Department of Economics, Delhi School of Economics, University of Delhi

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Author(s): JAGANNATH MALLICK
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Globalization, Structural Change and Productivity Growth in the Emerging Countries

JAGANNATH MALLICK[1]

University of Hyogo, Japan
and
The Japan Society for the Promotion of Science (JSPS)

ABSTRACT

The paper examines the sources of labor reallocation or structural change, and measures and empirically evaluates the contribution of structural change to labor productivity growth (LPG). The paper also evaluates the relative contributions of human and physical capital to LPG. The paper found that changing final demand is the most crucial factor in labor reallocation in India. In the PRC, this and changes in technology are factors of labor allocation. The regression analysis confirmed that structural change, globalization, and human capital significantly contribute to LPG. Due to its prevailing structure, India is capable of leading global economic growth in the future, provided that certain necessary policies on human capital development, outward-oriented policies, and other conducive economic reform measures are taken. There is enough room for India to use manufacturing as a growth escalator, and for China to tap into services as a growth escalator to avoid the middle income trap.

Keywords: Foreign Direct Investment, Trade, Structural Change, Productivity Growth, Emerging Economy.

JEL Classification: F1, J2, O4

1. INTRODUCTION

Since the early 1990s, several emerging economies have initiated a number of globalization measures to integrate with the world economy (Organization for Economic Cooperation and Development [OECD] 2009). For instance, emerging countries have significantly reduced both tariff and non-tariff trade barriers in recent decades (Kalirajan *et al.* 2013).[2] Globalization and economic integration have changed lifestyles, impacting consumption patterns and preferences, which in turn has changed production patterns

1 University of Hyogo. Japan, Email: mallickjagannath@gmail.com.

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2 For example, customs tariff rates in India have declined steadily from 150% in 1991–1992 to 10% in 2008–2009 (Government of India, 2008: 64).

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all over the world, particularly in developing countries. As a result, the demand for the output of modern economic activities has increased over the years, resulting in changed patterns of allocation of production factors. Globalization and economic integration have also facilitated the transfer of technology, increased the efficiency of production, and substantially increased the inflow of foreign direct investment (FDI) and trade. The inflow of FDI brings advanced technology and expertise to host economies, which enhances labor productivity. Trade also boosts productivity through the specialization and scale effects. However, FDI inflows and the performance of international trade are better in some modern activities than in others in developing countries, which has increased productivity in certain activities and altered the pattern of consumption demand as well.

The gap in labor productivity across various sectors is expected to be larger in developing countries than in developed economies (Lewis 1954). A high labor productivity gap has been identified as a cause of low aggregate labor productivity in developing countries. Generally, labor productivity is lower in agriculture than in other economic activities. Increased wages are inducing the reallocation of labor from low to high productivity sectors (Lewis 1954). Labor reallocation or structural change could also be the combined effect of productivity growth, and changes in technology and the volume of final demand, both domestic and external.

The movement of labor and other resources from lower productivity activities to higher productivity activities may boost overall productivity and expand income, especially in emerging economies (Kuznets 1979). Syrquin (1984) argued that, due to differences in factor returns across various sectors, gains can result from a reallocation of factors or structural change due to the boosting of productivity growth. Hence, the structural change should be seen as a major source of labor productivity growth (LPG) and hence economic growth, especially in emerging economies.

This aspect of reallocation is a characteristic of structural change, which the economic development literature emphasizes as necessary for an economy to achieve higher growth. Existing studies, such as Havlik (2005), Coe (2007), OECD (2007a; 2007b), McMillan and Rodrik (2011), and Basu (2012) mainly focus on developed countries. Studies of developing countries mainly use the three broad sectoral economic classifications; however, a few, such as Cheng (2014), use the 10-sector classification method. Structural transformation occurs not only across the broad sectors but also within them. The existing studies, which are largely based on broad-sector data, may not reflect the structural change effect seen within certain industries. Hence, a more disaggregated analysis may provide better insights into the process and effect of structural change on LPG.

The relevance of the issues of structural change and productivity growth in emerging

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economies is largely due to (i) these countries' increasing involvement in world trade due to increased global trade and FDI; (ii) the changing nature of globalization promotes technological advances, which have reduced production costs by decreasing transportation and communication costs; and (iii) the changing nature and patterns of consumption demand due to globalization. The empirical evaluation of the factors of a changing economic structure, which is reflected by heterogeneous employment growth across various activities, suggests reasons for low employment growth or the shrinking of employment in certain sectors. A higher productivity growth rate in a sector also has ambiguous implications for the economy's overall performance. This can be achieved by either actually raising sectoral productivity or by reducing employment to some extent. If the productivity growth is due to a reduction in employment, caution should be exercised with regard to labor reallocation. If labor is reallocated to lower productivity activities, overall productivity growth and thus economic growth will suffer (Bosworth and Collins 2008; McMillan and Rodrik 2011). Hence, the decomposition of LPG into the contributions of structural change effects and sectoral productivity growth will have crucial policy implications. Empirically evaluating the impact of the structural change effect on overall LPG will suggest how globalization and labor reallocation contribute to LPG.

There is currently a dearth of studies that compare the issues of structural change and productivity growth in India and the People's Republic of China (PRC). These are the two largest emerging economies in the world and they have been following broadly similar patterns of growth after initiating substantial economic reform measures. The structural changes are expected to play a larger role in the process of economic growth in both India and the PRC, as these countries have significantly opened up their economies and improved their connectedness to world trade networks. Hence, a comparative study of the experiences of these two countries during the period of globalization will help policymakers to frame policies to achieve higher growth and development. The present study attempts to strengthen the existing literature from several points of view. First, this study explores the sources of employment change by using the input–output analysis. Second, it measures the contribution of labor reallocation to the overall growth of labor productivity. Third, it empirically evaluates the effect of structural change on LPG by controlling the broad measures of economic globalization and types of human capital.[3] Finally, the study discusses the effects of structural change in boosting LPG and hence the growth of an economy by taking into account the roles of human and physical capital.

3 Productivity growth is significantly related to the quality of human capital, that is, the workforce's technological competence. Although different firms can apply the same technology, their output would vary with respect to the skill or human capital of the labor force employed by these firms (Romer 1990).

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2. EMPIRICAL APPROACHES AND DATA

2.1 Empirical Approaches

The study uses an input–output analysis to examine the factors of structural change. It decomposes employment growth into the contributions of labor input coefficient change, technology change, and final demand change as described in Miller and Blair (2009: 606). The labor input coefficient change involves the requirement of labor as input for the production of output. The change in technology coefficients relates to intermediary inputs required per unit of output. The other component is related to the growth of domestic demand comprising public and private consumption, and investment expenditures, and the external demand. The impact of changes in exports, reflecting shifts in demand affected by foreign trade or external demand.

If 'l_t^i' is the required number of labour to produce output 'o_t^i' for an individual industry 'i' in year 't', where i = 1, 2, ..., 25 and t = 1980, 1981, ..., 2010, the labour input ratio is

$$e_t^i = \frac{l_t^i}{o_t^i} = \frac{l_t^i}{M_t^i F_t^i}$$

or

$$l_t^i = e_t^i M_t^i F_t^i \qquad ...(1)$$

where, M_t^i is the input–output multiplier of industry i and F_t^i is the final demand of that industry. Now, taking the differentiation of both side of equation (1) and arranging them, the change in employment can be expressed as follows, as in Miller and Blair (2009):

$$dl_t^i = \frac{(M_t^i F_t^i + M_{t-1}^i F_{t-1}^i) de_t^i}{2} + \frac{(e_t^i F_t^i + e_{t-1}^i F_{t-1}^i) dM_t^i}{2} + \frac{(e_t^i M_t^i + e_{t-1}^i M_{t-1}^i) dF_t^i}{2} \qquad ...(2)$$

Equation 2 reflects the decomposition of change in employment (dl) into the contribution due to the change in labour input coefficient (dLIC) that represents the change in productivity, the change in technology (dT) (that is, due to changes in the Leontief-inverse matrix), and the change in final demand (dFD) (that is, changes resulting from shifts in the components of final demand). Now, equation 2 can be modified to reflect employment growth (g) by dividing l_{t-1} on both sides.

$$\frac{l_t^i - l_{t-1}^i}{l_{t-1}^i} = \frac{(M_t^i F_t^i + M_{t-1}^i F_{t-1}^i) de_t^i}{2l_{t-1}^i} + \frac{(e_t^i F_t^i + e_{t-1}^i F_{t-1}^i) dM_t^i}{2l_{t-1}^i} + \frac{(e_t^i M_t^i + e_{t-1}^i M_{t-1}^i) dF_t^i}{2l_{t-1}^i} \qquad ...(3)$$

Furthermore, the contribution of structural change or of labor reallocation to LPG is analyzed by using shift-share analysis. Several empirical studies have used labor

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reallocation approach to measure structural change (Havlik 2005; McMillan and Rodrik 2011; de Vries *et al.* 2012) due to its advantage of capturing the technological intensity of sectors (Syrquin 1988). The approach is explained as follows:

If V_t and L_t are the total value added and employment at period t, labor productivity at time t (LP_t) may be defined as follows:

$$LP_t = \frac{V_t}{L_t} = \frac{v_t^1 + v_t^2 + \ldots + v_t^{25}}{L_t} = \frac{l_t^1 * \left(\frac{v_t^1}{l_t^1}\right)}{L_t} + \frac{l_t^2 * \left(\frac{v_t^2}{l_t^2}\right)}{L_t} + \cdots + \frac{l_t^{25} * \left(\frac{v_t^{25}}{l_t^{25}}\right)}{L_t} = \sum s_t^i * lp_t^i \quad \ldots(4)$$

where, V_t^i is the value added of industry i in the year t, $s_t^i = \frac{l_t^i}{L_t}$ is the share of industry i in total employment, and lp_t^i is labor productivity of industry i in time period t.

