Chapter 10
Structural Change and Economic Growth in India—A State-Wise Analysis

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Abstract This paper reviews the recent literature on structural change, human capital and economic growth and examines the relationship between structural change and economic growth across 14 major Indian states from 1993–94 to 2011–12. Calculating income share for various economic activities and following in the line with Dietrich for NAV and MLI, McMillan and Rodrik for within and static effects, Timmer et al. for within effect, static and dynamic effects, it estimates structural change in income for 14 major states from 1993–94 to 2011–12. There has been an increasing trend in patterns of structural change as evident by NAV and MLI across sectors to contribute to the growth process of per capita real income. Using catch up regression for absolute convergence, it finds the evidence of absolute beta divergence meaning by relatively richer states have grown faster than poorer counterparts. Including structural change in income and employment in industrial sector (high intensity) along with other control variables such as per capita investment, human capital, initial level of per capita real income in cross-sectional regressions, it finds significant contribution of structural change for economic growth across Indian states during this period. However, some of the fundamental variables are although in expected line, they are not significant which calls for re-examination of these issues within suitable framework such as dynamic panel data analysis that will sort out some of the problems encountered in cross-sectional growth regression.

Keywords Structural change · Economic growth · Human capital Convergence

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10.1 Introduction

There has been vast literature on economic growth. Many studies have analyzed various determinants of economic growth within neoclassical and endogenous growth theory framework to explain differences in levels and growth rates of income across countries and regions (Barro 1991; Mankiw et al. 1992; Levine and Renelt 1992; Acemoglu et al. 2001 among others). They have identified saving or investment rate, population growth rate, urbanization rate, human capital, levels of technology, size of government, rule of law, quality of social and political institutions etc. that affect economic growth. Recently there are a few studies that attempted to analyze structural change and economic growth and productivity (Cortuk and Singh 2013; Sen 2016; Teixeira and Queiros 2016; Timmer and De Vries 2009 among others). Structural change and economic growth may be correlated and impacting with each other over time. Since economic growth is originating out of various sectors, the nature and patterns of these structural changes will affect the quality of growth processes.

Structural transformation generally referred to as long term changes in the composition of an aggregate that is attributable to changes in the relative significance of the sectors in the economy to changes in the location of economic activity (urbanization) and to other concomitant aspect of industrialization which take place together (see, Singariya 2014). Structural change in modern development include a relocation of workforce from agriculture towards non-agricultural production. Most often it has recognized that, structural changes do not only characterized economic development, they are also indispensable for economic growth. Structural change as a source of economic growth has been excessively studied in literature on endogenous growth (Kaldor 1996; Lewis 1954; Romer 1987; Fisher 1939; Clark 1940/51; Kuznets 1971). Because structural change come out with a change in final demand, new method of production, which allows for a more efficient allocation of resources or innovation of a new product line which itself augment the value of the produce, that form the essence of the growth process (Zagler 2009). In addition to that, development of an economy is also regarded as a process that entails sustained increase in output per-capita accompanied by structural change in productive capital and employment (Roy 1980). However structural change does not come without a cost. The most evident social cost of structural change is unemployment and underemployment. The reason is that, firm producing a product in a declining market will lay off workers. Workers specializing in a particular mode of production make their qualification redundant until these workers re-qualify and are matched to a new job in an expanding product segment or in a new technology, these workers will suffer from the spell of unemployment (Zagler 2009). India is pragmatic example of such growth. Because unlike other developed and developing countries, India is not following same kind of structural change in terms of income and employment (see, Papola 2012). As a result of which economic growth has been accompanied by a much lower rate of growth in employment and by zero or negative growth of what the ILO has termed as “Decent Work” (Bagchi 2005).

The higher economic growth in the post reform period has been accompanied by a slower growth in employment. Employment growth has infact, declined with the acceleration of growth rate of GDP. Thus, structural change has not delivered on employment front as they have on GDP front (Papola 2012). This type of growth is widely recognized as "jobless growth".

Therefore, for a developing country like India where socio economic problem such as poverty, unemployment and inequality influences policy decisions it becomes important to study structural change and its relationship with economic growth and employment, so that growth and employment impulses emerging sectors could be identified and foster to sustain economic growth momentum. An in depth understanding of structural change from time to time become all more important for policy makers to design effective policies to achieve broader objective of inclusive growth. In this backdrop, the present study attempts to examine structural change across 14 Indian states in term of income. It also tries to relate it with economic along with other factors of growth from 1993–94 to 2011–12 within growth regression framework. The following section gives the review of literature. Section third deals with data and methodology. Empirical results are discussed in section four. A concluding remark is given at the end.

