39 in 1994-95, indicating strong *sigma* divergence. Another simple measure that has been used to study this issue is the coefficient of variation. Nagaraj, et

al. (*1998)* uses the coefficient of variation of the real per capita SDP across states to confirm that inequalities have indeed risen over the period 1960 to 1994. Their study reveals that although the dispersion fell mildly in the early 1960s in the poorest of regions mainly due to a higher agricultural growth brought about by 'Green Revolution', the later years witnessed a sharp rise in inequality, particularly in the 1970s. Although the 1980s saw inequalities increasing less notably, the 1990s again displayed a rising tendency of inequality. According to the authors, the dispersion was observed to be 1.6 times higher in the 1990s than that found in the 1970s. Ahluwalia (*2000)*, while attempting to measure variation in growth performance across 14 major Indian states in both the pre-reform (1980s) and post-reform (1990s) years, observed a significant degree of dispersion in growth rates among Indian states during the later period. The coefficient of variation that was around 0.15 in the 1980s, almost doubled in the 1990s to around 0.27, indicating divergence. In another recent paper, Bhattacharya and Sakthivel (*2004)* observed the pattern of growing disparity among states in India. They show that the average coefficient of variation based on per capita GSDP has gone up from 0.22 during the 1980s to 0.43 during the 1990s, almost a two-fold increase.

The standard deviation and the coefficient of variation are simple measures that have been used to quantify inter-state inequality in the Indian economy. There are a few studies that have used more sophisticated techniques to measure inequality including the Gini coefficient and Theil's entropy index. Ahluwalia (*2000)* attempts to look at trends in inter-state inequality for the pre-reform period (1980s) and the post-reform period (1990s), by constructing a population-weighted Gini coefficient based on per capita GSDP. His study reveals that the coefficient remained stable at 0.15 till about 1986-87

after which it went up to reach 0.17 during the closing years of 1980s. During the nineties, the coefficient climbed steeply reflecting worsening inter-state inequality, to touch 0.23 in 1998-99. Das and Barua (*1996)* use Theil's entropy index as a measure of inequality and show that the index went up from 3.19 in 1970-71 to 8.06 in 1992-93, growing at an annual average rate of 3.55 percent. From this, they conclude that the Indian economy has developed only at the cost of raising regional disparities.

The role of the sectors

A few papers looking at the issue of convergence or divergence of the Indian states have specifically thrown some light on the sectoral roles in this context. Rao, Shand and Kalirajan (*1999)* find that a major source of the steady rise in standard deviation of per capita SDP from 0.22 in 1965-66 to 0.39 in 1994-95 is the primary sector, whose dispersion rate soared up northwards to 0.37 in 1991-92 as opposed to 0.17 in 1965-66. The standard deviation of per capita SDP for the secondary sector was relatively stable until 1990 (around 0.48) but went up sharply later. This is attributed to better performances of industrially advanced states responding positively to the liberalisation effort. As far as the service sector is concerned, no consistent trend was discernible from their study. Another study that looks at the sectoral aspect in some details is that by Das and Barua (*1996).* This paper uses a regression exercise to analyse the role of the sectors and finds that the agricultural and services sector inequalities are significant factors that explain the aggregate inequality in the Indian context, while total manufacturing does not. Next, while disaggregating manufacturing into registered and

unregistered components, they find that unregistered manufacturing is also a significant sector contributing to aggregate inequality while registered manufacturing was not.

III. A FRAMEWORK TO DECOMPOSE THE RATE OF DIVERGENCE

The literature on the convergence of regional economies has largely ignored the role played by various sectors in this process. Even though a few contributions have tried to throw some light on the role of the sectors, they have not quantified the contribution of each of the sectors in the trends in regional inequality.[3] In order to quantify these roles, it is necessary to decompose these trends in regional inequality into their sectoral components. In this section, we shall describe a framework that can be used for this purpose. For the sake of convenience, we shall present the following analysis in terms of divergence, although it is also applicable for analysing convergence. Our starting point is to choose a measure for the rate of divergence of regions over time. Since the objective of this study is to decompose the total divergence into its sectoral components, we need a measure that is amenable to algebraic treatment. As we shall show in this section, the coefficient of variation can be used for this purpose.[4]

