# Structural Change and Poverty Reduction at Sub-State Levels in India

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# Structural Change and Poverty Reduction at Sub-State Levels in India*

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## Abstract

Over the last two decades India has witnessed a significant rise in growth rate compared to historical levels. In this study, we investigate the pattern and nature of growth, and its implication for poverty reduction in India. In particular, we focus on the extent to which, structural change defined as changes in the composition of the economy in terms of key sectors, their employment and productivity, has an impact on poverty reduction. The paper is first of its kind in focusing on these issue at the sub-state level, which is important given the large size of Indian states that mask a great deal of heterogeneity. Moreover, the paper focuses on alternate definitions of structural change, including for the first differentiating between productivity increases in India arising from workers moving into above average productivity level sectors from workers moving to sectors that are experiencing positive productivity growth. The paper finds that while improving sectoral productivity is important for poverty reduction, there is a strong link between shift of workers into sectors witnessing an increase in poverty and poverty reduction. Thus poverty reduction requires generating jobs in dynamic sectors that are witnessing productivity growth as well as imparting adequate skills to the workforce to make them employable in these sectors.

Keywords: Structural change, poverty reduction, reallocation effect and labour productivity

JEL Classification: I32; J24; J62; R11.

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*The views expressed in this publication are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent.

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# 1. Introduction

India's economy started experiencing robust growth in the 1980s, following 3 decades of slow growth. Average annual GDP growth increased from 5.6% in the 1980s to 5.9% in the 1990s, and further to 7.3% in the 2000s. As a result, India's per capita GDP increased more than five folds during these three decades to almost USD1500 by 2015, enabling its transition into a middle income country. Moreover, the growth has been broadly inclusive. Poverty rates based on World Bank's USD1.90 a day poverty line, exhibit a decline from 52.6% in 1983 to 21.3% in 2011-12. A reduction of slightly higher magnitude is witnessed using the national poverty lines, according to which poverty rates have more than halved from 45.3% in 1993-94 to 21.9% in 2011-12.

While these trends are encouraging, they mask a great deal of divergence at the sub-national level. At the state level, per capita GDP of Haryana, one of the richest states in India, is nearly 3.7 times that of the poorest state of Bihar. International comparison implies that while Haryana's per capita GDP is close to that of Vietnam, Bihar's is closer to that of Eritrea or Guniea-Bissau. A further disaggregated analysis at the district level indicates an even greater degree of divergence. The district of Gurgaon in Haryana has a per capita GDP, which in 2011, was 28 times that of the poorest district of Madhepura in Bihar. Again, in international terms, this would imply a comparison between People's Republic of China and Burundi, with the latter being the lowest ranked economy in terms of per capita income in 2011.

Similarly, despite a secular decline in poverty rates, some states continue to have a significant proportion of their population below the poverty line. For example, close to 40% of the population in Chhattisgarh continue to live in abject poverty, while in Bihar the ratio is close to 33.7%[1]. At the other extreme, Himachal Pradesh, Kerala and Punjab have less than 8% of the population living below the poverty line. What this means is that, even as India witnessed rapid growth and poverty reduction since 1990s, it has not been able to eliminate the large disparities across states and regions, which continue to pose a challenge for policy makers.

In this paper, we investigate the pattern and nature of growth, and its implication for poverty reduction in India. In particular, we focus on the extent to which, structural change defined as changes in the composition of the economy in terms of key sectors, their employment and productivity, has an impact on poverty reduction. The underlying theme is that shift of resources from low productivity sector into high productivity sector not only facilitates growth but also reduces poverty, as average wages tend to be higher in sectors with higher productivity.

While several papers have looked into the extent of structural change in India, with a few looking at the relationship between structural change and poverty reduction, this paper's contribution is threefold. Firstly, while much of the existing literature evaluates the extent of structural change at the aggregate country level or at the state level, this paper undertakes an analysis at the sub-state level. The latter becomes important given the large size of Indian states, which can mask a great deal of heterogeneity. Secondly, we extend the existing analysis to 2011-12, covering the period 2009-10 to 2011-12, when India witnessed the fastest pace of poverty reduction. Finally, the paper analyses various alternate definitions of structural

[1] Poverty estimates at the state and sub-state levels are based on Tendulkar Poverty Lines for 1993-94, 2004-05, 2009-10 and 2011-12. For 1999-00, given the lack of comparable estimates and after considering alternative methodologies, poverty estimates are based on interpolation of 1993-94 and 2004-05 at the state and sub-state levels separately for rural and urban areas.

change. These range from indices that define structural change as the aggregate shifts in sectoral shares, to structural change being associated with productivity increase, where changes in employment shares of the sector are weighted by productivity levels. For the first time, this paper differentiates between productivity increases in India arising from workers moving into above average productivity level sectors from workers moving to sectors that are experiencing positive productivity growth.

We focus our attention on 18 major states of India, which together account for nearly 84% of output, 96.7% of employment and 93.7% of people living below the poverty line. We analyze the 55$^{th}$, 61$^{st}$ and 68$^{th}$ rounds undertaken in 1999-00, 2004-05 and 2011-12. The choice of the initial period is driven by the availability of data on district domestic product, while the choice of the final period is based on the most recent data on poverty estimates This period coincides with the high growth period in India, with India's GDP growing at an average annual rate of 7.4%, and poverty declining from 45.3% in 1993-94 to 21.9% in 2011-12.

## 2. A Brief Review of the Existing Literature

The process of structural transformation typically referring to the reallocation of labour across sectors over time has been extensively well documented with notable early contributions from Clark (1957), Chenery (1960), Kuznets (1966) and many recent contributions including Duarte and Restuccia (2010), McMillian et al (2014). The early work starts with analysis of structural transformation of the global economy as a whole. The appearance of the new data sets and long time series at the country level over time made it worthwhile to study the role of structural change at the regional level and the country level. Later contribution is important as the nature and speed with which structural transformation takes place differs across regions/countries and can be an important contributor to overall country's economic growth and poverty reduction. In fact, this paper is an attempt to study the role of structural transformation in India at sub-state level.

At the global level, McGregor and Verspagen (2016) analyzed the role of structural transformation and found that at levels of GDP per capita below $5000, agriculture is the dominating sector and its share in the employment declines as GDP per capita increases. Another structural break takes place at around $12000 when the share in the manufacturing sector declines. However, this process of structural transformation and growth differs across regions and countries which in turn are influenced by various factors (Felipe et.al (2015); Sen (2016)).

Developing countries are characterized by large productivity gaps across sectors and within sectors. High-growth countries are typically those that have experienced growth-enhancing structural change—movement of workers from low-productivity activities such as agriculture to high-productivity sectors such as manufacturing and services, leading to an increase in productivity and incomes. McMillian and Rodrik (2011) found that structural change has been growth reducing in both Africa and Latin America while pattern of structural change has been growth inducing in Asia with labour moving from low to high-productivity sectors. The results for Africa appeared to be puzzling since countries in Africa are by far the poorest countries in the world and thus stand to gain the most from structural transformation. Subsequently, after deeper research, McMillian et al (2014) learned that things seem to be turning around in Africa after 2000, with structural change contributing positively to overall productivity growth. Further, authors identified three factors that help determine the extent to which structural change contributes to overall productivity growth. Structural change has typically been growth reducing for countries with a relatively large share of natural resources in exports; whereas,

competitive or undervalued exchange rates and labour market flexibility contributes to growth enhancing structural change. Ungor (2015) compared Latin America with East Asia and reported similar findings. Latin American countries exhibit much slower de-agriculturalization than East Asian countries, while the manufacturing employment share has been almost stagnant in Latin America but exhibits a hump shaped pattern among East Asian countries.

In the Asian context, the pace of structural transformation has differed widely across countries. The so-called Asian Tigers (the Republic of Korea; Taipei, China; Singapore; Hong Kong, China) were the first generation of postwar developing countries that managed to make the transition to developed economies by going through a deep process of structural transformation. (Felipe, et al. (2014)). However, there are other Asian countries, which have not done as well in terms of structural transformation even when they enjoyed growth success.