The change in LP between the two points of time t and $t\text{-}1$ can be written as

$$dLP_t = \sum(\overline{s^l} * dlp_t^i) + \sum(\overline{lp^l} * ds_t^i) + \sum(ds_t^i * dlp_t^i)$$

Thus, the change in the level of aggregate labor productivity can be expressed as:

$$LP_t - LP_{t-1} = \sum_{i=1}^{i=25}(lp_t^i - lp_{t-1}^i)(s_t^i + s_{t-1}^i)\frac{1}{2} + \sum_{i=1}^{i=25}(s_t^i - s_{t-1}^i)(lp_t^i + lp_{t-1}^i)\frac{1}{2} + \sum_{i=1}^{i=25}(lp_t^i - lp_{t-1}^i)(s_t^i - s_{t-1}^i) \quad \ldots(5)$$

Equation 5 can be modified to reflect growth rates by dividing LP_{t-1} on both sides.

$$\frac{LP_t - LP_{t-1}}{LP_{t-1}} = \frac{\sum_{i=1}^{i=25}(lp_t^i - lp_{t-1}^i)(s_t^i + s_{t-1}^i)}{2LP_{t-1}} + \frac{\sum_{i=1}^{i=25}(s_t^i - s_{t-1}^i)(lp_t^i + lp_{t-1}^i)}{2LP_{t-1}} + \frac{\sum_{i=1}^{i=25}(lp_t^i - lp_{t-1}^i)(s_t^i - s_{t-1}^i)}{LP_{t-1}} \quad \ldots(6)$$

Equation 6 suggests that aggregate productivity growth can be decomposed into three parts. The first term on the right side of the equation is called the intra-sectoral effect (ISE) or within-effect; this measures the change in the magnitude of LPG due to the change in sectoral productivity. The other two components are the static sectoral effect (SSE) (or between-effect) and dynamic sectoral effect (DSE). Both terms represent the effect of the overall structural change or labor reallocation on LPG. The SSE measures the addition to productivity growth due to changes in the share of labor as a result of the movement of labor from one sector to another. The positive value of SSE here

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indicates that labor is shifting from lower to higher productivity activities or sectors. In contrast, a negative SSE value suggests that labor is shifting from higher to lower productivity activities; this is an undesired pattern as it deteriorates overall LPG. The DSE is the interaction between changes in sectoral productivity and changes in the labor input share across sectors. A positive DSE value suggests that changes in labor share and in sectoral productivity are either both positive or both negative. A negative DSE value indicates that one of the two changes is negative while the other is positive. This means that productivity may increase when employment shrinks or decline when employment expands.

This study empirically evaluates the impact of structural change and types of human capital on LPG in the study period (1980–2010). As this period is not long enough for the sophisticated time series method to be applied, the study uses pooled regression by combining both countries. The available studies show that there are several ways to describe the structural changes of an economy. Hence, this study uses an alternative measure of structural change to check the robustness of the results.

2.2 Data

The study uses data from secondary sources. The patterns and contribution of structural change are examined by using annual data from the World KLEMS and the Groningen Growth and Development Center (GGDC) 10-sector databases. The World KLEMS uses 26 sectoral classifications for India and 37 for the PRC. A concordance table for the creation of 25 sectors for India and the PRC using data from the World KLEMS is in Table A1. Further, the GGDC 10-sector database provides data on gross value added at constant prices and persons employed across various countries; these data are internationally comparable and widely used. The 10-sector data on these two variables are divided into 25 sectors based on disaggregated data from the World KLEMS.

The sources or factors of heterogeneous employment growth across the same 25 industries, which reflect the causes of structural change, are analyzed using the World Input–Output Database (WIOD). However, the use of the WIOD is limited to the period 1995–2010 due to data limitations. The WIOD provides an annual record of all transactions of goods and services at current prices in US dollar units by using a 35-sectoral classification for India and the PRC. These 35 sectors are merged into 25 sectors based on Table A2. The detailed data and variables are described in Table A3.

The generated annual data on gross value added (v) at constant prices and labor person (l) across 25 industries are used to decompose LPG into the components of structural change and sectoral productivity growth between 1980–1981 and 2010–2011.

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The impact of structural change or the labor reallocation effect on LPG is analyzed empirically using regression analysis. The dependent variable is overall LPG. The independent variables are the measures of structural change, economic globalization, and human capital, which are selected based on existing studies. Economic globalization is broadly represented by international trade and FDI (OECD 2005; 2010; Eurostat 2007). The FDI is measured as a percentage of gross domestic product (GDP). International trade is measured as the growth of trade (GTR). The data on net FDI inflows and international trade (exports and imports) are sourced from the World Bank's World Development Indicators. Further, human capital is measured by the following indicators: the overall human capital index (HK) (obtained from the Penn World Table [PWT]), and the gross enrollment ratio in the primary, secondary, and tertiary education (GERP, GERS, and GERT) (obtained from the World Bank).

Further, in evaluating the role of capital intensity in aggregated LPG, Solow's growth accounting approach is used by considering the gross domestic product as a combined function of labor person, capital stock, and human capital (Hulten 2009). Annual data on real GDP, labor person, real physical capital stock, human capital, and labor compensation share in income for the aggregated economies between 1980–1981 and 2010–2011 are taken from a single source, the PWT, which is internationally comparable.[4]

3. STRUCTURAL CHANGE IN INDIA AND THE PEOPLE'S REPUBLIC OF CHINA

Structural change is associated with economic reform measures taken at various stages of an economy's development, which ultimately boost its growth. India saw a marked acceleration in economic growth after comprehensive economic reforms were implemented in 1991. However, India's economy has grown at a slower rate than that of the PRC, as the PRC introduced economic reforms in 1978, 13 years before India. World Bank data show that the PRC's per capita GDP in terms of purchasing power parity was lower than that of India before 1991. The PRC's accelerated growth rate surpassed that of India in 1992, and the gap between the two countries has widened since then (Figure A1).

Since 1978, the PRC's model of economic growth has essentially been based on intense industrialization. With respect to economic reform measures, India and the PRC also differ in several other ways. For example, with regard to tax reform, the PRC introduced the value-added tax in 1994, while India introduced it in 2005. Furthermore, unlike in the PRC, India's strong democratic traditions make it difficult to undertake serious labor reform measures in the country. The methods of labor reform measures

4 The GGDC 10-sector database does not provide data on human capital and factor incomes.

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introduced in the PRC have been better than those introduced in India (Sundar and Ratnam 2007). Further, reforms in India have been based less on the industry than on services, such as banking, transport, and telecommunications and on the production and export of a variety of software services. The 8-year gap that exists between India and the PRC achieving parity in per capita income means that India's per capita income in 2010 (i.e., $3,079) was achieved by the PRC in 2002.

The economic structure of India and the PRC has been changing in step with the passing of economic reform measures. The structure of employment and income in the 25 sectors for India and the PRC are presented in Tables 1 and 2. In 1991, the Indian economy was dominated by agriculture, which accounted for 69.4% of employment and 37.6% of total value added. This situation has gradually changed due to a series of economic reform measures adopted starting in the mid-1980s. By 2010, agriculture accounted for 52.80% of employment and 15.20% of value added. The industrial sector accounted for 13.45% of employment in 1981; this increased 1.48 times to reach 19.90% in 2010. In contrast, the industrial sector's income share increased only 1.08 times, from 24.58% in 1981 to 26.51% in 2010. This is associated with the sector's increased employment share during the same period. In contrast, the income share of the service sector increased 1.54 times; this was associated with the sector's employment share, which increased 1.59 times during the same period from 17.20% in 1981 to 27.35% in 2010. The sector's share of value added also increased from 37.87% to 58.27%. Although the service sector is driving India's economic growth, the absorption of labor in this sector has not kept pace with the growth of its share of value added. In particular, it absorbs largely medium and highly skilled labor.

Significant structural transformation also occurred within the subsectors of industry and service activities. The industrial sector comprises mining and quarrying, utilities (electricity, water and gas), construction, and 13 manufacturing industries. In India, the employment share of certain industries—such as rubber and plastic products, machinery, electrical and optical equipment, and transport equipment—nearly doubled during this period. The construction sector was the main driver of job growth in India during 1981–2010, when its employment share increased 4.29 times. Construction was also the primary industrial activity in terms of value addition, accounting for 6.6% of the total valued added in 1981. Overall, employment growth in the industrial sector has been driven by basically modern activities. The share of total employment of other industrial activities, such as food, beverages, and tobacco, and wood and wood products, registered minimal or negative growth during this period.

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TABLE 1
EMPLOYMENT AND VALUE ADDED SHARE IN INDIA (%)

	Employment share					Value added share				
	1981	1991	2001	2010	Ratio of 2010 to 1981	1981	1991	2001	2010	Ratio of 2010 to 1981
AHFF	69.4	64.6	59.2	52.8	0.76	37.6	30.3	24.0	15.2	0.41
Industry	**13.45**	**15.10**	**16.19**	**19.89**	**1.48**	**24.58**	**25.62**	**25.05**	**26.51**	**1.08**
MQ	0.5	0.7	0.6	0.6	1.08	2.2	2.7	2.2	1.7	0.78
FBT	2.2	2.4	2.5	2.0	0.92	2.1	2.1	2.1	2.2	1.07
TEXLE	3.5	3.2	2.4	2.7	0.77	2.5	2.2	2.2	2.1	0.86
WWP	1.3	1.0	1.1	0.8	0.63	1.7	0.7	0.3	0.2	0.14
PPPPPP	0.2	0.3	0.3	0.4	1.43	0.5	0.7	0.4	0.5	0.91
CRPPNF	0.0	0.0	0.0	0.0	1.56	0.2	0.5	0.4	0.6	2.42
CHE	0.4	0.4	0.5	0.4	1.09	1.3	1.8	2.5	2.8	2.19
RUBPL	0.1	0.1	0.2	0.2	1.94	0.3	0.5	0.7	0.6	1.65
ONMMP	0.9	0.9	0.9	0.9	0.98	0.5	0.8	0.8	0.9	1.69
BFMP	0.7	0.8	0.9	0.8	1.13	2.0	1.9	2.0	2.4	1.22
MAC	0.2	0.3	0.3	0.3	1.78	1.1	1.0	0.7	0.8	0.70
EOEQ	0.2	0.2	0.3	0.3	1.80	0.6	0.8	1.1	1.4	2.13
TEQ	0.2	0.2	0.2	0.3	1.78	0.7	0.7	0.8	0.9	1.28
OMRE	0.7	0.9	0.9	1.0	1.45	0.6	0.6	0.7	0.7	1.21
EGW	0.3	0.4	0.3	0.3	0.98	1.7	2.4	2.3	2.0	1.22
CON	2.1	3.3	4.8	8.9	4.29	6.6	6.2	5.7	6.8	1.03
Service	**17.16**	**20.30**	**24.63**	**27.35**	**1.59**	**37.87**	**44.05**	**50.96**	**58.27**	**1.54**
TRA	5.9	7.4	9.2	10.4	1.75	10.7	11.1	13.6	14.5	1.36
HOR	0.8	0.9	1.2	1.4	1.74	0.7	0.9	1.3	1.4	1.92
TRSPT	2.2	2.8	3.8	4.6	2.10	6.1	6.6	8.2	13.5	2.23
FS	0.3	0.5	0.6	0.9	2.75	2.5	4.5	5.7	7.3	2.98
PADCSS	2.7	2.8	2.4	1.8	0.68	5.6	6.4	6.5	5.5	0.99
EDU	1.6	1.7	2.2	2.5	1.57	2.6	3.2	3.9	3.7	1.39
HESW	0.6	0.6	0.7	0.8	1.39	1.0	1.3	1.7	1.5	1.51
OS	3.0	3.6	4.4	4.9	1.61	8.7	10.1	10.2	10.7	1.24

Source: The basic data of World KLEMS

Employment growth in India's service sector was driven by trade; hotels and restaurants; transport, storage, post, and telecommunications and financial services. The value added share of the financial sector increased 2.98 times, while its share of employment increased 2.75 times. In contrast, public administration and compulsory social security have lost in terms of the job share. Other service activities like education, health and social work, and other services have registered minimal growth in terms of job creation.