According to the coefficient of variation-based approach, any increase in inequality among the economies (measured by the coefficient of variation of the distribution of their output) over time indicates divergence.[5] In order to estimate how much each of the sectors contribute to the aggregate divergence, the first step is to quantify the rate of divergence. In the regression-based approach, this is measured by the speed of divergence, and is determined from the estimation of the neoclassical growth

model. However, there is no equivalent term in the coefficient of variation-based approach, although the degree of divergence is determined by the extent of the increase in the coefficient of variation. We formalize this idea by defining the rate of divergence as the growth rate of inequality, i.e., the growth rate of the coefficient of variation of output over time.[6] Thus, denoting per capita regional output by X_i, its coefficient of variation by $C(X_i)$, and the rate of divergence by D, we have

$$D = \frac{\dot{C}(X_i)}{C(X_i)} \qquad \ldots(1)$$

Let there be n regions such that the output of each region is given by X_i, i = 1….n. Let there be m sectors that contribute to each region's output X_i, such that the output of each sector in each region is given by X_{ij}, i =1…n, j = 1…m.

Then, $$X_i = \sum_j X_{ij}$$

Let $\overline{X}$ be the arithmetic mean of X_i and $\overline{X}_j$ be the arithmetic mean of X_{ij}.

Thus, $$\overline{X} = \frac{1}{n}\sum_i X_i = \frac{1}{n}\sum_i\sum_j X_{ij} = \sum_j \frac{1}{n}\sum_i X_{ij} = \sum_j \overline{X_j} \qquad \ldots(2)$$

The above equation indicates that the average output for the economy is equal to the sum of the average output of each of the sectors. Next, define P_j as the ratio between the average output of the jth sector and the average output of the economy.

Thus, $P_j = \frac{\overline{X_j}}{\overline{\overline{X}}}$

Let us also assume that $\sigma(X_i)$, $Var(X_i)$, $Cov(X_{ij},X_{ik})$ and $r_{ij,ik}$ are the symbols for the standard deviation, variance, covariance and the correlation coefficient of the corresponding variables, respectively.

By definition, $Var(X_i) = \frac{1}{n}\sum_i (X_i - \overline{X})^2$

$$= \frac{1}{n}\sum_i \left(X_{ij} - \sum_j \overline{X_j} \right)^2$$

$$= \frac{1}{n}\sum_i \left[\sum_j \left(X_{ij} - \overline{X_j} \right)^2 \right]$$

$$= \sum_j \left[\frac{1}{n}\sum_i \left\{ (X_{ij} - \overline{X_j})(\sum_k (X_{ik} - \overline{X_k})) \right\} \right]_{k=1....m}$$

$$= \sum_j \left[\sum_k \left(Cov(X_{ij}, X_{ik}) \right) \right]$$

Or, $Var(X_i) = \sum_j Cov(X_{ij}, X_i)$ …(3)

Now by definition, the coefficient of variation is given by,

$$C(X_i) = \frac{\sigma(X_i)}{\overline{X}} = \frac{Var(X_i)}{\sigma(X_i) \times \overline{X}} \quad \ldots(4)$$

Substituting equation (3) in equation (4) we get,

$$C(X_i) = \frac{\sum_j Cov(X_{ij}, X_i)}{\sigma(X_i) \times \overline{X}}$$

$$= \sum_j \frac{\sigma(X_{ij}) \times r_{ij,i}}{\overline{X}}$$

$$= \sum_j \left(\frac{\sigma(X_{ij})}{\overline{X_j}} \times \frac{\overline{X_j}}{\overline{X}} \times r_{ij,i} \right)$$

Thus, $$C(X_i) = \sum_j \left(C(X_{ij}) \times P_j \times r_{ij,i} \right) \quad \ldots(5)$$

Equation (5) indicates that the level of aggregate inequality (measured by the coefficient of variation of aggregate output) is equal to the sum of each sectors contribution. The contribution of each sector is equal to the product of: (i) the inequality in the sector, (ii) the average regional output of the sector as a proportion of the average regional output, and (iii) the correlation coefficient between the sector and the whole economy. This means that the inequality for the aggregate economy is affected not only by the sectoral

inequalities, but also by the relative size of the sectors and their interlinkage with the economy. The size of the sectors add a scale effect to the sectoral inequality, i.e, a larger sector adds more to the economy's inequality compared to a smaller sector. The interlinkages of a sector with the whole economy - represented by the correlation coefficient between the two – also has an important role. This is due to the fact that a high correlation between any sector and the economy implies that a region that has a relatively high output from that sector also has a relatively high aggregate output, while a region that has a relatively low output from that sector also has a relatively low aggregate output. Thus, for a given level of inequality in the sector, an increase in the correlation coefficient increases the economy's inequality.