10.2 Literature Review

History has witnessed that economic growth is completely associated with structural change. Structural economists like Kuznets empirically validated that growth is conveyed by change in sectorial composition. Structural change is a long process that reallocates labor and capital from one sector to another resulting in differences in labor and capital productivity across different sectors. Demand side factor such as income elasticity of demand is considered as the driving force behind changes in product structure of an economy. The supply side factors such as change in technology, geographical condition, intuitional responses and trade inter-industry division of labor also led to relocation of activities from one sector to another sector. Whatever may the reason of structural change, it leads to economic growth in all aspect.

By using Generalized Method of Movements of dynamic panel data model for highly developed 21 OECD countries for the period 1960–2011 and for transition and Mediterranean countries over a shorter time period from 1990 to 2011, Teixeira and Queiros (2016) analyzed the impact of two core variables such as (1) human capital measured by the average educational attainment of adults (2) structural change measured by share of employment in knowledge/technology intensive industries on economic growth. Some control variables like investment, public consumption, population growth, institutional environment have used in the study which considered as relevant factors for economic growth. The study has observed that, countries with a higher stock of human capital tend to grow faster than others. A higher stock of human capital improves the workers skill which has a positive

impact on productivity. Countries that experiencing changes in productive structure towards a greater share of technology/knowledge intensive industries will tend to observe high economic growth. Therefore, growth rate of countries that observe an increase in the specialization in high level industries tend to be higher. The estimated result replicates that, the estimated, isolated impact of human capital and structural change on economic growth is higher for OECD countries for long period of time (1960–2011) than European and Mediterranean countries over shorter time span (1990–2011). It seems evident that, the effects of the interaction between structural change and human capital only appear in long term yielding opposite results in shorter period. Regarding the control variable it has observed that, investment/physical capital variable plays an important role in economic growth both for more developed, western countries and eastern European, emergent economies. High public consumption can create market distortions than negatively affect economic growth. The study confirms that, a negative relationship between population growth and economic growth for developed OECD countries but it failed to find any evidence that population growth matters for economic growth for less developed countries. It has observed that, more democratic, freer countries have on average higher economic growth.

Sen (2016) analyzed various factors responsible for structural change in different countries like Malaysia, Republic Korea, Taipei, China and India etc. it has observed that, countries that have been able to successfully transfer workers from low productivity to high productivity sectors are seen to have sustained inclusive growth. It has argued that, the pace of structural transformation is determined by two independent set of factors such as the demand for labor from high productivity sectors and the supply of labor from low productivity sectors. Further, both government failures and market failures can negatively affect the demand for labor from high productivity sectors as well as constrain mobility of labor from low productivity sectors. Government failures such as labor regulations and product market regulations can have negative impact on the demand for labor in high productivity sector such as manufacturing, while land policies can create impediments in the smooth out movement of labor from low productivity sectors such as agriculture. Market failure such as lack of coordination in investment and credit market imperfections can have negative impact on the demand for labor in the modern sector of the economy unless addressed by effective industrial and financial policies while human capital-related market failures can limit the supply of skilled workers from low productivity sectors to high productivity sectors. With respect to India, the review has suggested that, stringent labor regulations, burdensome land acquisition policies, market failure related to human capital formation and skill development of labor force act as hindrances in the path of structural transformation. Given the very large share of workers employed in Indian agriculture and need to increase the rate of structural transformation in the economy requires easing government policies relating to functioning of land and labor market.

McGreor and Verspagen (2016) have analyzed the structural change process of Asian countries, observed that, structural change and productivity growth are interrelated because broad sectors of the economy offer different possible ways for

productivity growth. In particular, sectors in which more developed countries tend to relocate more labor than developing countries, tend to offer better opportunities for reaching high productivity levels. The agriculture sector dominates in low income countries, the manufacturing sector as well as service sector rise in middle income countries and the manufacturing share falls in high income countries with service sector. The findings revealed that, productivity growth within the sector is in most of the cases, the largest component of productivity growth in Asia. This is called static structural effect which is especially strong in countries with intermediate level of productivity growth. Whereas the dynamic structural effect had a negative impact on the Asian productivity growth. The dynamic effect measures the interaction between the change of sectorial employment share and change in the productivity of in a sector. The negative effect in many cases results from a process of deindustrialization where manufacturing declines in terms of employment share but at the same time it shows strong productivity increases. It has observed that structural changes are most important variable in determining potential productivity growth.