Betts et al. (2013) and Teignier (2013) studied the path of structural transformation in South Korea during its growth miracle period. The studies found a vital role of comparative advantage and international trade in accelerating the transition out of agriculture into industry and services. Dekle and Vandenbroucke (2012) studied structural transformation in China during 1978–2003 and found that differential sectoral productivity growth and the reduction of the relative size of the Chinese government caused most of the structural transformation, but mobility frictions (like the household registration system known as hukou system) slowed the movement out of agriculture.

Various studies have shown that structural transformation in India has been very slow and is atypical in the Asian context (Kocchar et al (2006), Sen (2014)). This is because of the various reasons—fall in share of labour-intensive manufacturing in total output over time (Sen (2009)), shift in economic activity towards services and not manufacturing as in the case of other Asian high-growth economies and dualism of India manufacturing sector with rising gap of the labour productivity in the formal sector vis-à-vis informal sector. In studying the role of structural transformation in India during 1980-2005, Verma (2012) also found that Total Factor Productivity growth was fastest in services. This growth pattern differs not only from the historical growth experience of developed countries such as United Kingdom, France and the United States but also from many Asian economies.

The literature on structural transformation identified two broad factors affecting role of structural transformation in various economies—government failures and market failures (Sen 2016). The first relates to government failure including labour regulations/policies (Besley and Burgess (2004), Botero et al (2004) and Fallon and Lucas (1993)), land policies (Studwell (2013)) and product market regulations (World Bank (2013)) which can impede the functioning of factor and product markets affecting the reallocation of labour from low-productivity sectors to high productivity sectors. Market failures such as coordination problems in investments (Lin and Monga (2010)), credit market imperfections (Stiglitz and Weiss (1981); Sen and Vaidya (1997)) and human capital formation are other potential reasons which affect the demand for labour in high-productivity sectors and the supply of labour from low-productivity sectors.

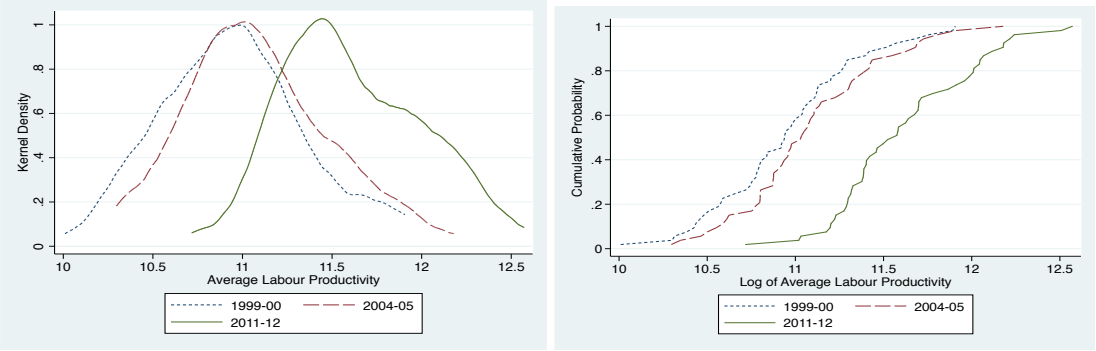
## 3. Extent of Structural Change across Regions

In this section, we catalogue the movement of resources across sectors as a driver of growth in India. We focus on the period from 1999-00 to 2011-12, the latter being the latest year for which employment and poverty data is available. While ideally the

analysis should be conducted at the district level, there are some difficulties. Out of the nearly 15,000 observations available (451 districts, 11 sectors and 3 years), nearly 3000 or about 30% of the observations have a positive sectoral district domestic product without having a corresponding employment figure. This could be driven by a small sample size of sectors that traditionally employ a limited set of workers. This makes calculating labour productivity difficult. To overcome this, we conduct our analysis at the region level, which is aggregation of districts. The 18 states that we focus on are accordingly decomposed into 53 regions. In the case of smaller states of Jharkhand, Chhattisgarh and Uttarakhand, the entire states can be considered as a region, the larger states are divided into two or more regions. In particular, the region comprises groups of districts that form contiguous clusters and in most instances have socio-cultural relevance.[2]

Even at the region level, there are 11 instances of regions having sectors with positive output but missing employment. Closer inspection reveals that in 10 such instances, the sectors were 'mining and quarrying' or 'electricity, gas and water supply'. Given the low employment potential of these sectors, we drop these sectors[3]. Another instance is the registered manufacturing sector in Assam Hills region. We drop this region from our analysis, and hence focus on 9 sectors across 52 regions.

**Figure 1: Distribution of Productivity per Worker Across Regions**




(a) Kernel Density (b) Cumulative Distribution

Source: Author's Calculations

Figure 1 plots the kernel density and the cumulative distribution of log of average productivity per worker across 52 regions over the periods 1999-00, 2004-05 and 2011-12. Several characteristics are evident. First, as expected there is a rightward shift of the distribution across the years, implying that productivity per worker increased between these periods at each point in the distribution. While average productivity grew at an average annual rate of 2.8% during the period 1999-00 to 2004-05, it accelerated sharply to 7.9% during 2004-05 to 2011-12. This has been associated with reducing variance, implying some degree of convergence across the regions over the years. Second, there is a slight increase in kurtosis, in 2011-12, compared to 2004-05. Finally, the extent of skewness increased sharply between 1999-00 and 2004-05 before falling a bit in 2011-12. The skewness is positive in both periods implying that the data is skewed right, with the right tail being longer than the left.

Next, we focus on the different measures of structural change and evaluate how the various regions in India have performed. We move from relatively simple definitions

[2] The classification of districts into regions is broadly in line with the classification followed by NSSO.

[3] At the national level, these two sectors account for 1.1% of employment.

of structural changes, where the focus is only on aggregate shifts in sectoral shares to more complex ones that combine changes in employment shares across sectors with productivity levels.

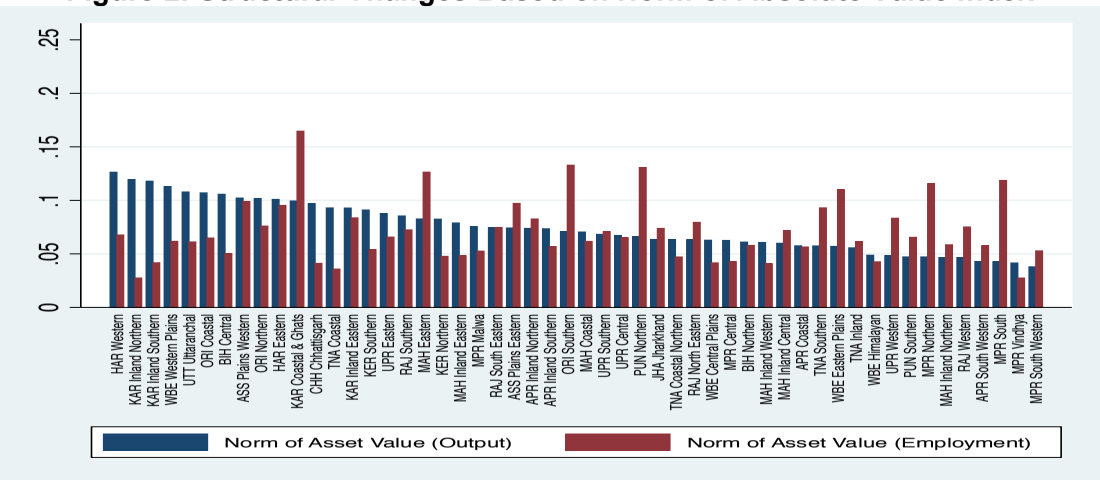
### 3.1 The Norm of Absolute Value Index

The Norm of Absolute Value (NAV), following Dietrich (2009) is the simplest index to measure structural change. Let $\phi_{i,T}$ 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 with. The NAV index is then given as