Equation (5) breaks up the coefficient of variation of aggregate output into its sectoral components. However, in order to derive the rate of divergence, we need to derive the growth rate of coefficient of variation. Differentiating both sides of equation (5) with respect to time and dividing by $C(X_i)$ we get,

$$\frac{\dot{C}(X_i)}{C(X_i)} = \sum_j \left[\left(\frac{\dot{C(X_{ij})}}{C(X_{ij})} + \frac{\dot{P_j}}{P_j} + \frac{\dot{r_{ij,i}}}{r_{ij,i}} \right) \times \left(\frac{C(X_{ij}) \times P_j \times r_{ij,i}}{C(X_i)} \right) \right] \quad \ldots(6)$$

Equation (6) implies that the aggregate divergence is equal to the weighted sum of growth rates of the three components in equation (5). In each case, the weights are the sectors' contribution to the economy's initial levels of inequality, as a ratio of the economy's initial levels of inequality. It should be noted here that equation (6) follows from equation (5) only in continuous time, when certain cross products arising out of an expansion of equation (5) take up negligible values and are assumed to be equal to zero. However, when we will use these equations to undertake some measurement in discrete

time (in the next section), errors creep in due to non-negligible values of the cross products. In that case, the right hand side of equation (6) becomes approximately equal to the left hand side of the equation.

IV. DATA AND RESULTS

In this section, we use the framework described in the previous section to look at the comparative contributions of the agricultural, industrial and the services sector in changing the regional inequalities in India during the nineties. Most studies dealing with the regional dimensions of the Indian economy consider the states as the appropriate unit of their analysis and base their study on the major states of India.[7] In consonance with this approach, we use data from seventeen major Indian states, i.e., Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Goa, Haryana and Himachal Pradesh. In order to generate data on the aggregate and sectoral output of the states, we use GSDP (Gross State Domestic Product) data classified by industry of origin. The agricultural output is derived by aggregating over agriculture, forestry and logging and fishing, while the industrial output is the aggregate of mining and quarrying, registered and unregistered manufacturing, construction and electricity, gas and water supply. The services sector comprises of transport, storage and communication, trade, hotels and restaurants, banking and insurance, real estate, ownership of dwellings and business services, public administration and other services. The GSDP and the population data series for this study are obtained from the Central Statistical Organisation (CSO). The

time period chosen for the study is 1990-91 to 1999-2000, i.e., it coincides largely with the period of liberalisation that was initiated during the early part of the nineties.[8] It may be noted that, in order to avoid the complexity arising out of the reorganisation of states (which resulted in a number of new states) we have used data till 1999-2000, which is the last year for which data from the undivided states (such as, Uttar Pradesh, Bihar and Madhya Pradesh) is available.

The objective of this empirical exercise is to use the framework described in the earlier section to measure: (a) the contribution of sectoral divergences, and (b) the total contribution by each sector in the divergence of aggregate output. It was demonstrated in the preceding section that the aggregate divergence is equal to the weighted sum of the growth of three components which are, (i) the inequality in the sectors, (ii) the average regional output of the sectors as a proportion of average regional output and (iii) the correlation coefficient between the sectors and the aggregate economy. Tables 1,2 and 3 deal with each of these three components respectively. Table 1 presents the inequality at the aggregate and sectoral levels over the chosen time period. The upper part of the table presents the coefficient of variation of per capita output for the states covered by this study, for all the years under consideration. Column two gives the coefficient of variation for per capita output (GSDP), column three for the per capita agricultural output, column four for the per capita industrial output (S) and the fifth column for the per capita services output.