Dietrich (2011) has observed that, aggregate growth causes structural change and in terms of employment or in terms of real value added for most of the countries especially those with largest economics. Here, structural change decelerated in every short period of time and accelerated in every long period of time. Economic growth has a decelerating impact on structural change if the structural change measured in terms of change in employment. If the structural change measured in terms of real value added, the aggregate impact is positive which means that, change in sectorial structure of output is driven by changes in demand due to rising income or productivity growth differences. Second for the opposite case, that structural changes cause economic growth, the result for the employment and real value-added show less significant result, but the conclusion remains the same as structural change promotes economic growth or at least does not decelerate it. For France, Japan, Netherlands and US for the case of employment and for Germany, Italy and US for the case of real value added, a significant positive influence of structural change on economic growth has observed. Only for UK the result is inconclusive in this matter. It appears to be the case that, rigidities impede growth and therefore structural change is needed for economic growth.

There are many studies focusing on nature and patterns of structural change of different sectors of states as well as Indian economy. Setthy (2003) has analyzed the structural change across states over the period from 1980–81 to 1999–2000 by using the gross and net SDP and per capita SDP data. To observe the nature of structural change, sectorial composition GSDP and NSDP have examined based on different base period like 1960–61, 1970–71, 1980–81 and 1993–94. Until 1980s the share of agriculture has remained at one half or above for many states like Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, Orissa, Punjab and Haryana and Himachal Pradesh. The share of service sector has risen in almost all states but the most rapid expansion has taken place in states like Kerala and Maharashtra. The manufacturing sector has also experienced relatively adverse terms of trade in 1990s.

Rao (1979) has analyzed various fact about structural change in Indian economy for the period 1950–51 to 1976–77 and observed that, there is a fall in the share of primary sector in each of three sub periods covered the period 1950–1977. The share of secondary sector fell marginally in the first period and rises in the second and third period while the share tertiary sector recorded a rise in all these three periods. Bhattacharya and Mitra (1990, 1993) have analyzed about growth of service sector and its implications in India for the time period 1950–51 to 1986–87. They have observed that service sector is growing much faster than the commodity sector. It appears that income from service sector is growing much faster than the demand generated for service by commodity sector. These changes are in the direction of modernization and increasing share of secondary and tertiary sector. Nevertheless, Indian economy continue to be dominated by unorganized and private sector. However, starling feature of structural change is the failure of occupational structure to coincide with sectorial NDP structure. Papola (2012) has analyzed the process of structural change in India for the time period 1950 to 2004. He has divided the whole period into four parts from independence to mid-1960s, mid 1960 to 1980s, 1980 to early 1990s and from 1990s to 2004–05. It has observed that, the first three decades rate of economic growth followed by industrial sector.

Cortuk and Singh (2013) examined the changes in growth rate and how the rate of growth is different for 16 major Indian states for the period 2000–2006. It also analyzes the relationship between growth rate and structural change between states for the same period. The regression between SDP per capita and growth rate of the states shows a slight positive relationship which indicates the phenomenon of divergence among Indian states. Again, the regression between the structural change index (NAV) and growth rate of states shows somewhat flatter regression line through with a positive slope indicating a weak positive relationship between structural change and growth over this period. There is a clear negative relationship observed between per capita SDP and structural change. This indicates that India's richer states have seen less structural change over this period. The basic regression result shows that structural change In Indian economy is significant in explaining growth of economy for the period 2000–2006 but not vice versa. Growth does not seem to lead to structural change. However, the result emerges only if specification of disturbance term is carefully done. In particular, the study has allowed hetero-scedastic, auto-correlated type of AR (1) and cross-sectional correlated error terms. Otherwise both the lagged growth and lagged structural change have insignificant effects in explaining its impact on growth and structural change of current period. The study also analyzed that, the growth is more persistent and cumulative in richer states.