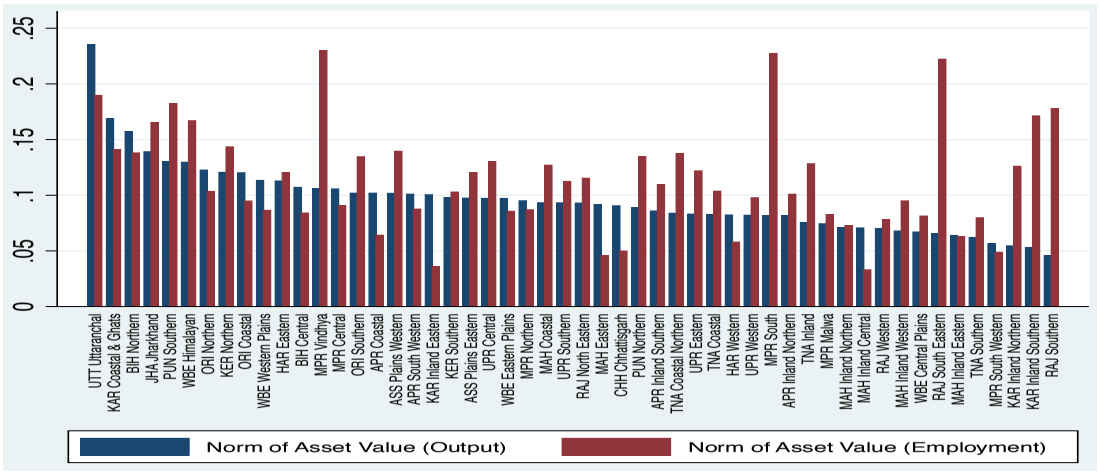
$$\frac{1}{2}\sum_{i}\left|\phi_{i,T}-\phi_{i,S}\right| \qquad (1)$$

The computation of this index involves taking the differences of the sector's share between the final period and the initial period, and summing up the absolute values of these differences. Finally, the resulting term is divided by two, as each change is counted twice. As a result, the index can take a value from zero, if the sectoral 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.

**Figure 2: Structural Changes Based on Norm of Absolute Value Index**




**(a) 1999-00 to 2004-05**




**(b) 2004-05 to 2011-12**

Source: Author's Calculations

Figure 2 highlights these indices for the 52 regions in India. We calculate the indices based on the change in output shares as well as employment shares between 1999-00 and 2004-05, and again between 2004-05 and 2011-12. The regions are ranked according to extent of structural change observed in terms of output. It is evident that there is very little correlation between change in structure of output and change in structure of employment in both the periods. Thus the change in sectoral share of output in these regions was not accompanied by labour moving in or out of these sectors. For example, in Haryana Western, which experienced the maximum structural change in terms of output, while share of agriculture in district domestic product declined by 11.6 percentage points between 1999-00 and 2004-05, the employment share increased by 0.5 percentage. In several other sectors, including unregistered manufacturing, trade, hotel and restaurants and banking, insurance and real estate, changes in sectoral share of output were in the opposite direction to changes in employment share. On the other hand, although share of registered manufacturing and construction in district domestic product increased by more than 4.0 percentage points, the increase in employment was much more muted.

At the same time, there is a negative, albeit low, correlation between structural changes taking place between 1999-00 and 2004-05 and those taking place between 2004-05 and 2011-12, implying that the process of structural change was not persistent.

### 3.2 Modified Lilien Index

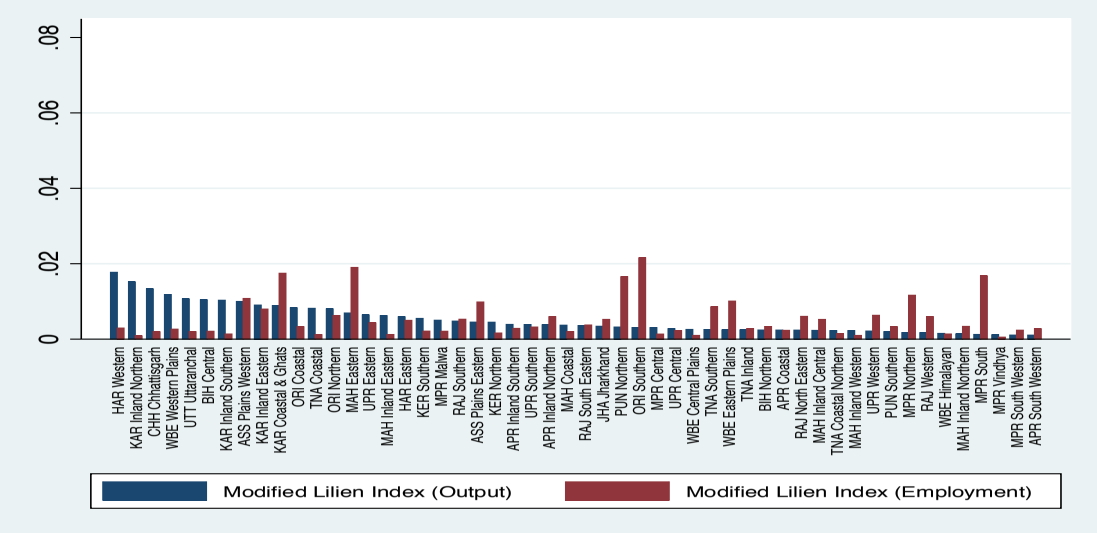
The second index used in the literature to measure structural change is a modified Lilien Index. It was originally used to measure the sectoral growth rate for the demand for labour from period S to period T and employed to measure the degree of liquidity of factor reallocation. However, Dietrich (2012) modified the Lilien index by augmenting it with weights of the share of sectors in both periods.

$$\text{MLI}=\sqrt{\sum_i \phi_{i,S}\phi_{i,T}\left(\log\frac{\phi_{i,S}}{\phi_{i,T}}\right)^2} \qquad (2)$$

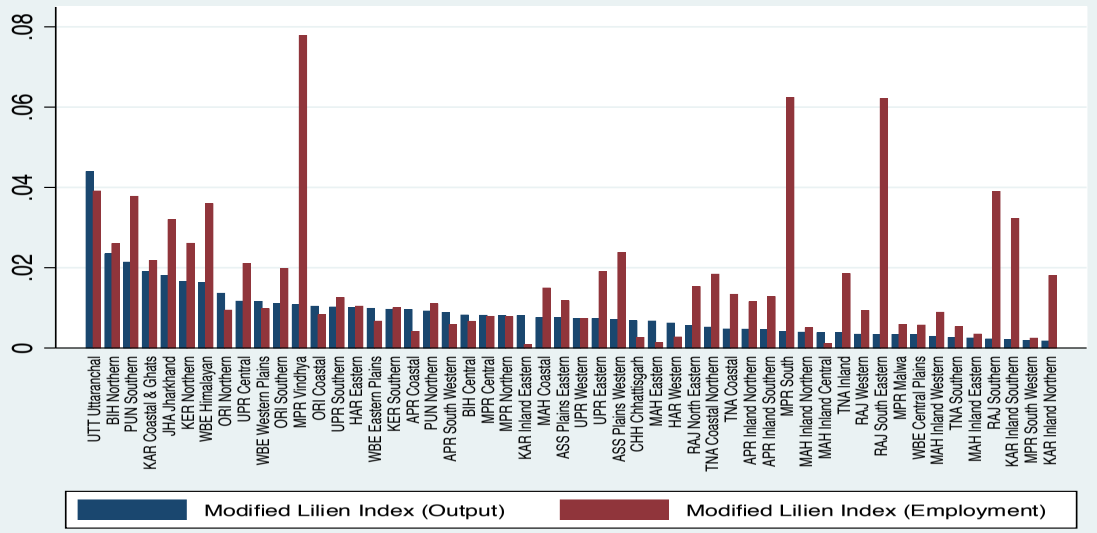
A low MLI implies that the structural change in the economy is taking place at a slow rate, while a high MLI means that structural change is occurring at a rapid rate. Based on these calculations, we construct the structural change indices for output and employment over the period 1999-00 to 2004-05 and 2004-05 to 2011-12. These are shown in Figure 3.