Table 1 highlights two points. Firstly, it is clear that throughout the period, the industrial and the services sectors had much higher income inequality compared to the agricultural sector, which was the least unequal. Secondly, the table unambiguously

points to inequality increasing for the aggregate economy as well as all the sectors during this period. The rise is the lowest for the services and the agricultural sector, where the coefficient of variations has risen by about fifteen percent between 1990-91 and 1999-00, while the coefficient of variation of the industrial sector as well as the aggregate economy have gone up by about thirty percent over this period. This clearly indicates that during the nineties, the Indian economy has exhibited aggregate as well as sectoral divergence in regional per capita incomes, although the degree of divergence has been different for various sectors.

TABLE 1

Aggregate And Sectoral Divergence Rates (1990-1999)

	COEFFICIENT OF VARIATION OF PER CAPITA INCOME			
	GSDP	**Agriculture**	**Industry**	**Services**
1990-1991	0.38	0.35	0.52	0.52
1991-1992	0.37	0.38	0.51	0.49
1992-1993	0.40	0.37	0.56	0.51
1993-1994	0.40	0.39	0.56	0.50
1994-1995	0.39	0.38	0.51	0.53
1995-1996	0.41	0.38	0.52	0.55
1996-1997	0.44	0.39	0.57	0.58
1997-1998	0.43	0.37	0.55	0.55
1998-1999	0.48	0.36	0.68	0.59
1999-2000	0.49	0.41	0.67	0.60
RATE OF DIVERGENCE	3.00	1.70	2.87	1.60
WEIGHTS		0.14	0.36	0.51
SECTORAL CONTRIBUTION		0.23	1.02	0.81
SECTORAL CONTRIBUTION (PERCENTAGE)		7.75	34.12	26.97

Source: Author's calculation.

The lower part of Table 1 calculates the contributions of each of the sectoral divergences towards aggregate divergence. The first row here gives the sectoral divergence rates, which (as defined in the previous section) is the rate at which the inequality grew over this period. This is the average annual (compound) growth rate of the coefficient of variations between the years 1990-91 and 1999-2000. The next row gives the weights (which we shall discuss in some detail below) that must be multiplied to the sectoral divergence rates in order to get the sectoral contributions. The row following this gives the contribution of the sectoral divergences, which is equal to the product of the sectoral divergence rates and the weights (the product of rows two and three). Finally, the last row expresses these contributions as a percentage of aggregate divergence. From Table 1 we find that the services sector exhibited the lowest rate of divergence (1.6 percent per annum), followed closely by the agricultural sector (1.7 percent per annum) while the rate of divergence for the industrial sector is significantly higher (2.87 percent per annum). As a result of the divergence in all the sectors, the rate of divergence of the economy was as high as three percent per annum for this period. Secondly, we find that the weights are significantly different for the three sectors. As explained in the earlier section, these weights are the particular sector's contribution to the economy's initial levels of inequality (i.e., $C(X_{ij}) \times P_j \times r_{ij,i}$), as a ratio of the economy's initial levels of inequality (i.e., $C(X_i)$). Since these weights correspond to the relative contribution of each sector in the initial period, we shall henceforth refer to them as initial conditions. The differences in these initial conditions indicate that the contribution of the sectors in explaining the level of inequality in 1990-91 (i.e., the initial period) was significantly different, with agriculture having the lowest contribution

(fourteen percent), followed by industry (thirty six percent), while services had the highest contribution (fifty one percent).[9] This dissimilarity in the initial conditions ensure that although the rate of divergence of the services sector is roughly similar to that for the agricultural sector and about half of that in the industrial sector, the contribution of the services sector divergence is more than three times that of the agricultural sector and about eighty percent of that from the industrial sector. The last row gives the sectoral contribution as a percentage of aggregate divergence. We find that in terms of sectoral divergence, the agricultural sector contributes only 7.75 percent, the industrial sector contributes 34.12 percent, while the services sector contributes almost 27 percent.

The second component of aggregate inequality, Pj (the average regional output of the sectors as a proportion of the average regional output) is given in Table 2. The upper part of the table gives the average per capita state output of each sector as a proportion of the average per capita state output. As we have already stated, this is a measure of the relative size of the sector. It is clear from this table that over this period, the relative size of average per capita agricultural output (i.e., the proportion of per capita GSDP for an average state that comes from agriculture) has come down from about one third to about one fourth. This fall has been made up by rising shares, principally in the services sector and partly in the industrial sector. This indicates that the Indian economy is undergoing significant structural transformation, changing from an agricultural to a non-agricultural economy.