Bagchi et al. (2005) have analyzed the how Gujarat model of growth has benefited most of the population for the period from 1970–71 to 2000–01. It has observed that economic growth is sustained by growth of tertiary and secondary sector which has a little impact on the growth rate of primary sector. Growth rate of service sector has increased from 5% during 1970s to 7% during 1980s further to 8% during in 1990s. Within the tertiary sector, trade, hotels, Insurance, storage,

transport, communication and real estate play a leading role in generating income growth during these periods. Therefore, it seems that the economy of Gujarat grew in a volatile and unbalanced fashion over the period under consideration. Agriculture accounted for 52% of workforce and 13% of NSDP during 2000–01. Such a discrepancy seriously damaging the implications for income and security of people engaged in the sector. The share of number of factory employees to the all India total has increased only marginally, but the corresponding shares of productive capital, value of output and net value added increased at a much faster rate especially in 1990s. The factory sector has undergone a high degree of concentration than in the rest of India. Similarly, in case of manufacturing sector the share of the sector in GDP is much higher than the share of employment. The productivity of labor in manufacturing sector was also more than its wage rate.

10.3 Data and Methodology

This study is based on secondary data for 14 major states. To analyze structural change in term of income, data on disaggregated NSDP are collected from online EPW research foundation for the period 1993–94 to 2011–12. Disaggregated NSDP for this period corresponds to three different series such as 1993–94, 1999–00 and 2004–05. Series 1993–94, 1999–00 are converted to 2004–05 series to arrive at a comparable data for the total period. To understand sectorial contribution to NSDP of each state, percentage is used. NAV and MLI are calculated using these sectoral shares in income and are considered as structural change in income. Trend growth rate of per capita real income at 2004–05 constant prices is estimated from semi-log model which takes into account all years during a period. This is treated as dependent variable in case of regression analysis. Similarly, enrolment and gross enrolment ratio for higher education, and population data are also collected from online EPW research foundation database. Enrolment per ten thousand population is used as proxy human capital for 1993–2011 and GER for 2004–2011. Credits extended by all scheduled commercial banks are taken as proxy for investment data from www.rbi.org.in. Share of employment in industry sector is used from different quinquennial round for 1993–2011. This could be considered as another proxy for structural change in employment.

10.3.1 Estimation of Structural Change in Income

Structural change is calculated using the following methodology as available in the recent literature. This estimated structural change is alternately considered as one of control variables in Eq. (10.5) to explain differences in growth rate of per capita real income across states in India.

Norm of Absolute Value Index

The norm of absolute value (NAV) is a simplest index to measure structural change given by Dietrich (2009). Let ϕi, T be the share of sector i in the final period T and $\phi_{i,S}$ be the share of sector i in the initial period S. The NAV index can be written as

$$\text{NAV} = \frac{1}{2}\sum_{i}^{s}\left|\Phi_{i,T} - \Phi_{i,S}\right| \tag{10.1}$$

NAV index can take a value from zero, if the sectorial shares remain constant, to unity, if the change in all sectors is at its highest implying that the whole economy undergoes a total change. According to this index, structural change is equal to the overall change in the distribution of economic activity across the sector.

Modified Lilien Index

Lilien index was originally used to measure the sectorial growth rate for the demand for labor from period S to period T and employed to measure the degree of liquidity of factor allocation. However, Deitrich (2012) modified the Lilien index by augmenting it with weights of the share of the sector in both periods. The MLI can be written as follows.

$$MLI = \sqrt{\sum_{i}^{s}\Phi_{i,S}\Phi_{i,T}\left(\log\frac{\Phi_{i,S}}{\Phi_{i,T}}\right)^{2}} \tag{10.2}$$

A low MLI implies that the structural change in the economy is taking place at a slow rate, while a high MLI means that structural change is occurring at a rapid rate. A major drawback of the MLI and NAV indices is that while they provide a useful summary of the change in the structure of the economy, they do not provide any information on how the change in the economy impacts productivity.

McMillan and Rodrik Index

McMillan and Rodrik (2011) consider the base period employment shares and final period productivity levels. More specifically, the change in labor productivity is decomposed as where Δy is the change in aggregate labor productivity between final and initial period, and y_{it} and y_{is} are the sectorial labor productivity levels in the final and initial period, respectively. Similarly, ϕ_{it} and ϕ_{is} are the final and initial employment shares of the various sectors. The first term is positive when the weighted change in labor productivity levels in sectors is positive, and reflects the contribution to overall productivity change from an increase in sectorial labor productivity. This is referred to as the within effect. The second term in Eq. 10.3 is the reallocation effect, which reflects the change in labor productivity due to reallocation of employment across sectors, and is positive when labor moves from less

to more productive sectors. This is also referred to as structural change in McMillan and Rodrik (2011) and Hansen et al. (2001).