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As seen in Table 2, the intent and speed of structural change in the PRC's economy exceeded that seen in India. Like India, the PRC previously had a predominantly agrarian economy, with agriculture accounting for 58.0% of employment and 32.5% of total value added in 1981. After reform measures were introduced, the situation in the PRC completely changed due to rapid and widespread industrialization and tertiarization. By 2010, agriculture's share of employment had declined to 31.9% and that of value added to 9.3%. In contrast, the industrial sector's employment share increased 1.13 times from 25.42% in 1981 to 28.83% in 2010; and its income share increased 1.07 times from 45.51% in 1981 to 48.85% in 2010. The rise in the industrial sector's income share from 1991 to 2001 was partly due to changes in ownership in the mid-1990s (OECD 2005: 35). The growth rate of the service sector's employment share was significantly higher than that of value added in 1981–2010; during this period the sector's employment share increased 2.39 times from 16.45% to 39.32%, and the value added share increased 1.9 times from 22.01% to 41.86%. The service sector's share of both employment and value added was initially very low compared to other market economies with the same level of development as India. The PRC, as a planned socialist country, had prioritized agriculture and industry over the tertiary sector. This was gradually changed in subsequent decades in line with the progress of economic reforms in order to provide space for the market economy and to allow private ownership. Further, the PRC's entry into the World Trade Organization in 2001 significantly encouraged a rapid increase in exports and FDI, which also attributed to the growth of income and employment in the 2000s.

TABLE 2
EMPLOYMENT AND VALUE ADDED SHARE IN THE PEOPLE'S REPUBLIC OF CHINA (%)

	Employment share					Value added share				
	1981	1991	2001	2010	Ratio of 2010 to 1981	1981	1991	2001	2010	Ratio of 2010 to 1981
AHFF	58.1	52.0	45.7	31.9	0.55	32.5	26.0	14.2	9.3	0.29
Industry	**25.42**	**25.97**	**23.88**	**28.83**	**1.13**	**45.51**	**45.72**	**47.34**	**48.85**	**1.07**
MQ	2.7	2.7	1.8	1.7	0.61	5.0	3.0	5.5	4.1	0.83
FBT	2.2	2.0	1.6	1.6	0.70	3.8	5.2	4.0	4.2	1.11
TEXLE	3.8	3.9	3.2	4.2	1.11	6.1	4.3	3.8	2.9	0.47
WWP	1.7	0.6	0.6	1.0	0.56	0.5	0.4	0.9	0.9	1.80
PPPPPP	0.9	0.9	0.7	0.7	0.86	0.9	1.3	1.6	1.0	1.09
CRPPNF	0.1	0.1	0.1	0.1	1.95	1.5	1.0	0.7	1.5	0.99
CHE	0.8	1.0	0.9	1.1	1.39	4.1	4.7	3.7	3.1	0.76
RUBPL	1.0	0.9	0.9	1.2	1.26	1.1	1.1	1.5	1.2	1.07
ONMMP	1.7	1.8	1.2	1.1	0.64	2.2	3.0	2.0	2.4	1.10

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TABLE 2 continued...

	Employment share					Value added share				
	1981	1991	2001	2010	Ratio of 2010 to 1981	1981	1991	2001	2010	Ratio of 2010 to 1981
BFMP	1.9	1.9	1.6	1.7	0.89	4.5	4.1	3.9	4.6	1.02
MAC	1.9	1.7	1.0	1.5	0.80	4.2	4.4	3.1	3.5	0.84
EOEQ	1.1	1.2	1.6	3.0	2.77	2.5	3.7	4.4	5.5	2.26
TEQ	0.5	0.5	0.6	0.9	1.71	1.1	1.4	2.0	3.8	3.58
OMRE	2.8	1.9	1.3	0.9	0.31	0.6	1.7	1.9	0.7	1.20
EGW	0.2	0.3	0.4	0.5	2.13	3.2	1.8	3.2	2.7	0.83
CON	2.2	4.3	6.3	7.8	3.56	4.2	4.7	5.2	6.7	1.58
Service	**16.45**	**22.01**	**30.40**	**39.32**	**2.39**	**22.01**	**28.25**	**38.46**	**41.86**	**1.90**
TRA	4.1	6.1	7.3	8.7	2.11	4.7	4.4	8.2	8.5	1.80
HOR	0.7	0.9	2.1	2.7	4.01	1.1	0.7	2.1	2.1	1.92
TRSPT	3.2	3.8	3.5	3.1	0.97	4.6	6.5	7.9	6.9	1.51
FS	0.2	0.4	0.5	1.6	6.65	1.6	5.3	4.1	5.1	3.10
PADCSS	1.4	1.7	1.7	5.1	3.58	2.8	3.0	3.4	4.0	1.44
EDU	3.0	3.4	5.1	4.6	1.56	2.0	2.2	2.6	2.9	1.49
HESW	1.1	1.3	2.3	2.3	2.20	0.6	0.7	1.3	1.3	2.17
OS	2.8	4.5	7.9	11.2	4.00	4.6	5.5	8.9	11.0	2.38

Source: The basic data of World KLEMS

In the PRC, there was also a high degree of heterogeneous employment growth within the industrial sector. Some industries' employment share increased by twice or more than twice between 1981 and 2010: that of coke, refined petroleum products, and nuclear fuel increased 1.95 times; electrical and optical equipment 2.77 times; transport equipment 1.71 times; electricity, gas, and water supply 2.13 times; and construction 3.56 times. Other industries registered minimal or negative employment growth during this period. There was a high degree of heterogeneity in terms of the growth of the service sector's employment share. Other than transport, storage, post and telecommunications, the employment share of the seven service subsectors increased during 1981–2010. There was also correspondingly heterogeneous growth in the income share of the industrial and service sectors.

In sum, the pattern of change seen in employment and income shares confirms that activities have shifted from agriculture to the industrial and service sectors in both countries, a growth pattern experienced by developed countries in the past (Denison 1967; Jorgenson and Timmer 2011; de Vries *et al.* 2012).[5] At the beginning of the 1980s, the service sector was larger in India than in the PRC in terms of both employment

5 This is because they are facing post-industrial phases, when the service sector is most productive.

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and value added. Although it grew at a faster rate in subsequent decades, it achieved a satisfactory growth rate only in terms of value added and not in employment generation relative to the PRC. India's service sector was mainly driven by (i) urbanization, (ii) a rising standard of living, (iii) an increase in the number of middle- and upper-income households, and (iv) external demand, particularly the demand for information technology and software services (Wu 2007), which could not absorb labor proportionate to the growth of value added that it achieved. However, as of 2010, about 53% of labor was still concentrated in agriculture in India, a significantly higher percentage than in the PRC. This suggests that appropriate economic reform measures can move a large portion of labor from low productivity agriculture to the non-agricultural sectors, which would result in faster economic growth and a higher standard of living.

4. FACTORS OF STRUCTURAL CHANGE

The heterogeneous growth of employment across various sectors can be decomposed into several factors by using the methodology described in equations 2 and 3 in order to understand the factors of structural change. The period 1995–2010 is divided into two sub-periods for both countries, that is, before and after the 2000s. The results are presented in Table 3 for India and Table 4 for the PRC. As shown in Table 3, actual employment in agriculture increased by 1.8 million jobs every year from 1995–1996 to 2000–2001; this was mainly due to changes in final demand, which required 8.54 million additional jobs in this sector between 1995 and 2000. However, improved productivity eliminated 4.43 million jobs per year while upgraded technology eliminated 2.31 million jobs. Further, although the final demand change would have created 8.95 million jobs during 2000–2010, the actual change in employment was negative. In relative terms, the annual growth rate of employment declined further in 2000–2010 than in 1995–2000 due to stronger productivity growth (Table A4 [sector level LPG]). The annual growth rate of employment was -0.10% in 2000–2010, versus 0.75% in 1995–2000.

As seen in Table 3, the actual annual change in employment in the industrial sector during 1995–2000 was 1.75 million, largely due to final demand change. Change in final demand during this period would have required 2.97 million new jobs in this sector. However, productivity growth and technology changes together resulted in a loss of jobs, as shown above. There was also a positive gain in employment of about 2.76 million jobs per year in 2000–2010, largely due to changes in final demand. In relative terms, the annual growth rate of employment increased in 2000–2010 compared to 1995–2000. The annual growth rate of employment was 3.08% in 1995–2000; this increased to 4.21% in 1995–2000. Further, the employment pattern of certain industries within the industrial sector—such as wood and wood products; pulp, paper, paper products, printing, and publishing; and machinery—was not affected by changes in final demand in 1995–2000. Nonetheless, these changes positively affected employment in most industries.