As can be seen from comparing Figures 2 and 3, the indices developed using the modified Lilien methodology is highly correlated with the indices constructed using the norm of asset value methodology. In fact, for the period 1999-00 to 2004-05, the correlations are as high as 0.93 for output shares and 0.94 for employment shares. While the correlation remains around 0.94 for employment share during the latter period, it increases to 0.96 in the case of output share. Moreover, both MLI and NAV indices indicate that the pace of structural change increased sharply during the period 2004-05 to 2011-12, compared to 1999-00 to 2004-05. While the average structural change in output during the first period according to the NAV and MLI indices were 0.075 and 0.005, respectively, it increased to 0.096 and 0.009 in the second period. Similarly, the average structural change in employment calculated using the NAV and MLI indices rose from 0.071 and 0.005, respectively to 0.114 and 0.017.

**Figure 3: Structural Changes Based on Modified Lilien Index**




**(a) 1999-00 to 2004-05**




**(b) 2004-05 to 2011-12**

Source: Author's Calculations

### 3.3 McMillan and Rodrik Index

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. Consider an example, where industry employs 40% of the workforce, while agriculture and services employ 30% of workforce each. Labour productivity in the services sector is higher than in the industry sector, which in turn is greater than agriculture sector. Both the NAV and MLI would return the same value in the case where 10% of workforce shift from industry to services compared to the instance where 10% of workforce shifts from industry to agriculture. However, the productivity implications of these two moves are very different with labour productivity being significantly higher in the case where services gain 10% of the workforce, compared to the case where labour shifts to agriculture.

Thus a change in the structure of the economy has important implications for labour productivity, and hence the earning potential and welfare of the workers. To evaluate the contribution to growth arising from reallocation of workers, the literature

decomposes the change in labour productivity into 'within effect' and 'reallocation effect'. While the within effect captures productivity growth within sectors, the reallocation effect or structural change measures the productivity effect of reallocation of labour among the different sectors. De Vries et al. (2015) point out that this decomposition can be performed in various ways depending on the choice of the base and the end years of the periods, which has important implications for the measurement and interpretation of structural change.

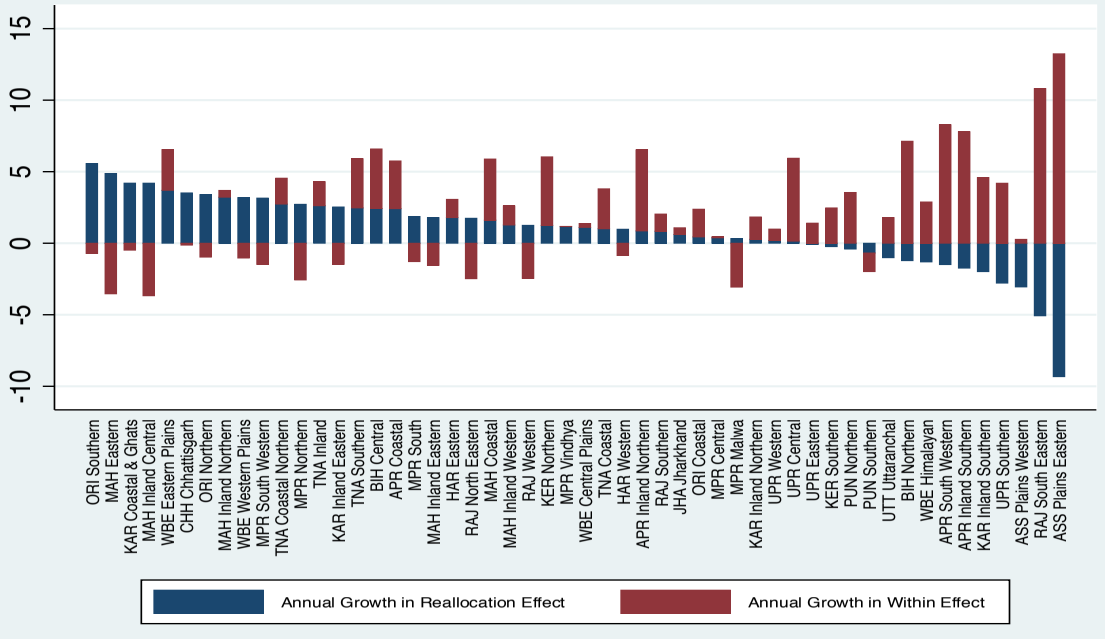
McMillan and Rodrik (2011) consider the base period employment shares and final period productivity levels. More specifically, the change in labour productivity is decomposed as

$$\Delta Y = \sum_i \left( y_{i,T} - y_{i,S} \right) \phi_{i,S} + \sum_i \left( \phi_{i,T} - \phi_{i,S} \right) y_{i,T} \qquad (3)$$

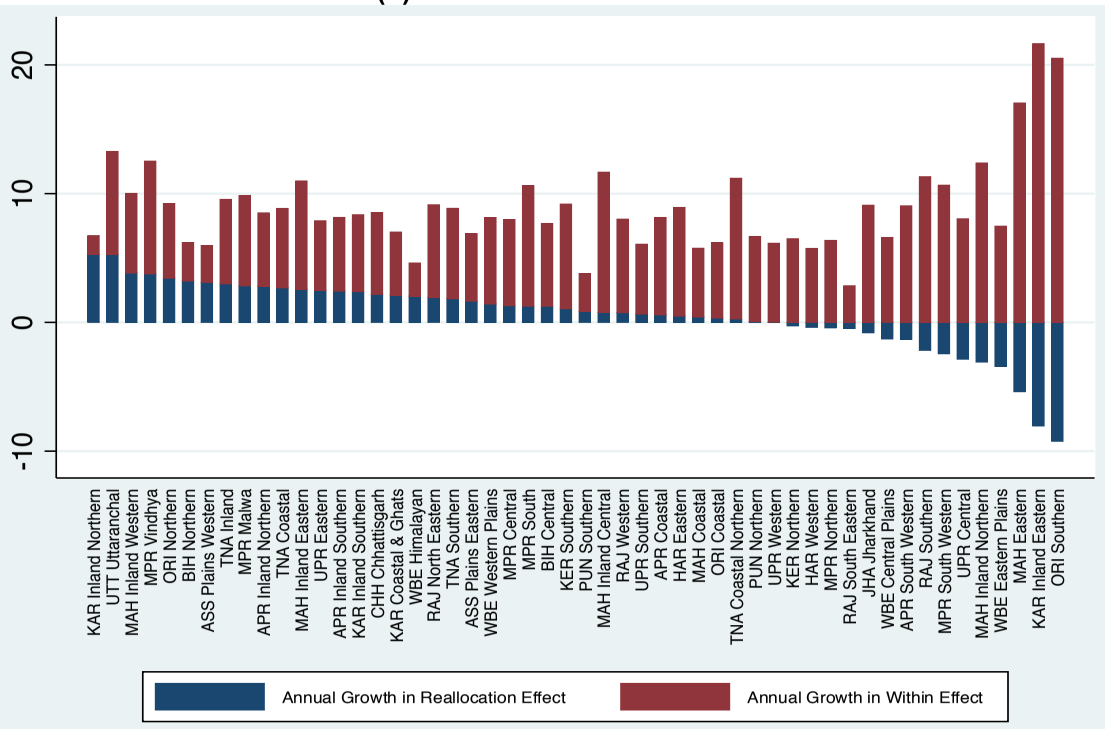
where $\Delta Y$ is the change in aggregate labour productivity between final and initial period, and $y_{i,T}$ and $y_{i,S}$ are the sectoral labour productivity levels in the final and initial period, respectively. Similarly, $\phi_{i,T}$ and $\phi_{i,S}$ are the final and initial employment shares of the various sectors. The first term is positive when the weighted change in labour productivity levels in sectors is positive, and reflects the contribution to overall productivity change from an increase in sectoral labour productivity. This is referred to as the within effect. The second term in Equation 3 is the reallocation effect, which reflects the change in labour productivity due to reallocation of employment across sectors, and is positive when labour moves from less to more productive sectors. This is also referred to as structural change in McMillan and Rodrik (2011) and Hasan et al. (2015).