$$\Delta Y = \sum_i \left(y_{i,T} - y_{i,S}\right)\Phi_{i,S} + \sum_i \left(\Phi_{i,T} - \Phi_{i,S}\right)y_{i,T} \tag{10.3}$$

Timmer and De Vries Index

Timmer and De Vries (2009) argue that the structural change term in the McMillan and Rodrik index is only a static measure of the reallocation effect as it depends on the differences in productivity level and not their growth rates. They use the base periods for the productivity levels as well as employment share, and introduces a third interaction term.

$$\Delta Y = \sum_i^s \left(y_{i,T} - y_{i,S}\right)\Phi_{i,S} + \sum_i^s \left(\Phi_{i,T} - \Phi_{i,S}\right)y_{i,S} + \sum_i^s \left(y_{i,T} - y_{i,S}\right)\left(\Phi_{i,T} - \Phi_{i,S}\right) \tag{10.4}$$

Here, the first term as before reflects the contribution to overall productivity change from an increase in sectorial labor productivity (the 'within effect'). In the second term, the term within parenthesis would be positive for sectors that have witnessed an increase in employment share and negative for sectors that have experienced a decline in employment share. So, a positive second term would imply that sectors, which witnessed an increase in employment share, were the ones that had a higher level of initial productivity. The third term, which is the interaction term, represents the joint effect of changes in sectorial productivity levels and employment shares. A positive term implies that workers are moving into sectors where productivity levels are increasing.

Thus, the reallocation effect term in Eq. (10.3) is broken into two different terms in Eq. (10.4) where the first term represents if labor has moved into sectors that have above average productivity levels and the second term indicates if sectors that have witnessed an increase in employment shares have also experienced productivity growth. De Vries et al. (2015) refer to the first term as 'static reallocation effect' and the second term as 'dynamic reallocation effect'.

Growth Regression Framework

In the line with Teixeira and Queiros (2016), econometric specification is based on catch up equation (Barro and Sala-i-Martin 2003) that can be given as

$$Y_i = \beta_0 + \beta_1 IPCIi + \beta_2 SCI_i + \beta_3 INV_i + \beta_4 SCI_i + \beta_5 HC_i + \beta_6 (SC_i \times HC_i) + u_i \tag{10.5}$$

where

Y_i	is the trend growth rate of per capita real income of state *i*
IPC	Initial level of per capita income
SCI	Structural change in income
INV	Average per capita investment
SCE	Structural change in employment in industrial sector
HC	Enrollment in higher education per thousand population
$HCI \times HC$	Interaction between structural change in employment in industrial sector and enrollment in higher education per thousand population
u	random error term
i	1, 2, … 14 Indian states.

10.4 Empirical Results on Structural Change in Income

Using Eqs. (10.1) and (10.2), NAV and MLI are calculated and presented in Table 10.1. These indices are based on the change in income shares from 1993–94 to 2011–12. This period is divided into three sub-periods: 1993–1999, 2004–2011 and 1993–2011. NAV index lies "between" 0 and 1. Except Andhra Pradesh and West Bengal, NAV index for all other states is greater than one for all the sub-periods. According to this index structural change is equal to the overall change in the

Table 10.1 NAV and MLI in income across 14 states from 1993–94 to 2011–12

Index		NAV			MLI	
Time Period	1993–1999	2004–2011	1993–2011	1993–99	2004–2011	1993–2011
AP	0.85	0.75	1.07	0.25	0.48	0.34
BI	1.32	2.24	1.12	0.78	0.38	0.45
GJ	1.20	2.33	1.18	0.66	0.36	0.34
HY	1.52	2.18	1.17	0.58	0.40	0.42
KN	1.30	1.64	1.31	0.45	0.39	0.35
KR	1.58	3.25	1.13	1.40	0.39	0.66
MP	1.17	1.11	1.40	0.33	0.48	0.34
MH	1.30	2.07	0.97	0.63	0.30	0.37
OR	1.50	1.71	1.43	0.49	0.48	0.42
PN	1.26	1.75	1.33	0.62	0.42	0.44
RJ	0.97	1.57	1.18	0.53	0.36	0.32
TN	1.11	2.08	1.12	0.68	0.36	0.33
UP	1.07	1.39	1.21	0.41	0.38	0.33
WB	0.57	6.94	6.48	2.85	2.90	0.16

Source Author's calculation from Eqs. (10.1) and (10.2)

distribution of economic activity across the sector. One of the possible explanations for this high index is due to the conversion of series 1993–94 into 2004–05 which might have resulted in over estimation of the value of income or output before the year 2004–05.