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TABLE 3
DECOMPOSITION OF ANNUAL CHANGE IN EMPLOYMENT IN 1995–2010 IN INDIA (MILLION)

Sector code	*dl*	dLIC	dT	dFD	*g*	*dl*	dLIC	dT	dFD	*g*
	1995–2000					2000–2010				
AHFF	1.80	-4.43	-2.31	8.54	0.75	-0.26	-5.31	-3.91	8.95	-0.10
Industry	**1.75**	**-1.05**	**-0.17**	**2.97**	**3.08**	**2.76**	**-4.10**	**-0.16**	**7.02**	**4.21**
MQ	-0.04	-0.08	-0.24	0.29	-1.43	0.05	-0.06	-0.50	0.61	2.04
FBT	0.22	-0.19	0.07	0.33	2.29	-0.10	-0.82	0.14	0.57	-0.96
TEXLE	-0.20	-0.83	0.19	0.43	-1.99	0.32	-0.47	0.41	0.39	3.49
WWP	0.23	0.55	-0.01	-0.31	6.30	-0.09	-0.11	0.04	-0.02	-1.81
PPPPPP	0.06	0.08	0.00	-0.02	5.94	0.03	-0.08	0.11	0.01	2.21
CRPPNF	0.00	0.00	-0.01	0.02	2.84	-0.01	-0.02	-0.01	0.02	-3.81
CHE	0.03	-0.11	-0.02	0.17	1.83	-0.01	-0.14	0.01	0.12	-0.53
RUBPL	0.05	-0.03	0.06	0.02	7.18	-0.02	-0.10	0.03	0.05	-2.38
ONMMP	0.08	-0.19	0.26	0.00	2.34	0.06	-0.17	0.57	-0.33	1.58
BFMP	0.14	0.10	-0.19	0.23	4.60	0.02	-0.54	0.00	0.56	0.43
MAC	-0.04	-0.06	0.04	-0.02	-2.67	0.03	-0.10	-0.01	0.14	2.24
EOEQ	0.05	-0.17	0.11	0.12	5.43	0.01	-0.12	-0.03	0.16	0.94
TEQ	0.01	0.00	0.01	0.00	2.39	0.08	-0.03	0.01	0.09	11.55
OMRE	0.06	0.03	0.03	0.00	1.89	0.10	-0.35	-0.16	0.62	2.87
EGW	-0.03	-0.10	-0.04	0.11	-2.23	0.01	-0.08	0.02	0.08	1.16
CON	1.12	-0.37	0.02	1.46	8.35	2.28	-0.56	-0.45	3.29	11.98
Service	**3.66**	**-2.88**	**-1.72**	**8.26**	**4.39**	**2.63**	**-7.73**	**1.91**	**8.45**	**2.58**
TRA	1.50	-0.28	-0.31	2.08	4.89	1.05	-2.27	0.57	2.75	2.75
HOR	0.25	-0.09	0.05	0.28	6.87	0.18	-0.27	-0.03	0.48	3.63
TRSPT	0.75	-0.37	-0.30	1.42	6.42	0.61	-1.96	1.48	1.09	3.93
FS	0.04	-0.18	0.01	0.21	1.69	0.19	-0.16	0.17	0.18	7.87
PADCSS	0.06	-0.79	-0.10	0.95	0.60	-0.18	-0.81	-0.05	0.68	-1.75
EDU	0.39	-0.39	-0.07	0.84	5.54	0.24	-0.47	0.01	0.70	2.71
HESW	0.15	-0.09	-0.01	0.25	6.47	0.07	0.02	-0.01	0.06	2.27
OS	0.53	-0.37	-0.75	1.65	3.34	0.47	-1.08	-0.96	2.50	2.55

Source: Author's calculation

In India's service sector, employment increased by 3.66 million jobs per year during 1995–2000, mainly due to changes in final demand, which required 8.26 million new jobs. Of these, 4.6 million per year were eliminated by significant changes in productivity and technology. Thus, the actual change in employment during 2000–2010 was 2.63 million jobs per year. While this increase was due to both upgraded technology and changed final demand, the final demand effect was significantly stronger than that of

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technology. Significant productivity growth resulted in a loss of 7.73 million jobs each year. The annual employment growth rate was 4.39% in 1995–2000; this declined to 2.58% in 2000–2010.

TABLE 4
DECOMPOSITION OF EMPLOYMENT GROWTH IN 1995–2010 (PEOPLE'S REPUBLIC OF CHINA) (%)

Sector code	*dl*	dLIC	dT	dFD	*g*	*dl*	dLIC	dT	dFD	*g*
	1995–2000					2000–2010				
AHFF	0.60	-59.34	52.41	7.53	0.18	-8.72	-37.83	20.53	8.58	-2.65
Industry	-0.39	-28.95	13.04	15.52	-0.22	4.73	-39.72	14.08	30.37	2.75
MQ	-0.80	-3.40	1.16	1.44	-4.63	-0.06	-3.80	3.53	0.21	-0.46
FBT	-0.18	-2.52	1.79	0.55	-1.45	0.04	-2.11	1.02	1.13	0.32
TEXLE	0.05	-3.95	2.36	1.63	0.20	0.87	-3.50	1.48	2.89	3.77
WWP	0.09	-0.47	0.67	-0.11	2.29	0.31	-0.79	0.60	0.50	7.03
PPPPPP	0.00	-1.01	1.08	-0.07	0.02	0.09	-0.84	0.76	0.17	1.88
CRPPNF	-0.02	-0.16	0.00	0.14	-2.41	0.01	-0.19	0.12	0.09	1.83
CHE	-0.22	-1.70	0.66	0.82	-3.00	0.18	-1.63	0.65	1.16	2.91
RUBPL	0.23	-1.08	0.76	0.55	4.29	0.25	-1.21	0.41	1.05	3.79
ONMMP	-0.84	-1.98	0.65	0.48	-6.39	-0.09	-1.38	1.07	0.22	-0.98
BFMP	-0.26	-1.41	0.81	0.34	-2.02	0.16	-3.46	1.29	2.32	1.35
MAC	-0.59	-1.84	0.57	0.68	-5.98	0.46	-1.51	0.30	1.67	6.61
EOEQ	0.66	-1.79	0.74	1.71	7.84	1.09	-2.86	0.30	3.64	9.31
TEQ	-0.09	-0.71	0.27	0.34	-2.03	0.26	-1.09	0.25	1.11	6.48
OMRE	-0.47	-2.10	0.04	1.58	-4.14	-0.26	-1.64	-0.29	1.67	-2.82
EGW	0.09	-0.62	0.14	0.57	3.21	0.06	-1.06	0.92	0.20	1.95
CON	1.98	-4.51	2.57	3.91	5.52	1.35	-10.47	3.97	7.85	2.95
Service	7.83	-33.08	24.84	23.35	4.35	8.01	-40.24	17.70	30.55	3.66
TRA	1.67	-6.88	2.45	6.10	3.79	1.37	-7.47	0.67	8.17	2.62
HOR	1.24	-1.13	1.43	0.93	13.51	0.52	-2.70	1.61	1.62	3.42
TRSPT	0.27	-5.07	1.35	3.99	1.14	-0.21	-5.58	1.77	3.61	-0.83
FS	0.14	-0.30	0.30	0.13	4.68	0.87	-0.19	0.14	0.92	23.99
PADCSS	0.23	-2.92	1.36	1.79	2.08	2.68	-0.57	1.03	2.22	21.81
EDU	0.58	-7.74	2.74	5.58	1.71	-0.17	-11.39	6.66	4.56	-0.46
HESW	0.58	-3.15	1.71	2.01	4.18	0.11	-4.71	2.02	2.79	0.65
OS	3.13	-8.22	3.14	8.20	7.63	2.84	-10.83	6.49	7.17	5.01

Note: The sum of the disaggregated industries' contributions is not added to the broad sector figures, due to the use of unweighted sectoral multipliers.

Source: Author's calculation

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In the PRC the situation was different. The annual growth rate of employment in the service sector was 4.35%, exceeding that of both the agricultural and industrial sectors. Agriculture registered minimal employment growth (0.18%) in 1995–2000; this turned negative in 2000–2010. In both periods, changes in technology and final demand positively impacted employment. At the same time, higher productivity growth is the reason for the negative effect of labor input coefficient change which could lead to the loss of jobs. Further, technology has a stronger positive effect on employment change in the PRC than in India.

5. CONTRIBUTION OF STRUCTURAL CHANGE TO LABOR PRODUCTIVITY GROWTH

5.1 Measurement of the Structural Change Effect

Discussions in previous sections make it clear that the employment growth rate in various sectors in India and the PRC is heterogeneous in nature, which leads to structural changes in India and the PRC. In general, employment has been shifting from agriculture, a low productivity sector, to high productivity sectors such as industry and services. This section evaluates the contribution of this pattern of reallocation of employment or structural change to LPG by using equation 6. LPG is decomposed into structural change effects (SC) that comprise both SSE and DSE, and sectoral productivity effects (ISE) —for the period 1981–1982 to 2010–2011, and the results are presented in Figure 1 (for India) and Figure 2 (for the PRC).

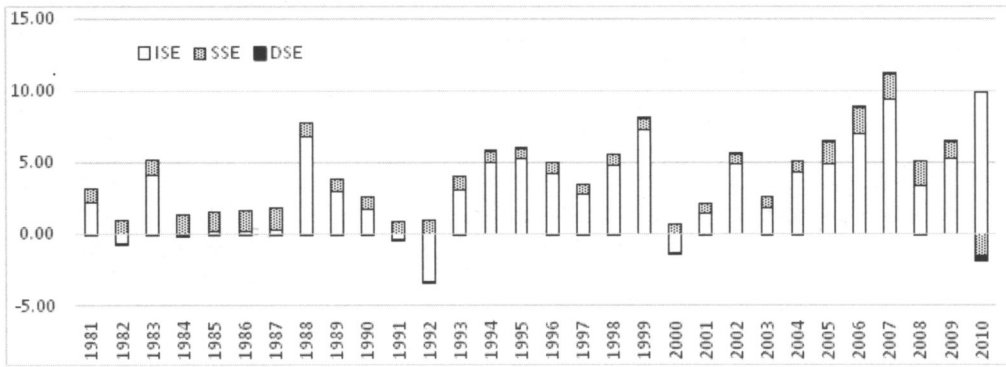

Figure 1: Contribution of Structural Change to Labor Productivity Growth in India

DSE = dynamic sectoral effect, ISE = intra-sectoral effect, SSE = static sectoral effect.