TABLE 2

Changes In The Relative Size Of The Sectors

	AVERAGE SECTORAL PER CAPITA OUTPUT AS A PROPORTION OF AVERAGE PER CAPITA OUTPUT		
	Agriculture	**Industry**	**Services**
1990-1991	0.33	0.28	0.39
1991-1992	0.32	0.28	0.40
1992-1993	0.32	0.28	0.40
1993-1994	0.31	0.28	0.40
1994-1995	0.31	0.29	0.41
1995-1996	0.29	0.29	0.42
1996-1997	0.29	0.29	0.42
1997-1998	0.27	0.30	0.43
1998-1999	0.25	0.30	0.44
1999-2000	0.24	0.31	0.45
RATE OF GROWTH	-3.52	1.11	1.65
WEIGHTS	0.14	0.36	0.51
SECTORAL CONTRIBUTION	-0.48	0.40	0.83
SECTORAL CONTRIBUTION (PERCENTAGE)	-16.10	13.20	27.78

Source: Author's calculation.

The lower part of Table 2 calculates the contribution of the change in the relative size of the sectors. The last four rows of this table are similar to those in Table 1, i.e., they correspond to the steps involved in the calculation of the sectoral contributions towards aggregate divergence. From these rows, we can surmise two points. Firstly, in consonance with their changing relative sizes, the growth rate of Pj from agriculture is negative while those from the industrial and services sectors are positive. Secondly, although the magnitude of the growth rate is highest for the agricultural sector followed by those from the services and the industrial sector, the different initial conditions for the sectors ensure that the magnitude of the contribution from the agricultural sector is

substantially lower compared to that from the services sector and only marginally higher than that from the industrial sector.

Table 3 deals with the third component of aggregate inequality, $r_{ij,i}$ (the interlinkage of the sectors with the economy). The upper part of the table gives the correlation coefficient between the sectors and the aggregate economy for the whole period. We find that throughout the period, agriculture is less integrated with the economy, compared to industry and services. More significantly for the agricultural sector, the strength of the interlinkages with the economy has weakened considerably over the decade, while that for the industrial and the services sectors have remained almost the same.

TABLE 3

Changing Linkages Between The Sectors And The Economy

	CORRELATION COEFFICIENT BETWEEN SECTORS AND THE ECONOMY		
	Agriculture	**Industry**	**Services**
1990-1991	0.45	0.94	0.94
1991-1992	0.45	0.93	0.94
1992-1993	0.53	0.95	0.94
1993-1994	0.52	0.94	0.94
1994-1995	0.48	0.94	0.93
1995-1996	0.44	0.94	0.94
1996-1997	0.45	0.95	0.94
1997-1998	0.41	0.96	0.95
1998-1999	0.36	0.96	0.96
1999-2000	0.35	0.96	0.97
RATE OF GROWTH	-2.72	0.29	0.27
WEIGHTS	0.14	0.36	0.51
SECTORAL CONTRIBUTION	-0.37	0.10	0.14
SECTORAL CONTRIBUTION (PERCENTAGE)	-12.45	3.43	4.63

Source: Author's calculation.

The lower part of table 3 calculates the contribution of the changing linkages between the sectors and the aggregate economy. The last four rows of this table are again similar to those in Table 1. Thus they correspond to the steps involved in the calculation of the sectoral contributions towards aggregate divergence. Here, due to the sharp fall in the correlation coefficient between agriculture and the economy, the rate of growth of the interlinkage is negative (implying a weakening of the linkage) and its magnitude is almost ten times as large as that of the other two sectors. As a result, despite the different initial conditions, the magnitude of the contribution is the largest from the agricultural sector, followed by the services and the industrial sector.

In Table 4, we have aggregated the results from the first three tables, in order to highlight the total contribution of each of the three components in equation (5), as well as the total contribution of each of the sectors. The second, third and fourth row represent the contribution of the three components while the second, third and fourth column represent the contribution of each of the three sectors. The fifth row gives the total contribution of each of the sectors. Similarly, the fifth column gives the total contribution of each of the three components. As we have mentioned earlier, there is an element of error in our decomposition exercise (using equation (6)) due to the measurement in discrete time. The last column gives the error as a percentage of total divergence. From Table 4, we find that the error is about ten percent, i.e., the decomposition explains about ninety percent of the aggregate divergence. However, this error is unavoidable and has to be kept in mind when we interpret the results of the decomposition exercise.