Figure 4 decomposes average annual growth in labour productivity into average annual growth in within effect and average annual growth in reallocation effect. The regions are ranked according to average annual growth in reallocation effect. At the aggregate level, the growth in average annual labour productivity was 3.16% during 1999-00 to 2004-05, of which 1.52% was due to within effect and 1.64% was a result of reallocation effect. In the subsequent period, growth in average annual labour productivity more than doubled to 8.06%, with a significant part of the increase coming from growth of within effect, which jumped to 6.15%. Average annual growth in the reallocation effect witnessed a small increase, rising up to 1.91%. However, the aggregate growth in productivity levels masks a lot of variation at the regional level.

**Figure 4: Decomposition of Productivity Growth**




**(a) 1999-00 to 2004-05**




**(b) 2004-05 to 2011-12**

Source: Author's Calculations

The period between 1999-00 and 2004-05 experienced a lot of volatility, with 29 regions witnessing either a negative growth in within effect or a negative growth in reallocation effect, while in one region both growth rates were negative. The remaining regions witnessed an increase in 'within effect' as well as 'reallocation effect'. The second period is relatively more homogenous with all the regions witnessing positive growth in within effect, although 15 regions still recorded negative structural change growth.

### 3.4 De Vries, Timmer and De Vries Index

De Vries et al (2015) 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. Absorption of additional workers in a high productivity sector can result in depressing productivity growth as the marginal productivity of these additional workers might be low. To account for this De Vries et al. (2015) suggest an alternative decomposition method that accounts for the possibility that growth and levels across the sectors are negatively correlated. It uses the base periods for the productivity levels as well as employment share, and introduces a third interaction term.

$$\Delta Y = \sum_i \left( y_{i,T} - y_{i,S} \right) \phi_{i,S} + \sum_i \left( \phi_{i,T} - \phi_{i,S} \right) y_{i,S} + \sum_i \left( y_{i,T} - y_{i,S} \right) \left( \phi_{i,T} - \phi_{i,S} \right) \qquad (4)$$

Here, the first term as before reflects the contribution to overall productivity change from an increase in sectoral labour 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 sectoral 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 Equation (3) is broken into two different terms in Equation (4) where the first term represents if labour 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'.

The productivity decomposition at the aggregate level among the three effects is illustrated in Table 1. The 'within effect' is same as in Section 3.3, while the structural change term is broken down into 'static reallocation effect' and 'dynamic reallocation effect'. While the former is positive in both the periods implying that workers did move into above average productivity sectors, the latter is positive only in the second period, indicating that workers moved into sectors that were witnessing labour productivity growth.

**Table 1: Decomposition of Productivity Growth**

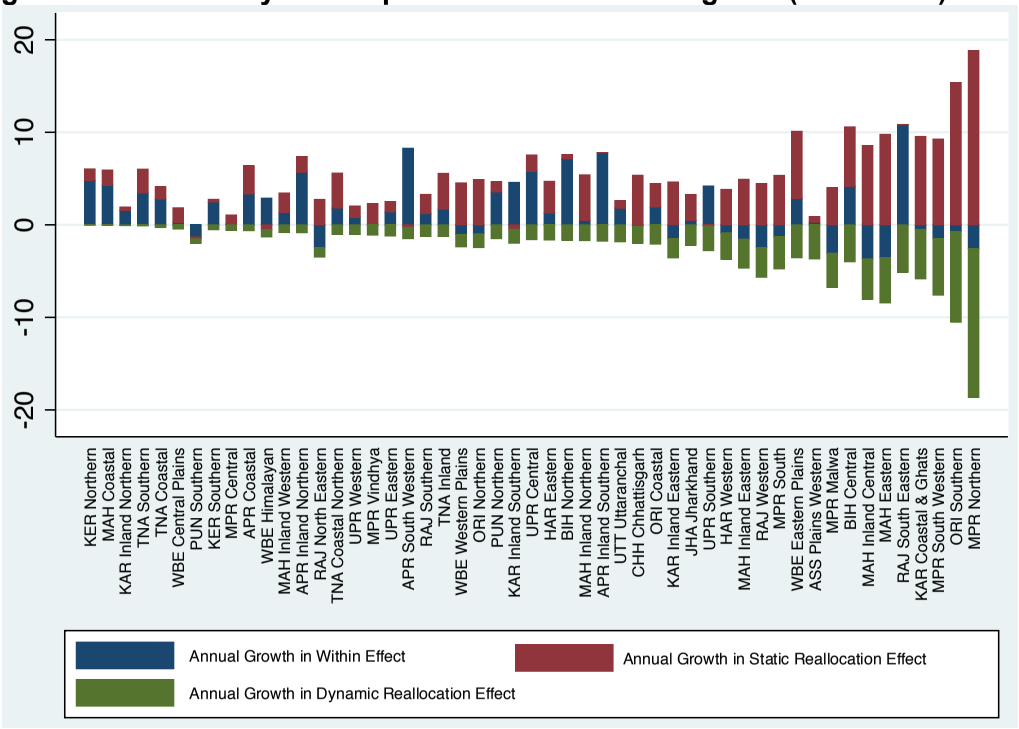
| Period | Average Labour Productivity | Within Effect | Static Reallocation Effect | Dynamic Reallocation Effect |
|---|---|---|---|---|
| 1999-00 to 2004-05 | 3.16 | 1.53 | 1.76 | -0.13 |
| 2004-05 to 2011-12 | 8.06 | 6.15 | 1.56 | 0.35 |

Source: Author's Calculations

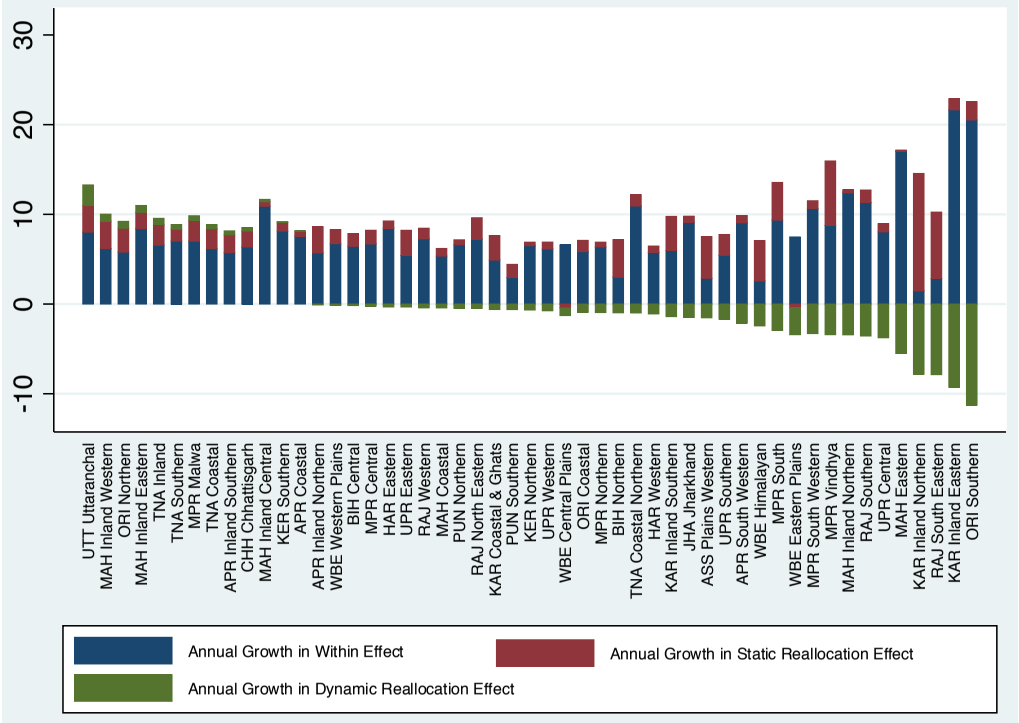
Again, as before, the aggregate picture masks a great deal of heterogeneity. Figure 5 illustrates the decomposition of labour productivity growth across the different regions during the two time periods. The regions are ranked according to the dynamic reallocation effect. As is evident, during the period 1999-00 to 2004-05, in only six regions out of 52, labour moved into sectors that experienced productivity

growth or moved out of sectors that experiences decline in productivity. Encouragingly, in the second period, the number of regions witnessing positive dynamic reallocation effect more than doubled to fourteen. Even in the case of static reallocation effect, the number of regions experiencing positive growth increased significantly from the first period to the second, implying that in more regions workers were moving to sectors characterized by above average productivity.