Source: Author's calculation

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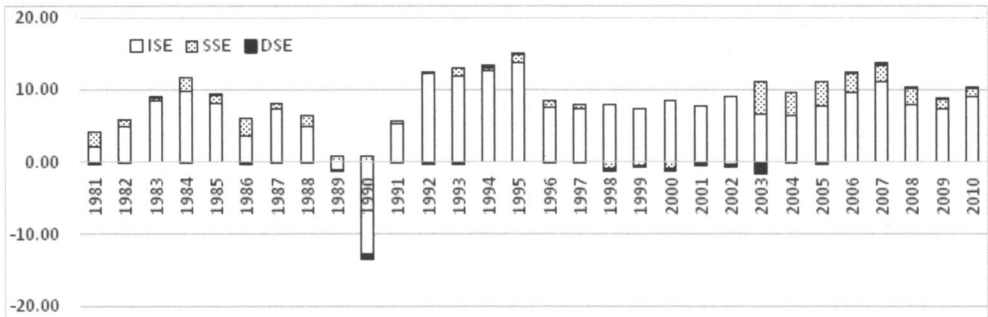

Figure 2: Contribution of Structural Change to Labor Productivity Growth in the People's Republic of China[6]

DSE = dynamic sectoral effect, ISE = intra-sectoral effect, SSE = static sectoral effect.

Source: Author's calculation

As seen in Figure 1, sectoral productivity contributed more to LPG than the structural change effects during the study period in India. For several years, the structural change was negative, suggesting that labor was moving in the wrong direction, from more productive to less productive activities. With regard to the PRC, Figure 2 indicates that sectoral productivity growth has contributed more to LPG than has the structural change in the PRC. However, the contributions of structural change in both countries are equally significant. Labor productivity has grown faster in the PRC than in India.

The pattern of structural change's contribution to LPG in India and the PRC is presented in Table 5. LPG in India has increased consistently over the three sub-periods. In 1980–1990, the annual average LPG was 2.85%; this increased to 3.82% in 1990–2000 and 6.11% in 1990–2000. Table 5 also shows that sectoral productivity growth was the primary component of LPG, and increased in tandem with it. The structural change effects, especially SSE, remained consistent in the three sub-periods.

In the PRC, sectoral productivity growth is the primary driver of LPG. In 1980–1990, the contribution of SSE was 1.25%; this declined substantially to 0.81% in 1990–2000 but increased to 1.99% in 2000–2010. Sectoral productivity growth and LPG consistently increased across the three sub-periods, and could explain why the PRC's economic growth is higher than that of India.

6 Employment growth was about 17% in 1990 because that was the year in which working 15-year-olds were first counted among employed persons (Lu *et al.* 2002).

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TABLE 5
DECOMPOSITION OF LABOR PRODUCTIVITY GROWTH
IN THREE SUB-PERIODS

	LPG	ISE	SSE	DSE
	India			
1980–1990	2.85	1.77	1.12	-0.04
1990–2000	3.48	2.73	0.78	-0.03
2001–2010	6.11	5.21	0.93	-0.03
	People's Republic of China			
1980–1990	4.52	3.51	1.25	-0.24
1990–2000	9.46	9.41	0.23	-0.18
2001–2010	10.02	8.22	1.99	-0.20

Note: The figures are in terms of annual averages.

Source: Author's calculation

5.2 Empirical Evaluation of the Structural Change Effect on Labor Productivity Growth

This section empirically evaluates the impact of structural change on LPG by controlling for types of human capital and measures of globalization and economic integration, especially international trade and FDI. These selected control variables are based on the following discussions.

Human capital. Educational levels are linked to productivity growth (Welch 1970; Schultz 1975; Romer 1990; Benhabib *et al.* 1992). In general, an educated, motivated, and flexible labor force will be able to adapt more easily to new processes and industries, allowing productivity to increase. Empirical studies such as Apergis *et al.* (2008) prove that human capital significantly affects labor productivity because it accelerates the innovation process and spread-out of technology or facilitates the transfer of technology. There may also be positive externalities from developed human capital (Lucas 1988). Workers with little education and few skills can learn from more highly educated and skilled workers due to the exchange of ideas and intergenerational complementarities (Kremer and Thompson 1993), which in turn improves productivity. Hence, labor forces with higher levels of human capital are expected to have larger positive effects on productivity growth.

International trade. The neoclassical Heckscher-Ohlin model and "new trade theories" predict the positive impact of international trade on productivity growth. The Heckscher-Ohlin model predicts that comparative advantages arise from differences in

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relative endowments of production factors due to trade. Countries will therefore specialize in the production of goods that employs more of their relatively abundant factors. Thus, under the assumption of a "two factors and two commodities economy", the movement from autarky to trade will be associated with an increase in the relative price of goods that use the relatively abundant factor more intensively in both countries. In other words, if both countries produce both commodities, the increase in their relative price will lead to increased production of the labor-intensive commodity in the labor-abundant country and of the capital-intensive commodity in the capital-abundant country. This will lead to increased demand for labor in the labor-abundant country and for capital in the capital-abundant country. The "new trade theories" describe trade between countries with similar resource endowments and characterised by the intra-industry trade of similar (but differentiated) products, and posits that trade reduces production costs and increases productivity due to increasing scales of output.

As predicted, opening up the domestic market improves the economy's productivity by diverting resources from less efficient sectors to more efficient ones. Empirical studies such as that of Apergis *et al.* (2008) also prove that trade positively impacts labor productivity. However, this gain may differ across countries depending on the status of such factors as the economy and human capital stock. Inflows of cheap inputs and advanced technologies alone may not boost productivity; the domestic labor force must also absorb the technology. If they lack the skill to do so, the benefits of trade may not boost productivity.

Foreign direct investment. FDI stimulates economic growth by improving technology and productivity in the host economies. Generally, FDI takes two forms: establishing a new enterprise and modifying an existing enterprise's ownership status. Changing an existing enterprise's ownership status is done through mergers and acquisitions that consist of buying or selling existing shares, which are carried out largely by multinational enterprises. Foreign firms have considerable advantages over local enterprises due to their capital, modern technologies, marketing skills, and potential to exploit comparative advantages (Globerman and Ries 1994; Blomstrom and Kokko 1998; Baldwin and Dhaliwal 2001; Baldwin and Gu 2005; Rao and Tang 2005).

The presence of foreign firms can also directly improve local firms' productivity through "horizontal" and "vertical" spillover effects,[7] which can occur through four mechanisms: imitation, competition, skills transfers, and access to new markets (Blomstrom and Kokko 1998; Gorg and Greenaway 2004). These spillovers can be generated through both "backward and forward linkages". These are related to multinationals' relationships with their local entrepreneurs as suppliers (backward linkages), and as clients (forward linkages). The quality standards required by multinationals for purchased inputs can lead

7 Horizontal (intra-industry) spillovers are created within an industry in which local and foreign firms compete with each other. Vertical (inter-industry) spillovers occur on the production line and can thus affect different industries. They derive from the supplier or customer relationships that connect local enterprises to multinationals.

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local enterprises to improve their production processes and overall productivity. Local enterprises as suppliers can benefit from the skills and technical assistance provided by multinationals (Blomström and Kokko 1998). Further, by interacting with multinationals as clients, local enterprises are exposed to new technologies and innovations imported by the multinationals (Driffield and Munday 2002).

Hence, the specification used to evaluate the effect of structural change on LPG is

$$\text{LPG} = \text{f(SC, human capital, GTR, FDI)} \qquad ...(7)$$

As the low number of observations in this study limits the usefulness of the country-level time series method, this study pooled data from both countries for a 30-year period for the empirical analysis. Further, the Lagrange multiplier test fails to support the use of the random effects regression (the probability value of the Lagrange multiplier statistic is greater than 0.10) and indicates that there is no panel effect. Hence, pooled ordinary least squares regressions are used to estimate the impact of structural change and human capital on LPG.

The results of six sets of regression are presented in Table 6. The simultaneity relations of LPG with FDI, GTR, and human capital are addressed by introducing these three variables at their 1-year lags in the regression analysis. Further, the variance inflation factors (VIFs) are found to be below 4 in all the specifications which suggest that there is no multicollinearity problems. The first four regressions use structural change and four alternative measures of human capital (GERP, GERS, GERT, and human capital index) in each regression as the two independent variables. This ensures the robustness of the results to the impact of human capital on productivity growth. Once human capital is established as a crucial factor of the productivity growth, the regression is extended to include the globalization measures (GTR and FDI), and measures of structural change in the analysis. The first measure of structural change is SC, which comprises both SSE and DSE. The second measure of structural change is a statistical index known as the modified Lilien index (MLI).[8]

As shown, increasing the number of independent variables to four helps to explain the variation in LPG as reflected by R square, which has increased significantly. The coefficients of all alternative measures of human capital are strongly statistically significant in all of the regressions. The findings of this study align with several earlier findings (Welch 1970; Schultz 1975; Romer 1990; Benhabib *et al.* 1992; Miller and Upadhyaya 2000; Goldar *et al.* 2003; Siddharthan and Lal 2003; Apergis *et al.* 2008; Xu *et al.* 2008; Kathuria 2013). Country-specific studies—such as Kathuria (2013) (for India), and Xu *et al.*

8 This is is an extended version of the Lilien index (Lilien 1982), which was modified by Stamer (1999). This is defined as $MLI_{t,t-1} = \sqrt{\sum_{i=1}^{i=25} s_t^i, s_{t-1}^i \left[\ln \frac{s_t^i}{s_{t-1}^i}\right]^2}$, where s is the sectoral employment share.

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(2008) and Wei and Hao (2011) (for the PRC)—prove that human capital is a crucial factor of the productivity growth. The differences seen in the magnitude of coefficients of human capital in this analysis also impart an important message. The coefficient of GERP in regression 1 indicates that a unit increase in the GER for primary education leads to a 0.10% increase in LPG by controlling for the structural change effect. The value of the coefficient of measures of human capital increased in regressions 2 and 3 as the level of education increased to GERS and GERT. This indicates that a higher educational level affects productivity growth more strongly, as deduced by Lucas (1988) and Kremer and Thompson (1993).