Lilien index is originally used to measure the degree of liquidity of factor reallocation. Dietrich (2012) modified the Lilien index (MLI) by augmenting with weights of the share of sectors in both periods. A low MLI implies that the structural change in the economy is taking place at a slow rate, while a high MLI indicates that structural change in occurring at a rapid rate. The calculated values for this index for different periods are given in Table 10.1. During 1993–2011, MLI ranges from 0.16 (West Bengal) to 0.66 (Kerala). This means that structural change in West Bengal is slow and it is high in Kerala. Since this estimation is different from Sen Gupta et al. (2016) in terms of sample size and time period. NAV and MLI index values may not be comparable.

McMillan and Rodrik (2011) decompose change in labour productivity based on period employment share and final period productivity levels to evaluate the contribution to growth arising from reallocation of workers/labour force across the sectors (within and between effects). Using this concept from Eq. (10.3), decomposition is evaluated in per capita income/output and the estimated average productivity is given in Table 10.2.

During 1993–2011, within effect is more than between effect to contribute to growth of per capita income for all the states. Positive within effect reflects the increase in sectoral productivity to overall change in growth whereas, positive between effects reflects the change in labour productivity due to reallocation of employment across sectors from less to more productive sectors. The calculated values for this decomposition are in lower side for all these states as population is used instead of employment.

De Vries et al. (2015) argue that structural change estimation in McMillan and Rodrik index is only a static measure of the reallocation effect as it depends on the differences in productivity level and not their growth rates. They suggest alternative decomposition method to account for differences in growth and levels across the sectors, which may be negatively correlated. It uses the base periods for productivity levels and employment share as well as joint effect of changes in sectoral productivity levels and employment shares to evaluate within effect, static effect and dynamic effect. In fact, the reallocation effect is divided into static and dynamic effect. Static effect relates to movement in labour from less average productive to above average productivity levels. Dynamic effect indicates if sectors that have witnessed an increase in employment share have also experienced productivity growth. Table 10.3 reveals the calculation of this index. The values of static effects are negative for industry that has not moved less productive sector to more productive sectors. Since it is based on population figure instead of employment, values of within, static and dynamic effect for decomposition may need further examination.

Table 10.2 McMillan and Rodrik index for 14 states from 1993 to 2011

Time period	1993–1999			2004–2011			1993–2011		
Decomposition	Within effect	Between effect	Total growth	Within effect	Between effect	Total growth	Within effect	Between effect	Total growth
AP	0.51	−0.14	0.38	0.57	−0.10	0.47	0.63	−0.12	0.51
BI	3.18	−0.74	2.45	−0.10	0.00	−0.10	1.04	−0.27	0.77
GJ	0.57	0.14	0.71	−0.14	0.03	−0.11	0.15	0.08	0.23
HY	2.05	−0.38	1.67	−0.10	−0.02	−0.11	0.66	−0.09	0.57
KN	0.96	−0.05	0.92	−0.19	0.01	−0.18	0.20	0.05	0.24
KR	−0.47	0.15	−0.32	0.01	−0.03	−0.02	−0.02	0.02	0.00
MP	2.27	−0.26	2.00	−0.18	−0.02	−0.20	0.69	−0.07	0.62
MH	−0.47	0.04	−0.43	−0.01	0.06	0.05	−0.22	0.05	−0.17
OR	3.37	−0.22	3.15	−0.12	0.02	−0.11	1.08	0.11	1.19
PN	1.73	−0.57	1.16	−0.03	0.00	−0.03	0.61	−0.18	0.43
RJ	1.16	−0.30	0.86	−0.08	0.02	−0.06	0.36	−0.09	0.27
TN	0.19	0.18	0.38	−0.07	0.00	−0.07	0.09	0.07	0.16
UP	−0.31	−0.12	−0.43	−0.14	−0.02	−0.16	−0.26	−0.04	−0.30
WB				−6.90	−0.10	−7.00	0.37	0.03	0.39

Source Author's calculation from Eq. (10.3)