TABLE 4

Components Of The Aggregate Divergence (Percentage)

	Agriculture	Industry	Services	Total	Error
Contribution from Sectoral Divergences	7.75	34.12	26.97	68.84	
Contribution from changes in Relative Size	-16.10	13.20	27.78	24.87	
Contribution from Changing Linkages	-12.45	3.43	4.63	-4.39	
Total Sectoral Contribution	-20.80	50.75	59.37	89.33	10.67

Source: Author's calculation.

Let us now focus on the relative contribution of each of the components of equation (5). It is clear from the above table that about seventy percent of aggregate divergence is due to the sectoral divergences with all the sectors contributing to it. The changing size of the sectors has contributed to about a fourth of aggregate divergence, indicating that structural changes in the Indian economy are an important factor behind the divergence. Finally, the changing interlinkages between the sectors and the economy have played a small role in keeping a check on divergence. Next, let us analyse the contribution of each of the sectors. The services sector, despite having the lowest rate of divergence among the three sectors, has the largest contribution due to initial conditions and high growth in the relative size of the sector. The industrial sector also makes a large contribution due to high rates of divergence, initial conditions and some growth in its relative size. The agricultural sector, on the other hand, has offset some of the aggregate

divergence due to this sectors' low rate of divergence, low initial conditions, shrinking size as well as weakening linkage with the aggregate economy.

V. SUMMARY AND CONCLUDING REMARKS

There is a significant literature that has looked into the issue of trends in regional inequality in India. However, none of these studies has focused on the contribution of the individual sectors towards these trends. In this paper, we have attempted to do this by using a framework that can measure the sectoral contributions. This framework demonstrates that the aggregate divergence (or convergence) is influenced by four factors i.e., (i) the sectoral divergences (or convergences), (ii) the changes in the relative size of the sectors, (iii) the changes in the relationship of the sector with the total economy and (iv) the initial conditions. Using this framework, we have looked at the trends in regional inequality in India during the nineties and the sectoral contributions towards these trends. Our findings are that the Indian economy experienced divergence, both at the aggregate level and in each of the three sectors (agricultural, industrial and services), during the nineties. However, the divergence rate was quite uneven across the sectors. Clearly, the highest rate of divergence was in the industrial sector, while the rate was significantly lower for the agricultural sector and the lowest for the services sector. The relative rankings are completely different however, when we consider the total contribution of the sectors towards aggregate divergence. Although the services sector has the lowest rate of divergence, it contributes more to aggregate divergence than any of the other sectors partly because its share in the aggregate inequality at the beginning of the period, i.e., in 1990, was very high (initial conditions) and partly due to a large change in its relative

size. The industrial sector is the second largest contributor largely due to its high rate of divergence and a high share in the aggregate inequality at the beginning of the period (initial conditions). Interestingly, the agricultural sector's contribution was to significantly offset the rate of aggregate divergence. This is due to a combination of low divergence in this sector, initial conditions, shrinking relative size as well as a significant delinking with the aggregate economy.

The results also show that although the divergences within the three sectors are largely responsible for the aggregate divergence, there are other contributory factors as well. In fact, the other significant factor is the structural transformation of the economy, which is responsible for a significant part of the aggregate divergence, while the changing interlinkages play an insignificant role.

What inferences can we draw about economic policy from the results of this exercise? As evident from our exercise, India is undergoing a structural transformation with a continuous shift from an agrarian to a non-agrarian economy. This of course, is a positive indicator of development, as the economies of scale associated with the production process in industry and services will enable the economy to sustain a high growth path. However, it is important to note that the nature of this transformation is also driving up the regional inequality in the Indian economy. More specifically, it is the industrial and services sectors that are responsible for this divergence, while the agricultural sector has, in fact, kept a check on the rate of divergence. This is, of course, consistent with the literature on agglomeration economies that has always stressed that the nature of industrial development in a market economy makes them concentrate in particular locations (Duranton and Puga, 2003; Rosenthal and