TABLE 6
IMPACT OF STRUCTURAL CHANGE ON LABOR PRODUCTIVITY GROWTH

Independent Variables	**Reg. 1**	**Reg. 2**	**Reg. 3**	**Reg. 4**	**Reg. 5**	**Reg. 6**
Structural Change						
SC	0.95 (0.59)[c]	0.85 (0.51)[c]	0.67 (0.41)[c]	0.84 (0.52)[c]	0.71 (0.42)[c]	
MLI						1.07 (0.56)[b]
Human capital						
GERP	0.10 (0.04))[b]					
GERS		0.16 (0.05)[c]				
GERT			0.21(0.12)a			
HK				7.50 (1.56))[c]	2.36 (1.40)[a]	1.50 (0.92)[a]
Globalisation						
GTR					0.07 (0.04))[b]	0.06 (0.34)[c]
FDI					1.09(0.46))[b]	1.02 (0.45))[b]
Constant	-5.59 (4.67)	-2.31 (2.28)	3.88 (1.10)[a]	-9.05 (3.04)[a]	-1.88 (4.19)	1.23 (4.50)
Observations	58	58	58	58	58	58
R-sq.	0.14	0.20	0.16	0.33	0.43	0.44

[a] Statistical significance at 1%; [b] Statistical significance at 5%; [c] Statistical significance at 10%.
Source: Author's estimation

The results show that the coefficients of GTR and FDI are positive and statistically significant at convenient levels in regressions 5 and 6. The inflow of FDI has increased productivity growth by bringing new advanced technologies and managerial skills to India and the PRC during this study periods. This finding is also consistent with Kathuria (2000; 2001), Goldar *et al.* (2003), Siddharthan and Lal (2003), and Banga (2004) for India, and Xu *et al.* (2008) for the PRC to establish the positive impact of FDI on productivity growth. Similarly, the growth of international trade has boosted productivity growth through the direct effects of specialization and economies of scale. These findings are in line with the findings of several earlier studies, including Mitra and Ural (2007) (for India) and Xu *et al.* (2008) (for the PRC).[9] Thus, although the PRC

9 Several studies also showed that international trade is the driving factor of productivity growth in several countries and regions: Austria (1998) for the Philippines, Muendller (2001) for Brazil, Lee (2004) for the Republic of Korea, Nachega and Thomson (2006) for Niger, Jajri (2007) for Malaysia, and Apergis *et al.* (2008) for Europe.

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and India initially adopted very restrictive trade policies, the gradual removal of trade barriers through economic reform measures has percolated trade benefits into different economic sectors, boosting productivity growth. Several studies—such as Grossman and Helpman (1991), Barro and Sala-i-Martin (1995), and Edwards (1997)—have also suggested that countries with greater degrees of openness have a greater potential to benefit from technology diffusion and achieve higher productivity growth. Further, Dollar and Kraay (2004) empirically proved that trade openness generates economies of scale and leads to productivity gains.

Although both globalization and economic integration are statistically significant in the regressions, the differences found in the value of coefficients constitute one of this study's crucial findings. For instance, in regression 5 the values of the coefficients are 0.07 for GTR and 1.09 for FDI. This indicates that a 1.00% increase in the growth of international trade leads to a 0.07% increase in LPG, and a 1.00% increase in the share of FDI in GDP leads to a 1.09% increase in productivity growth. Thus, it can be inferred that FDI boosts productivity growth more than does international trade. This could be due to the direct role that multinational enterprises play in the production processes of local firms through both forward and backward linkages. Multinationals try to increase their profit by increasing the efficiency of local firms by importing their capital, advanced technologies, and marketing and managerial skills (Globerman and Ries 1994; Blomstrom and Kokko 1998; Baldwin and Dhaliwal 2001; Baldwin and Gu 2005; Rao and Tang 2005).

6. POLICY IMPLICATIONS OF STRUCTURAL CHANGE FOR ECONOMIC GROWTH

The previous sections have established that structural change through labor reallocation is a crucial factor of LPG, and that final demand change is a determining factor of heterogeneous employment growth across various sectors. The decomposition of growth of per capita income into the contributions due to LPG and growth of employment rate (i.e., the growth of the ratio of employed persons to the total population) in Figure 3 reveals the significance of LPG in the growth of per capita income.[10] It is clear that LPG is a major component of the growth of per capita income in both the PRC and India. However, the increased employment rate did not contribute significantly to the growth of per capita income in the 1990s and 2000s, because the population growth rate was higher than that of employment in both the PRC and India. Hence, LPG is the main source of growth of per capita income in both countries, whereas higher LPG is the reason why per capita income growth is higher in the PRC than in India.

10 Per capita income = GDP/total population = (GDP/employment)* (employment/total population) = Labor productivity (LP) * employment rate (EMR). Hence, log (per capita income) = log (LP) + log (EMR). Differentiating both side of the equation yields growth of per capita income = (labor productivity growth) + growth of employment rate.

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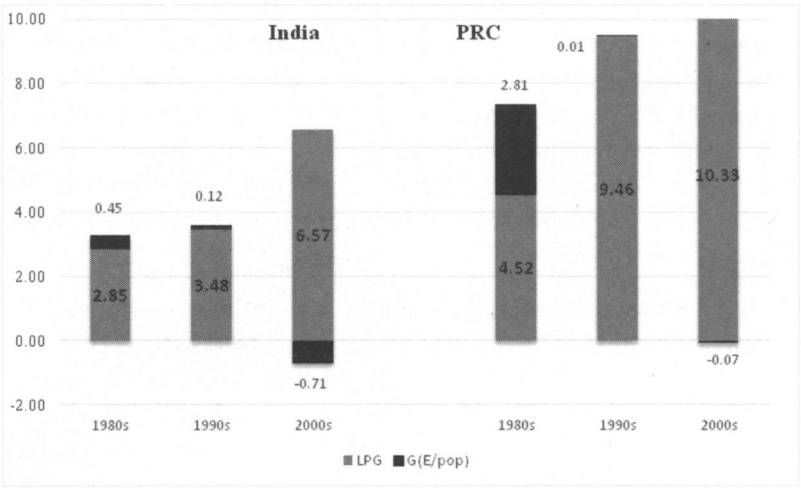

Figure 3: Growth of Labor Productivity, Employment, and Per Capita Income

G(E/pop) = growth of the ratio of employed persons to the total population (growth of employment rate).

Note: The numbers are in terms of annual averages in each period.

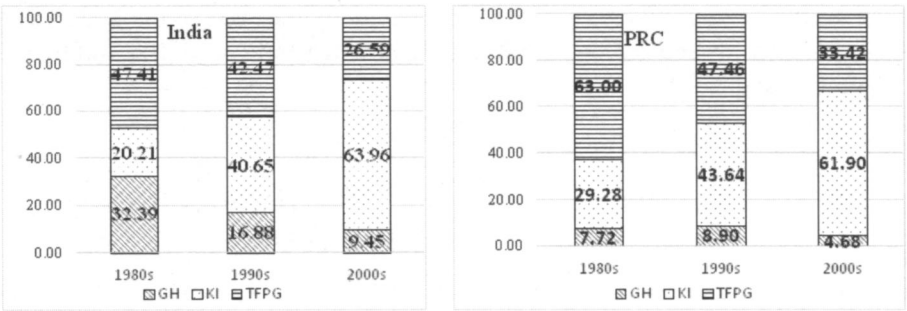

Figure 4: Capital Intensity and Labor Productivity Growth

GH = growth of human capital, KI = growth of capital intensity, TFPG = total factor productivity growth

Source: Basic data from Penn World Table

Further, as seen in Table 5, the contribution of structural change effect to LPG is larger than that of growth of employment rate in India. While this study focuses primarily on the reallocation effect of labor on LPG, to achieve a wider understanding of the issues it is also necessary to examine the role of physical capital in structural change and productivity growth. PWT data shows that the capital compensation share in income and capital intensity has been increasing in both countries, and that a significant gap in capital income share existed between the PRC and India in the 1980s, and gradually shrank in the 1990s and 2000s (Figures A2 and A3). This signifies the progression of capitalization in both economies during the study period.

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Figure 4 demonstrates the importance of physical capital, by decomposing LPG into the effect of the growth of human capital, the growth of capital intensity, and total factor productivity growth. [11] This suggests that the contribution of physical capital to LPG in India has been increasing, from about 20% in the 1980s, to 41% in the 1990s, and 64% in the 2000s. However, the contributions of both human capital and total factor productivity growth to LPG have declined in relative terms. In the PRC, human capital's contribution accounted for about 8% in the 1980s, 9% in the 1990s, and 5% in the 2000s; while that of total factor productivity growth accounted for 63% in the 1980s, 47% in the 1990s, and 33% in the 2000s. This decline could be due to the increase in gains from the capital intensity.[12] However, India and the PRC differ from each other in terms of allocation of capital stock across various activities (Table A5). In India, capital has been shifting from the agriculture and service sectors to the industrial sector. In contrast, the massive concentration of capital stock in the PRC's industrial sector has moved to the service sector. The capital stock of the PRC's agricultural sector also declined significantly during the period under study.

As structural change in terms of labor reallocation has boosted LPG in the PRC, India's present economic structure and the status of its structures of international trade and final demand, and demographic structures (Bloom 2011) indicate that the country is capable of competing with the PRC in terms of both higher productivity and economic growth. Although labor has largely moved from the low productivity agriculture sector to the non-agricultural sector, a significant proportion of the labor force remains concentrated in this sector, unlike in the PRC. Hence, there is scope to increase India's overall economic growth, if the government undertakes conducive economic reform measures. Further, many industries in India still lag the international best practice and the economy suffers from several constraints including inadequate infrastructure, a rigid labour market, etc. Accordingly, India has much income growth potential left to exploit. Further, India's economic growth strategy, which is driven by only the service sector, may not succeed in surpassing Chinese economic growth unless manufacturing sector made competitive. Services are more skill intensive relative to manufacturing activities, and hence it creates fewer jobs. India now needs to develop the manufacturing sector, which will absorb millions of additional labours. China, on the other hand, needs to develop services activities and to go up the value chain, from less skill-intensive to more skill-intensive, which will enable to avoid the middle-income trap. This is impossible to avoid its middle income trap, if it is manufacturing centric. Hence, there is enough room for India to use manufacturing as a growth escalator, and for China to tap into services as a growth escalator to avoid the middle income trap. Furthermore, the increasing reliance on the capital accumulation as the dominant sources of economic growth in

11 The trends seen in the total factor productivity indices in Figure A4 indicate that, although the PRC's total factor productivity was lower than that of India before 1984, its accelerated growth could surpass that of India by 1985.