Table 10.3 de Vries, Timmer and de Vries index for 14 states from 1993 to 2011

	1993–1999				2004–2011				1993–2011			
	Within	Static	Dynamic	Total growth	Within	Static	Dynamic	Total growth	Within	Static	Dynamic	Total growth
AP	4.61	−1.30	−0.08	3.22	6.25	−1.85	0.80	5.20	13.21	−3.61	1.24	10.83
BI	27.58	−5.45	−1.93	20.19	−1.10	−0.82	0.80	−1.12	21.92	−7.27	1.21	15.85
GJ	5.45	−1.65	3.07	6.87	−1.50	−0.35	0.69	−1.16	3.17	−2.10	3.10	4.18
HY	19.29	−3.25	−0.57	15.47	−1.08	−1.05	0.87	−1.26	13.87	−5.21	3.40	12.06
KN	9.64	−1.33	0.85	9.16	−2.13	−0.65	0.80	−1.99	4.12	−2.43	3.35	5.05
KR	−1.00	−11.31	12.81	0.49	0.14	−1.14	0.78	−0.22	−0.32	−18.78	18.38	−0.72
MP	21.83	−1.54	−1.10	19.20	−2.00	−1.46	1.29	−2.17	14.50	−3.91	2.17	12.75
MH	−4.26	−1.63	2.03	−3.87	−0.16	0.21	0.46	0.52	−4.59	−1.82	2.70	−3.71
OR	31.84	−1.87	−0.30	29.67	−1.37	−1.06	1.24	−1.19	22.77	−3.69	6.01	25.09
PN	15.62	−4.43	−1.32	9.87	−0.35	−0.97	0.98	−0.34	12.71	−6.15	2.46	9.02
RJ	10.14	−2.96	−0.05	7.13	−0.91	−0.43	0.69	−0.64	7.55	−3.96	1.83	5.43
TN	2.66	−1.23	3.08	4.51	−0.74	−0.71	0.70	−0.75	1.97	−1.72	3.10	3.35
UP	−3.50	−2.21	1.04	−4.67	−1.53	−0.99	0.81	−1.72	−5.37	−3.78	2.94	−6.22
WB	180.49	7.96	634.09	822.54	−75.95	−62.39	61.29	−77.05	7.69	−0.31	0.83	8.21

Source Author's calculation from Eq. (10.4)

10.4.1 Empirical Analysis of Structural Change and Economic Growth

Given that our estimation for McMillan and Rodrik index and de Vries, Timmer and de Vries index for within and between effects (static and dynamic) are fragile, NAV and MLI index are used to represent structural change. This structural change may be occurring due to some other factors such as investment, demography and urbanization, human capital, level of technology, quality of social and political institutions etc. Therefore, structural change interaction with these control variables over long period of time can affect the growth process.

An attempt is made here to estimate Eq. (10.5) to examine the effects of structural change, investment per capita, gross enrolment ratio (GER) for higher education, share of employment in industry, and interaction of human capital and structural change on economic growth across 14 Indian states during 1993–2011. Treating trend growth rate of per capita real income as dependent variable and using different specifications for independent variables, five different models have been tried within cross-sectional growth regression framework and estimated results are given in Table 10.4.

Table 10.4 Cross-sectional regression of economic growth, investment, human capital and structural change for 14 major Indian states during 1993–2011

Dependent variable: trend growth rate of per capita real income (1993–2011)					
Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	−9.834 (−1.38)	−9.823 (−1.32)	1.454 (1.02)	0.639 (0.39)	2.766 (1.15)
Initial level of per capita real income	1.486* (2.22)	1.480 (1.96)*	−2.026 (−1.31)		
Structural change in income		0.002 (0.04)	0.037 (0.82)	0.031 (0.69)	−0.081 (−1.16)
Per capita investment			5.89E−05 (1.93)*	0.000 (0.91)	0.000 (0.75)
Structural change in employment in Industrial sector (SCE)			0.140 (2.43)**	0.162 (2.61)**	0.156 (2.89)**
Human capital (HC)				0.154 (0.97)	0.151 (1.09)
Structural change (emp)*HC					0.009 (1.98)*
R-sq	0.253	0.253	0.525	0.570	0.710
Adj R-sq	0.191	0.117	0.383	0.379	0.529
F-stat	4.067	1.865	3.685	2.982	3.917
Prob (F-statistic)	0.067	0.201	0.051	0.080	0.043

Note t-values are given in parentheses. ** & * significant at 5 and 10% level, respectively
Source Equation (10.5)

Given the other control variables constant, growth rate of per capita real income is regressed on the initial level of per capita real income for Model 1 to observe absolute convergence or divergence across 14 Indian states. The positive and significant coefficient implies the evidence of absolute divergence during the period 1993–2011. This means that relatively rich states with higher initial level of per capita real income have grown faster than the relatively poor states in India during this period.