**Figure 5: Productivity Decomposition Across the Regions (1999-2011)**




**(a) 1999-00 to 2004-05**



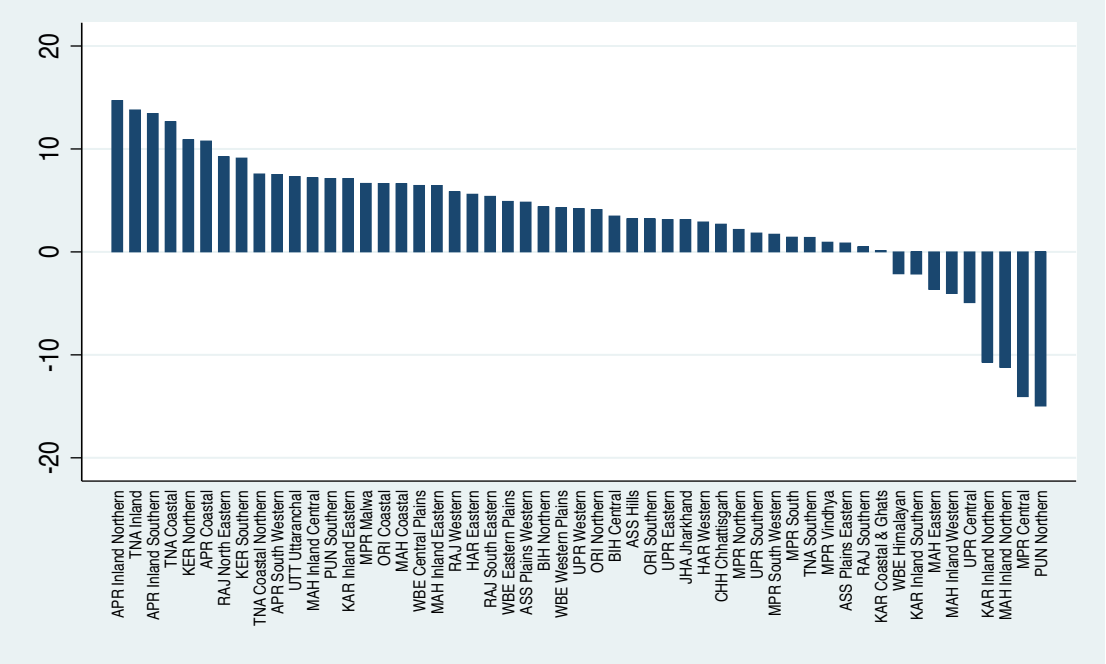

**(b) 2004-05 to 2011-12**

Source: Author's Calculations

## 4. Impact of Structural Change on Reduction in Poverty across Regions

In this section, we consider the experience of regions with regards to poverty reduction. Again, as can be seen in Figure 6 below, 9 regions witnessed an increase in poverty, while the remaining regions experienced a drop in poverty. More importantly, the extent of change varied considerably across the regions. Regions from the southern states witnessed some of the fastest reduction in poverty with 9 out of the top 10 regions in terms of poverty reduction belonging to these states. This is in line with Hasan et al (2015), which also points out that southern states of Kerala, Tamil Nadu, Karnataka and Andhra Pradesh witnessed the highest poverty reduction between 1987 and 2009. The evidence at the other end is more varied. While Maharashtra and Karnataka had two regions each that witnessed an increase in poverty, the states of Andhra Pradesh, Punjab, Madhya Pradesh, West Bengal and Uttar Pradesh reported one such region each.

**Figure 6: Average Annual Rate of Poverty Reduction across Regions (1999-00 to 2011-12)**




Source: Author's Calculations

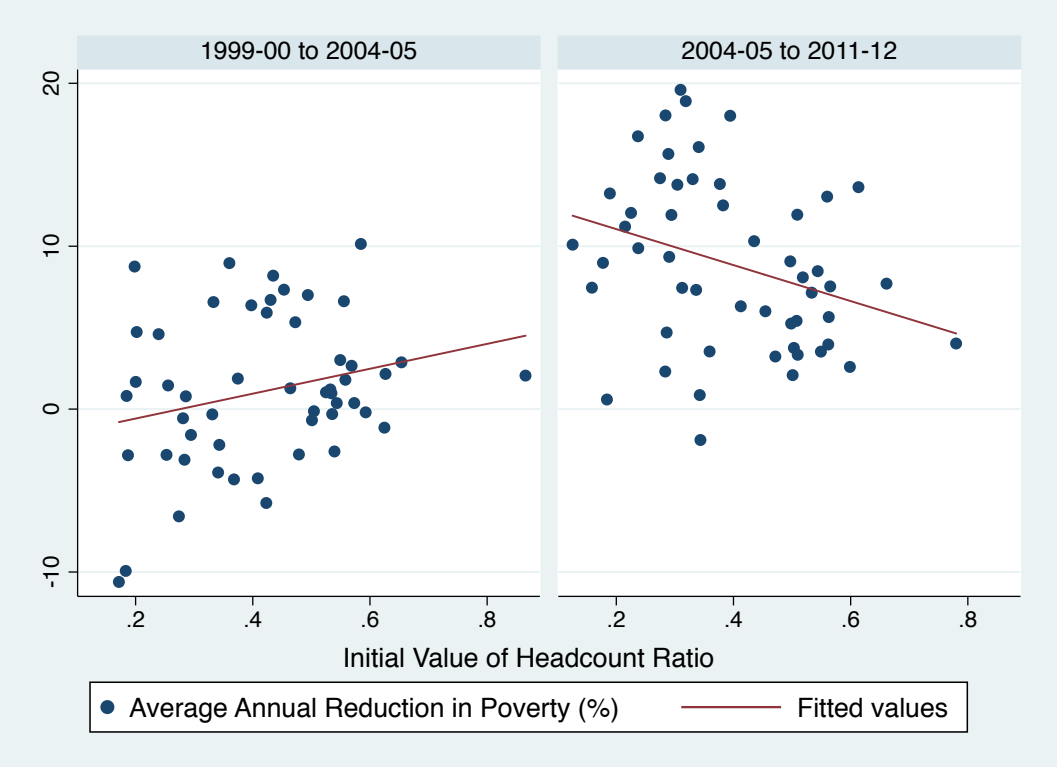
We also investigate if regions are exhibiting a convergence in terms of poverty rates. For this to happen, poverty reduction needs to occur at a faster pace in regions where initial poverty rates are high. Figure 7 provides a relationship between average annual rate of poverty reduction and initial poverty rates during the periods 1999-00 to 2004-05 and 2004-05 to 2011-12. While the first period witnessed some degree of convergence with a positive relationship between the two variables, the trend reverses in the subsequent period with regions exhibiting lower poverty rates in 2004-05 witnessing faster reduction in poverty between 2004-05 and 2011-12.

Next, we focus on the relationship between the various measures of structural change and poverty reduction. We evaluate the impact of the different measures of structural change on poverty reduction using a simple regression specification outlined as

$$Y_{j,t,t-s} = \alpha + \beta X_{j,t-s} + \gamma Z_{j,t,t-s} + \varepsilon_{j,t} \quad (5)$$

where $Y_{j,t,t-s}$ is the average annual rate of poverty reduction between period $t$ and $t-s$ in region $j$ and $X_{j,t-s}$ is the poverty rate in region $j$ in the initial period i.e. $t-s$ and $Z_{j,t,t-s}$ is the main variable of interest. It takes the value of the NAV and MLI index when structural change is measured by these indices, and the average annual rate of growth rate of labour productivity and its components 'within effect' and 'reallocation effect' when productivity growth is decomposed into these effects.