12 The PRC's performance in terms of human capital was better than that of India (Figure A5).

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both the countries by neglecting the contribution due to TFP growth and the natural environment, raises doubt on the sustainability of higher growth, which has to be looked upon by the policy makers.

7. CONCLUSIONS

This study reveals the large-scale reallocation of labor from agriculture to non-agricultural sectors in both countries. However, a larger proportion of India's labor force remains concentrated in the agriculture sector, as compared to the PRC. Although India's service sector is its main driver of economic growth, it has not absorbed the labor force proportionately, compared to the PRC. The input–output results reveal that the final demand change is the main factor for heterogeneous employment growth in India, while changes in final demand and technology are the main factors of employment growth in the PRC.

Overall productivity increased considerably in both countries during 1980–2010; however, LPG has been lower in India than in the PRC. The empirical results confirm that the structural change effect is a significant factor in explaining LPG. The study used an alternative measure to check for robustness, and these have consistently provided positive and statistically significant results regarding the impact of structural change on LPG. Further, it was found that both measures of globalization (FDI inflows and international trade) are significant in explaining LPG.

The study also highlights human capital as a crucial factor of productivity growth. The study used human capital indices, which capture both years of schooling and returns to education to examine their impact on LPG. This study also vindicates the significance of human capital in explaining LPG. The study uses three alternative measures of human capital (GERs in primary, secondary, and tertiary education) for the analysis. It is important to note that, the higher the educational level, the greater the magnitude of impact on LPG.

This study provides policy lessons for India from the PRC's history of economic growth. LPG is the primary component of economic growth. FDI inflows and international trade boost productivity growth directly through technology diffusion and economies of scale, and indirectly by inducing structural change through the creation of demand for existing or new modern outputs. The PRC's performance in terms of FDI inflows and international trade has been better than that of India. Further, a significant proportion of the unproductive labor force is concentrated in India's agriculture sector, which must be made productive through both structural change and boosting sectoral productivity.

Hence, India must compete severely with the PRC in order to catch up in terms of productivity and economic growth. This must be done though faster economic

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reform measures and more outward oriented policies. These include the development of infrastructure, sound credit and macroeconomic policies, market-supporting institutions, conducive business laws and regulations, and flexible labor market policies that can promote exports, encourage foreign investment, and acquire advanced technologies (Cheng *et al.* 2005). Such measures will boost productivity and drive structural change, which lead to increased overall productivity of the economy. Further, as human capital is crucial to achieving higher LPG, relevant policies must be pursued through various incentives and promotional measures.

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APPENDIX

TABLE A1
25 SECTORS AND THEIR CONCORDANCE

India KLEMS (IKLEMS)	25 sector	The China Industrial Productivity (CIP)	25 sector
Agriculture, Hunting, Forestry and Fishing (AHFF)	1	Agriculture, forestry, animal husbandry, and fishery	1
Mining and Quarrying (M&Q)	2	Coal mining	2
Food Products, Beverages, and Tobacco (FBT)	3	Oil and gas excavation	
Textiles, Textile Products, Leather, and Footwear (TEXLE)	4	Metal mining	
Wood and Wood Products (WWP)	5	Non-metallic minerals mining	
Pulp, Paper, Paper Products, Printing, and Publishing (PPPPPP)	6	Food and kindred products	3
Coke, Refined Petroleum Products, and Nuclear Fuel (CRPPNF)	7	Tobacco products	
Chemicals and Chemical Products (CHE)	8	Textile mill products	4
Rubber and Plastic Products (RPP)	9	Apparel and other textile products	
Other Non-Metallic Mineral Products (ONMMP)	10	Leather and leather products	
Basic Metals and Fabricated Metal Products (BMFMP)	11	Saw mill products, furniture, and fixtures	5
Machinery not elsewhere classified (MACH)	12	Paper products, printing, and publishing	6
Electrical and Optical Equipment (EOEQ)	13	Petroleum and coal products	7
Transport Equipment (TEQ)	14	Chemicals and allied products	8
Manufacturing not elsewhere classified; Recycling (OMRE)	15	Rubber and plastic products	9
Electricity, Gas, and Water Supply (EGW)	16	Stone, clay, and glass products	10
Construction (CON)	17	Primary and fabricated metal industries	11
Trade (TRA)	18	Metal products (excluding rolling products)	
Hotels and Restaurants (HOR)	19	Industrial machinery and equipment	12
Transport, Storage, Post, and Telecommunication (TRSPT)	20	Electric equipment	13
		Electronic and telecommunication equipment	
Financial Services (FS)	21	Instruments and office equipment	
Public Administration and Defense; Compulsory Social Security (PADCSS)	22	Motor vehicles and other transportation equipment	14

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TABLE A1 continued...

Education (EDU)	23	Miscellaneous manufacturing industries	15
Health and Social Work (HSW)	24	Power, steam, gas, and tap water supply	16
Other Services (OS)	25	Construction	17
		Wholesale and retail trades	18
		Hotels and restaurants	19
		Transport, storage, and post services	20
		Information and computer services	
		Financial intermediations	21
		Real estate services	25
		Leasing, technical, science, and business services	
		Government, public administration, political and social organizations, etc.	22
		Education	23
		Healthcare and social security services	24
		Cultural, sports, and entertainment services; residential and other services	25

TABLE A2
CONCORDANCE OF 25 SECTOR WITH WORLD INPUT–OUTPUT DATABASE (WIOD)

NIC codes	Name of Industries	WIOD code	25 sectors
A to B	Agriculture, Hunting, Forestry, and Fishing	c1	1
C	Mining and Quarrying	c2	2
15t16	Food, Beverages, and Tobacco	c3	3
17t18	Textiles and Textile Products	c4	4
19	Leather, Leather, and Footwear	c5	
20	Wood, Wood Products, and Cork	c6	5
21t22	Pulp, Paper, Paper Products, Printing, and Publishing	c7	6
23	Coke, Refined Petroleum, and Nuclear Fuel	c8	7
24	Chemicals and Chemical Products	c9	8
25	Rubber and Plastics	c10	9
26	Other Non-Metallic Minerals	c11	10
27t28	Basic Metals and Fabricated Metal	c12	11

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TABLE A2 continued...

NIC codes	Name of Industries	WIOD code	25 sectors
29	Machinery (not classified elsewhere)	c13	12
30t33	Electrical and Optical Equipment	c14	13
34t35	Transport Equipment	c15	14
36t37	Manufacturing (not classified elsewhere); Recycling	c16	15
E	Electricity, Gas, and Water Supply	c17	16
F	Construction	c18	17
50	Sale, Maintenance, and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	c19	18
51	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	c20	
52	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods	c21	
H	Hotels and Restaurants	c22	19
60	Inland Transport	c23	20
61	Water Transport	c24	
62	Air Transport	c25	
63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	c26	
64	Post and Telecommunications	c27	
J	Financial Intermediation	c28	21
70	Real Estate Activities	c29	25
71t74	Renting of Machinery and Equipment, and Other Business Activities	c30	
L	Public Administration and Defense; Compulsory Social Security	c31	22
M	Education	c32	23
N	Health and Social Work	c33	24
O	Other Community, Social, and Personal Services	c34	25
P	Private Households with Employed Persons	c35	

NIC = National industrial classification

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TABLE A3
VARIABLES AND DATA

Variables	Measurement	Data sources	Remarks
Value added (v)	Annual data at current and constant prices 2005	Groningen Growth and Development Center (GGDC) 10-sector data base	The aggregate data from GGDC is distributed across 25 sectors based on their sectoral shares from World KLEMS data in 1980 to 2008. However, the World KLEMS data ends at 2008-09 for India. Hence, the 2008-09 share is also applied to GGDC aggregate data for the years 2009 and 2010.
Employment (l)	Annual data in labour person	GGDC 10- sector data base	
Intermediary demand or Input matrix (A)	Industry-by- industry matrix for 25 industries in 1995, 2000 and 2010	World Input Output Database (WIOD)	35 industries data are merged into create 25 industries for the years 1995, 2000 and 2010.
Final demand	It includes consumption, investment and export at current prices in USD. All the components are converted into constant prices at 2005 base and into the national currencies based on deflators and exchange rates from Wold development Indicator (WDI) of World Bank.	WIOD	35 industries data are merged into create 25 industries for the years 1995, 2000 and 2010.
Gross output (o)	The output is at current prices in USD, which is converted into constant prices based on the deflators from World KLEMS data and into the national currencies based on data from WDI.	WIOD	35 industries data are merged into create 25 industries for the years 1995, 2000 and 2010.

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TABLE A3 continued...