Strange, 2003). However, this literature also differentiates between natural and man-made advantages of these locations *vis-à-vis* others. While the first type would include natural factors like distance from the coastal areas, etc., the second type stresses on factors like urban infrastructural facilities etc that result from the concentration of economic activity in particular locations.[10] Clearly, policy interventions can limit these man-made factors far more successfully than those of the natural factors. Of course, it is impossible to estimate from this study how much of the industrial divergence during the period studied is due to each of these two types of factors, but there is ample evidence in other studies that indicate that unequal infrastructural facilities lead to unequal industrial performance in the Indian states (Mitra, Varoudakis and Veganzones-Varoudakis, 2002). The upshot of this discussion is that, a part of the industrial divergence in India is due to man-made agglomerating forces like urban infrastructure, and hence it is possible to keep this divergence within control by ensuring a more equitable regional distribution of such infrastructure and developing better infrastructure in the backward areas.

As we have shown in this study, the industrial sector contributes about fifty percent of the aggregate divergence due to its high rates of divergence, initial conditions and growth in its relative size. However, due to its strong interlinkages with the services sector, it is partly responsible for the divergence in the services sector as well. Interestingly the services sector, which made the highest contribution to inequality at the beginning of the decade, seems to have turned a corner and had the lowest rate of divergence of all the sectors during the decade. This was made possible largely due to significant growth in the services sectors of the relatively poor states. This phenomenon has very important implications for the policy makers because it indicates that the nature

of the production process in the services sector is not as susceptible to the agglomerating forces as the industrial sector, and hence this sector can help in keeping a check on divergence. In terms of our framework, high growth in the services sectors of the relatively poor states will bring down the rate of divergence in two ways. Firstly, a higher rate of services growth in the poorer states will bring down the rate of divergence within the services sector. Secondly, a higher rate of services growth in the poorer states will also weaken the linkages of this sector with the aggregate economy, resulting in lower rates of divergence. In fact, we have found from our study that the agricultural sector has kept a check on aggregate divergence as a result of such weakening of its links with the aggregate economy. This indicates that a higher rate of agricultural growth in the poorer states also has the potential to restrict divergence in the aggregate economy. Thus, a policy package targeted towards the growth and development of the agricultural and services sectors in the backward areas may go a long way in keeping a check on regional divergence.

To sum up, in a developing economy like India with a liberalized market-friendly regime, a certain degree of divergence - especially in the industrial sector – is an inevitable part of the development process. However, the degree of divergence can be kept in check if the policy interventions reduce inequality in physical and other types of infrastructure and encourage the poorer regions to increase the growth in the agricultural and the services sectors. This may need some policy program targeted towards the development of these sectors in the backward areas. In the absence of such policies, the regional inequality may increase to an extent where this can become an obstacle in the path of sustained reforms and growth.

NOTES

1. Section two gives details of this literature.

2. The economic and political consequences of regional inequality are discussed in Venables and Kanbur (*2003)*.

3. Das and Barua (*1996)* comes closest to this objective but their study uses a regression-based approach and not an exact decomposition of the regional inequality. Moreover, their study includes data up to 1992, and hence does not capture the effect of the major reforms in India which took place after 1993.

4. The Gini coefficient is another popular measure that can be used for measurement and decomposition of inequality. However, the decomposition of the Gini coefficient by sources of income is not always easy to interpret in terms of economic behaviour and hence we have used the coefficient of variation.

5. The literature on regional convergence / divergence in India has used unweighted measures of inequality and in this paper we have adopted the same methodology.

6. This is similar to the concept of *proportionate inequality changes* that has been used in the literature on personal income inequality and its trends. See Jenkins (*1995*).

7. See for example, Das and Barua (*1996)*, Rao, Shand and Kalirajan (*1999)*.

8. The GSDP data supplied by the CSO corresponded to two base years, 1980-81 (for the period 1990-91 to 1992-93) and 1993-94 (for the period 1993-94 to 1999-00). In order to obtain one comparable time series for the whole period, we have constructed back series up to 1990-91 with 1993-94 as the base year using a methodology known as splicing.

9. The sum of the three contributions exceeds hundred percent due to rounding off of the weights up to two decimal places.

10. See Venables (*2003)* for a discussion of these two types of agglomerating forces.

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