**Figure 7: Relationship between Average Annual Rate of Poverty Reduction and Initial Poverty Rate (1999-00 to 2011-12)**




Source: Author's Calculations

The inclusion of lagged poverty rate serves two purposes. First, it captures the potential for poverty reduction in a region, as a larger initial poverty rate implies that more people can be pulled out of poverty. Second, it also provides a sense of whether poverty rates are converging across the regions or diverging. A positive and significant $\beta$ implies that regions with high poverty rates have witnessed faster poverty reduction, as a result of which poverty rates across the regions would be converging.

The NAV and MLI indexes summarize the overall change in the distribution of economic activity across the different sectors of the region. Below, we report the results of the regression analysis using these indexes for the period 1999-00 to 2011-12. The first two specifications in columns (I) and (II) are panel estimations with fixed effects, controlling for heteroskedasticity and within panel serial correlation in the idiosyncratic error term $\varepsilon_{j,t}$. To evaluate the robustness of the results we also estimate Equation (5) using generalized least square methodology, again controlling for heteroskedasticity and autocorrelation within panels. The results are outlined in columns (III) and (IV).

**Table 2: Effect of Structural Change Indexes on Poverty Reduction**

| | Fixed Effects | | Generalized Least Squares | |
|---|---|---|---|---|
| | I | II | III | IV |
| Constant | 1.820 | 5.857*** | -17.990** | -11.556* |
| | [1.362] | [9.597] | [-2.504] | [-1.693] |
| Lagged Poverty Rates | -5.906*** | -4.833*** | 33.385** | 33.086** |
| | [-2.855] | [-6.354] | [2.160] | [2.056] |
| Structural Change (NAV) | 63.047*** | | 109.566*** | |
| | [6.022] | | [3.671] | |
| Structural Change (MLI) | | 146.908*** | | 434.847*** |
| | | [3.247] | | [3.171] |
| Observations | 104 | 104 | 104 | 104 |
| Number of Regions | 52 | 52 | 52 | 52 |

Note: t-statistics in brackets, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's Calculations

It is evident that structural change, as measured by the NAV and MLI indexes, has contributed in a significant manner to reduce poverty, after controlling for initial poverty rates. This result is robust across fixed effects and generalized least squares panel estimations. Thus, the change in the structure of production between 1999-00 and 2011-12 was poverty reducing in the case of India. However, given that NAV and MLI indexes are agnostic about the relationship between structural change and productivity it is not possible to chart out the manner in which structural change, as reflected by these two indices, has brought about a decline in poverty.

To overcome this difficulty, we use the measure outlined in Equation (3), which focuses on productivity growth. With productivity being positively correlated to average wages across sectors, an increase in productivity is likely to result in a drop in poverty by raising the earning potential of the individual. Equation (3) decomposes aggregate productivity into the within and reallocation effects, with the latter being dubbed as structural change in McMillan and Rodrik (2013) and Hasan et al. (2015). We evaluate the impact of aggregate labour productivity growth as well as its components—within and reallocation effects—on poverty reduction in Table 3.

**Table 3: Impact of Aggregate Productivity Growth and Its Components on Poverty**

| | Fixed Effects | | | Generalized Least Squares | | |
|---|---|---|---|---|---|---|
| VARIABLES | I | II | III | IV | IV | VI |
| Constant | -17.433*** | -13.793** | -9.417 | -17.315*** | 2.775** | 7.245*** |
| | [-3.331] | [-2.299] | [-1.312] | [-55.849] | [2.338] | [11.268] |
| Lagged Poverty Rates | 0.410*** | 0.387** | 0.358** | 0.303*** | -0.016 | -0.061 |
| | [3.250] | [2.647] | [2.027] | [48.783] | [-0.605] | [-1.186] |
| Annual Growth in Labour Productivity | 1.108*** | | | 0.379*** | | |
| | [6.906] | | | [6.933] | | |
| Annual Growth in Within Effect | | 0.709*** | | | 0.665*** | |
| | | [4.759] | | | [10.172] | |
| Annual Growth in Reallocation Effect | | | -0.006 | | | -0.059 |
| | | | [-0.015] | | | [-0.529] |
| Observations | 104 | 104 | 104 | 104 | 104 | 104 |
| Number of Regions | 52 | 52 | 52 | 52 | 52 | 52 |

Note: t-statistics in brackets, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's Calculations

We find that annual aggregate labour productivity growth has a strong positive and significant impact on poverty reduction under both specifications. Among its components, annual growth of within effect has a positive significant impact on

poverty reduction, similar to the findings in Hasan et al. (2015). However, we find that annual growth in reallocation effect or structural change has no significant impact on poverty reduction. This is in sharp contrast to the findings of Hasan et al, which finds that the reallocation effect has a strong positive impact on poverty reduction. One plausible reason for the different results could be the use of different samples. While Hasan et al focus on 18 major states, and cover the period 1987 to 2009-10 we cover the period from 1999-00 to 2011-12, and conduct the analysis at a sub-state level.

To delve deeper into the impact of reallocation effect on poverty reduction, we make use of the decomposition outlined in Equation (4) where reallocation effect or the structural change is further broken down into static reallocation effect and dynamic reallocation effect. The results are outlined in Table 4 below.

**Table 4: Impact of Aggregate Productivity Growth and Its Components on Poverty**

| | Fixed Effects | | | | Generalized Least Squares | | | |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | I | II | III | IV | V | VI | VII | VIII |
| Constant | -17.433*** | -13.793** | -6.881 | -4.347 | -17.315*** | 2.775** | -1.087*** | 6.284*** |
| | [-3.331] | [-2.299] | [-0.966] | [-0.630] | [-55.849] | [2.338] | [-2.720] | [15.306] |
| Lagged Poverty Rates | 0.410*** | 0.387** | 0.329* | 0.292* | 0.303*** | -0.016 | 0.098*** | -0.020*** |
| | [3.250] | [2.647] | [1.907] | [1.760] | [48.783] | [-0.605] | [12.888] | [-2.905] |
| Annual Growth in Labour Productivity | 1.108*** | | | | 0.379*** | | | |
| | [6.906] | | | | [6.933] | | | |
| Annual Growth in Within Effect | | 0.709*** | | | | 0.665*** | | |
| | | [4.759] | | | | [10.172] | | |
| Annual Growth in Static Reallocation Effect | | | -0.487 | | | | -0.456 | |
| | | | [-1.499] | | | | [-1.541] | |
| Annual Growth in Dynamic Reallocation Effect | | | | 1.217*** | | | | 0.727*** |
| | | | | [2.801] | | | | [24.864] |
| Observations | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 |
| Number of Regions | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 |

Note: t-statistics in brackets, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's Calculations

Columns (I), (II), (V) and (VI) replicate the results outlined in Table 4 as it tests the same specification outlined there. Columns (III) and (VII) indicate that annual growth rate of static reallocation has an insignificant impact on poverty reduction under both specifications, thereby implying that movement of workers to above average productivity level sectors in the initial period is not poverty reducing. In sharp contrast, we find from Columns (IV) and (VIII) that the annual growth in dynamic reallocation effect has a strong positive impact on poverty reduction. Thus as employment shares of sectors that are witnessing a productivity growth increases, it leads to a reduction in poverty reduction. Moreover, the coefficient on dynamic reallocation effect is considerably higher than the coefficients on either aggregate labour productivity or other two components i.e. within effect and static reallocation effect. Thus, reallocation of workers to sectors, which are experiencing an increase in productivity or reallocation of workers out of sectors where the productivity is slowing down is a vital channel for poverty reduction.