Variables	Measurement	Data sources	Remarks
Foreign direct investment (FDI)	This is measured as the percentage of FDI in gross domestic product.	World Development Indicators (WDI), World Bank	
Growth of international trade (GTR)	The annual growth rate of international trade (includes export and import) at constant prices	WDI	
Human capital indices (HK)	National level annual indices	Pen World table (PWT)	
Gross enrollment ratio in primary education (GERP), secondary education (GERS) and tertiary education (GERT)	Annual ratio at national level	WDI	

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TABLE A4
ANNUAL AVERAGE GROWTH OF LABOR PRODUCTIVITY (%)

	1980s	1990s	2000s	1980s	1990s	2000s
	India			People's Republic of China		
AHFF	1.77	1.52	2.76	4.03	5.85	8.51
Industry	**2.20**	**3.16**	**3.99**	**3.16**	**11.69**	**8.18**
MQ	2.84	4.55	2.33	-0.59	18.41	14.51
FBT	3.75	2.99	8.60	9.79	16.12	9.42
TEXLE	2.07	8.31	3.58	-0.32	12.86	3.40
WWP	-3.50	-2.98	6.20	18.40	24.39	7.00
PPPPPP	4.52	-1.73	6.00	6.32	27.11	4.51
CRPPNF	8.85	-0.24	16.64	-2.60	13.99	27.00
CHE	5.75	6.11	9.53	3.83	10.61	6.37
RUBPL	4.54	2.31	8.79	5.17	16.30	5.65
ONMMP	6.75	5.82	7.30	7.50	15.22	12.57
BFMP	2.27	3.33	9.00	2.25	18.94	12.47
MAC	0.70	-0.46	5.27	4.35	16.82	6.39
EOEQ	4.88	2.18	9.50	6.19	11.49	7.48
TEQ	4.04	7.56	0.82	10.79	11.50	14.13
OMRE	4.27	5.64	4.08	26.16	16.17	6.73
EGW	3.43	7.24	4.33	-0.05	18.58	8.35
CON	-2.95	-0.02	0.84	-0.40	7.87	10.74
Service	**2.32**	**3.10**	**6.47**	**5.36**	**8.39**	**8.85**
TRA	0.94	2.82	5.88	16.95	12.88	8.47
HOR	2.52	4.72	5.47	24.56	17.76	7.78
TRSPT	0.26	2.86	9.55	-0.62	20.74	11.76
FS	2.93	6.07	4.27	14.13	1.97	1.02
PADCSS	3.61	5.43	7.39	2.94	12.56	1.86
EDU	4.24	2.99	4.09	4.65	4.79	16.84
HESW	5.75	3.15	4.53	5.48	13.39	12.05
OS	2.67	1.51	5.56	3.07	8.12	9.74

Sources: The basic data of World KLEMS

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TABLE A5
CAPITAL STOCK STRUCTURE (%)

	India				People's Republic of China			
Sector	1981	1991	2001	2008*	1981	1991	2001	2010
AHFF	23.37	17.36	13.37	10.65	12.81	7.75	5.35	4.29
Industry	**23.59**	**36.41**	**39.27**	**42.26**	**64.28**	**66.27**	**53.11**	**45.42**
MQ	1.59	3.35	2.51	2.73	9.13	9.18	5.52	4.33
FBT	2.32	5.12	4.05	3.98	2.73	4.44	3.44	2.74
TEXLE	1.53	2.11	3.01	3.81	4.65	6.63	3.12	2.03
WWP	0.13	0.22	0.41	0.42	0.52	0.56	0.43	0.49
PPPPPP	1.90	2.44	1.90	2.02	1.28	1.59	1.61	1.12
CRPPNF	0.67	0.59	2.05	1.44	1.29	1.77	1.84	1.43
CHE	1.56	2.47	3.50	3.56	6.47	6.55	4.68	3.84
RUBPL	0.23	0.49	0.84	0.97	0.92	1.43	1.15	0.90
ONMMP	1.05	1.90	2.23	2.42	3.35	4.13	2.61	2.25
BFMP	2.22	3.90	4.32	5.71	8.11	7.14	5.56	5.70
MAC	2.20	1.66	1.41	1.58	8.91	5.78	2.31	2.48
EOEQ	0.80	1.44	1.41	1.59	2.95	3.42	3.70	4.38
TEQ	0.53	0.69	1.40	2.19	3.26	2.34	2.14	2.15
OMRE	0.26	0.44	0.61	0.95	1.20	0.73	0.59	0.36
EGW	5.78	8.72	8.30	7.05	7.93	9.22	12.84	10.03
CON	0.84	0.88	1.30	1.85	1.57	1.36	1.55	1.22
Service	**53.04**	**46.23**	**47.36**	**47.09**	**22.92**	**25.99**	**41.54**	**50.28**
TRA	4.59	3.86	3.34	3.86	6.68	4.45	4.35	3.11
HOR	0.83	1.12	1.04	1.17	0.56	0.69	0.97	1.29
TRSPT	7.23	7.82	9.03	9.33	5.05	6.63	12.04	9.95
FS	0.45	0.88	1.82	1.15	1.51	0.74	0.70	0.25
PADCSS	13.05	12.79	11.05	9.73	2.95	2.75	3.64	7.88
EDU	0.74	0.99	1.62	2.50	2.04	2.97	2.84	2.45
HESW	0.26	0.39	0.67	1.17	0.46	0.76	0.72	0.90
OS	25.89	18.37	18.78	18.18	3.66	7.01	16.28	24.46

Source: The basic data of World KLEMS (sectoral-level capital stock data for India is available up to 2008).

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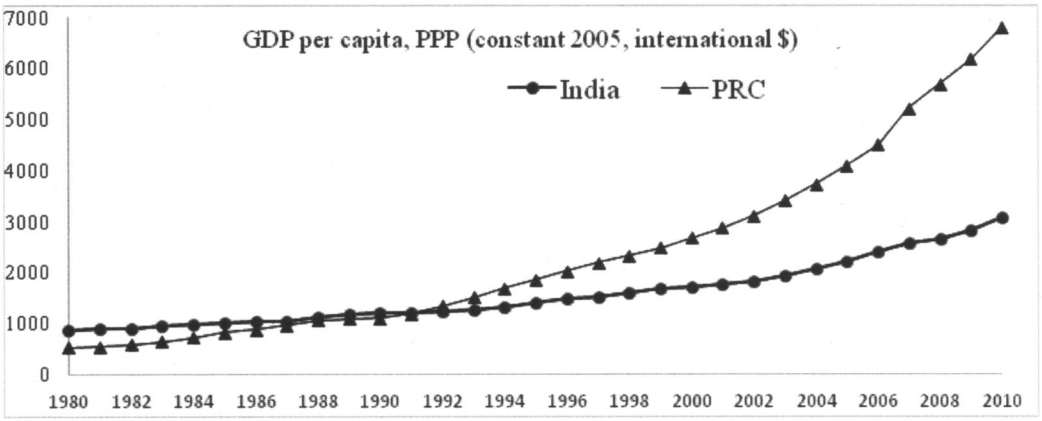

Figure A1: Per Capita Income in India and the People's Republic of China

Sources: World Bank, World Development Indicators (2008 and 2015).

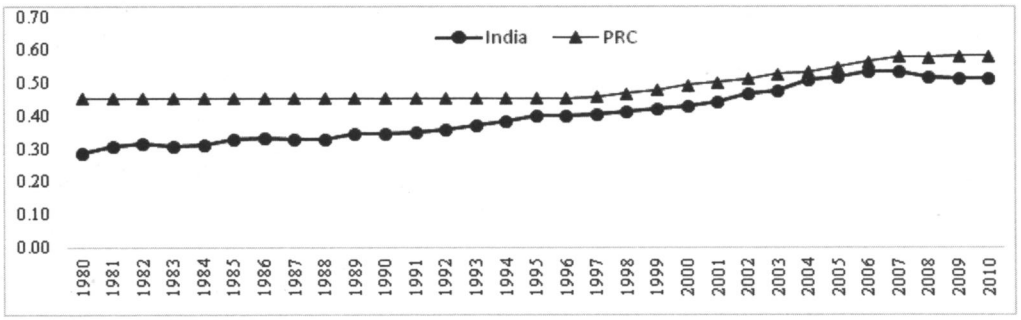

Figure A2: Capital Income Share in Gross Value Added

Source: Penn World Table

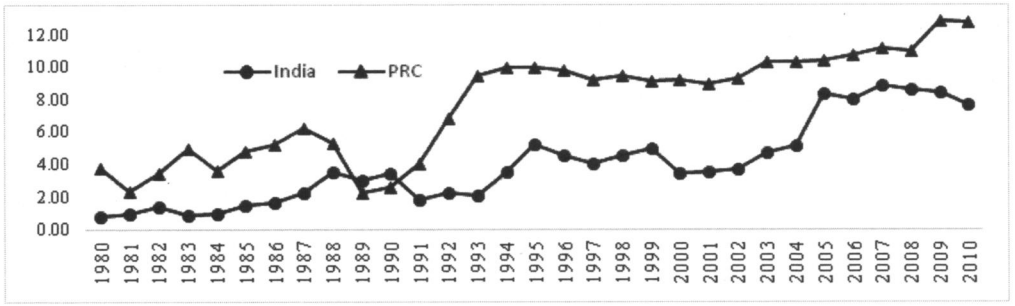

Figure A3: Trends of Indices of Growth of Capital Intensity

Source: Penn World Table

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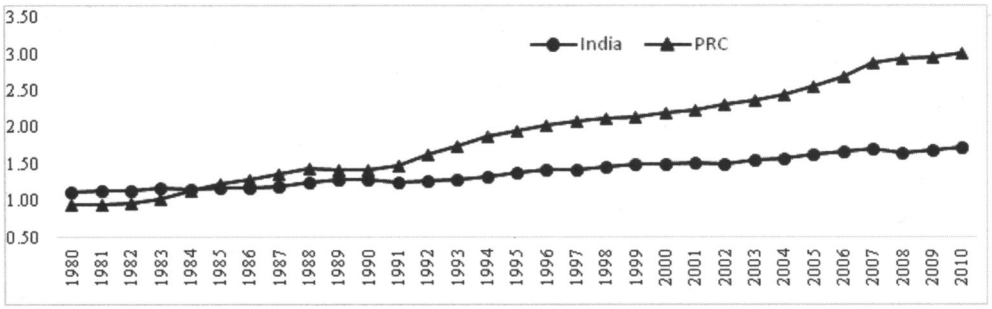

Figure A4: Trends of Indices of Total Factor Productivity

Source: Penn World Table

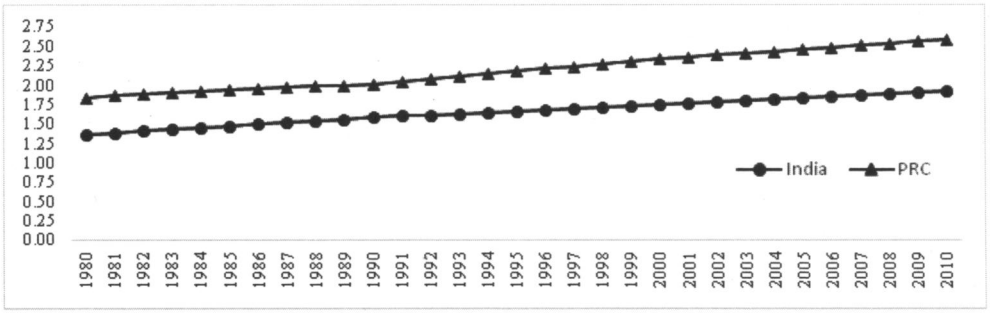

Figure A5: Trends of Indices of Human Capital in India and the People's Republic of China

Source: Penn World Table

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