Model 2 is estimated by taking initial per capita real income and structural change in income as independent variables. It shows that growth rate of per capita real income is positively and significantly related with initial level of per capita real income. This shows the divergence pattern of growth across Indian states during 1993–2011. But, structural change coefficient is negative and not significant. Similar kind of insignificant impact is found if MLI is also used. However, the regression model in this case is not significant as indicated by F-statistics of the model.

Once more number of variables such as initial level of per capita real income, structural change in income, per capita investment and structural change in employment are included in the Model 3, the explanatory power of the model has improved to 53% as reflected in R-squared value. The estimated coefficients of per capita investment and structural change in employment are positive and significant. States with higher investment in different economic activities and higher employment share in industrial sector have grown more than that of others across 14 Indian states during 1993–2011. Shift in labor/workers from agricultural to especially construction of industrial sector has significantly impacted the growth process of the states. The coefficient of initial level of per capita real income is negative implying the tendency of divergence across the states. The coefficient of structural change indicator for income is positive. However, they are not statistically significant from zero.

Model 4 is estimated including human capital along with the variables used in Model 3. The explanatory power of the model has marginally increased from 0.53 to 0.57. Except structural change in employment in industrial sector, none of the estimated coefficients are statistically significant from zero. Shift in workers from less productive rural areas to productive construction activities in rural and urban areas has contributed to the growth of per capita real income across the states during the period 1993–2011. However, the positive signs of the coefficients of structural in income, investment and human capital show the positive direction to affect the growth processes.

Since structural change in employment in industrial sector and human capital are interacting and positively associated each other, interacting variable is created to see its impact on growth of income. It is positive and significant in Model 5 implying that productive industrial sectors have attracted the skill work force and the combination of the two has resulted into positive economic growth. Human capital as measured by enrolment in higher education alone cannot affect the growth. However, positive coefficient for human capital indicates that there is positive tendency of human capital to impact economic growth.

10.5 Conclusion

This paper reviews the recent growing body of literature on structural change, human capital and economic growth, and examines impact of structural change on economic growth. After calculating the share of different sectors in NSDP and following in the line with Dietrich for NAV and MLI, McMillan and Rodrik for within and static effects, de Vries et al. for within effect, static and dynamic effect, it estimates structural change in income for 14 major states from 1993–94 to 2011–12. There is an increasing trend in patterns of structural change as evident by NAV and MLI across sectors to contribute to the growth process of per capita real income. However, since it is based on population instead of employment data for labor productivity, these estimates are fragile. Using employment data, labor productivity can be found as per McMillan and Rodrik and de Vries et al. for fine tuning the estimates of structural change.

Regression analysis shows that it finds the evidence of absolute beta divergence indicating the relatively richer states have grown faster than the relative poorer states in India. Including structural change in income and employment in industrial sector (high intensity) along with other control variables such as per capita investment, human capital, and initial level of per capita real income in cross-sectional regressions, significant contribution of structural change for economic growth across the states during this period.

Most of the important fundamental variables as identified and verified by neoclassical and endogenous growth theories are not statistically significant due to typical problems in cross-sectional regression framework that usually suffer from many econometric problems. The estimated coefficients of these variables can be improved in direction and magnitudes with better measurements of variables and suitable econometric techniques. Due to conversion of series from 1993–94 to 2004–05, disaggregated NSDP data might be overestimated because of changes in output and price levels over time. Since the sample is small (14), there is degree of problem. If we include more number of variables into the model, this problem can be dealt with. Average of variables between the periods will not consider all values of all years. Since human capital, investment and growth are correlated to each other, is problem of simultaneity. Independent variables are also highly correlated to each other giving rise to problem of multicollinearity. Many of these problems can be sorted out once we increase the sample size, longer period. There may also be omitted variable bias. Further, fixed effect and dynamic panel data models can take care of most of these problems since lagged dependent variables is appearing as one of the independent variables.

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