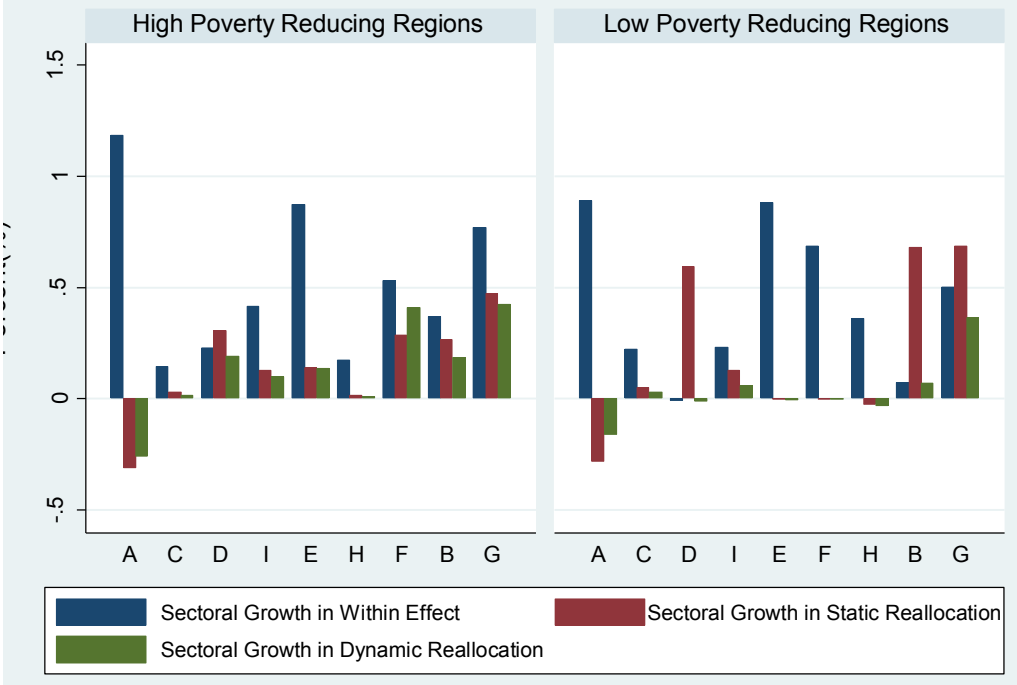
A plausible explanation of the results could be that as workers move into sectors with above-average productivity levels, their lower marginal productivity depresses the productivity growth and wage earning potential.

With a view to help our understanding of how various components of labour productivity is influencing poverty rates in India, we aggregate the six regions which recorded the highest average annual decline in poverty and compare it with the aggregate of six regions with lowest poverty reduction. The results are outlined in Figure 8. The sectors are based on (ascending) order of sectoral productivity in 2011-12.

A common factor across the two sets of regions is the agricultural sector, which was the biggest source of employment, experiencing positive growth in sectoral labour productivity i.e. within effect, but negative growth in both static and dynamic reallocation effects. This implies that for poverty reduction to occur at an accelerated pace, improving labour productivity in the agriculture sector and pulling people out of agriculture is not enough. The pace of poverty reduction crucially depends on sectors that are absorbing the workers coming out of agriculture. Moreover, in both sets of regions, a small fraction of the labour is reallocated to unregistered manufacturing, which was the second least productive sectors in both these set of regions.

While construction, which was the third least productive sector in both regions, witnessed a strong increase in employment share in the low poverty reducing regions, it also experienced a decline in sectoral productivity resulting in a negative dynamic reallocation effect. In contrast, the high poverty reducing regions witnessed a positive dynamic reallocation on account of an increase in employment share as well as improvement in labour productivity.

**Figure 8: Productivity Growth Decomposition by State and Sector (1999-00 to 2011-12)**




Note: The sectors are defined as follows: A = Agriculture and Allied Activities; B = Registered Manufacturing; C = Unregistered Manufacturing; D = Construction; E = Trade, Hotel and Restaurants; F = Transport, Storage and Communications; G = Finance, Insurance and Real Estate; H: Public Administration; and I = Community, Social and Personal Services
Source: Author's Calculations

Focusing on the remaining sectors the following salient features stand out. In the high poverty reducing regions, all the top six sectors in terms of sectoral productivity,

witnessed an improvement in labour productivity, along with an increase in employment share resulting in positive dynamic reallocation affect. In particular, the increase was substantial in the case of registered manufacturing, transport, storage and communication and banking, insurance and real estate, the three highest productive sectors in 2011-12. Thus these regions were able to generate jobs in modern dynamic sectors, which at the same time were recording strong increases in labour productivity.

Contrast this with the performance of the low poverty reducing regions. Among the high productivity sectors only registered manufacturing and finance, insurance, and real estate sectors witnessed an increase in employment share. Of these, in the case of registered manufacturing, there was very little improvement in productivity, resulting in the dynamic reallocation effect of the sector being a fraction of that in the high poverty reducing region. While the other high productivity sectors viz. trade, hotel and restaurant, public administration and transport, storage and communication witnessed an increase in labour productivity, they experienced a decline in the share of employment and consequently recorded a negative dynamic reallocation effect.

## 5. Summary and Conclusions

The main task of this research has been to quantify the nature and extent of the structural changes that have accompanied economic growth since 1999-00 and analyze its implications for poverty reduction in India at the sub-state level. Based on the availability of data, the research focuses on 9 sectors across 52 regions in the 18 larger states; two sub-periods 1999-00 to 2004-05 and 2004-05 to 2011-12. The main findings of the paper are outlined below.

First, as one would expect, average productivity grew at an average annual rate of 3.2% during the first period and accelerated sharply to 8.1% during the second period in line with GDP growth[4]. Average productivity grew for all regions and there is evidence to suggest that there was some degree of convergence among the 52 regions between 1999-00 and 2011-12.

Second, as revealed by aggregate measures of structural change of the economy such as NAV and MLI, both in terms of output as well as employment, it is clear that the quantum of change was greater in the second period as compared to the first period. There is also evidence to suggest that process of structural change was not persistent across the two periods. But, more importantly, low correlation between the change in the structure of output and that of employment means that movement of labor across sectors did not accompany the change in output.

Third, decomposition of growth in productivity reveals that the 'within effect' dominates the 'reallocation effect', accounting for most of the increase in productivity for a majority of the regions as well as at the aggregate level. The 'reallocation effect' is positive for India at the aggregate level for both periods, but the 'dynamic reallocation effect' if positive only in the second period. It is also significant that the extent of domination of the within effect is much more pronounced in the second period when productivity growth was much larger in comparison.

[4] India's per capita GDP grew at 3.9% during the first period (1999-00 to 2004-05) and 7.0% during the second period (2004-05 to 2011-12).

Fourth, there is significant positive impact of structural transformation of the economy on poverty reduction between 1999-00 and 2011-12. This holds for aggregate measures (NAV and MLI) as well as for decompositions of productivity growth in the form of 'within effect' and 'dynamic reallocation effect'. At the same time, the impact is not significant in the case of 'reallocation effect' in its aggregate form and its component 'static reallocation effect'.

In conclusion, this paper documents the key dimensions of structural change that has taken place in the Indian economy since 1999-00. While there is little doubt that structural transformation has been poverty reducing in India, the paper raises important questions about the channels though which this impact has been generated, which has important implications both for policy making and future research.

Given the significant impact of the 'within effect' in poverty reduction, it is important to understand the scope for further increasing the productivity levels of the low productivity sectors themselves. This is important as India's productivity levels in sectors such as agriculture, construction and unregistered manufacturing are far below several of its developing counterparts. In this context, the point where reallocation effect will become more important than within effect in terms of its contribution to productivity growth needs to be better understood. An assessment of the situation will allow framing better policy inputs for improving welfare of people engaged in the low productive sectors.

While the situation varies among regions, the 'reallocation effect' is positive in aggregate, meaning labor has moved to more productive sectors. Moreover, the 'dynamic reallocation effect' component, which is positively related with poverty reduction, is positive in the second period. So, another hypothesis which needs to be tested is the importance of high growth in inducing positive dynamic reallocation effect. This is especially important as the dynamic reallocation effect is positive for a small proportion of regions — six in the first period and 14 in the second.

The analysis of two groups of six regions that achieved the best and worst outcomes in terms of poverty reduction between 1999-00 and 2011-12 confirms that growth of employment in sectors with higher productivity alone is not enough. What is critical is that the high productivity sectors witness a growth in productivity as they absorb the workforce coming into these sectors. For this to happen, policies need to focus on two things. First, structural reforms in areas such as land, labor and infrastructure to increase productivity and generate employment opportunities in the more productive sectors and, second, right-skilling people to allow them to move to these sectors and contribute productively.

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