Department of Economics and Statistics "Cognetti de Martiis"
Campus Luigi Einaudi, Lungo Dora Siena 100/A, 10153 Torino (Italy)
www.est.unito.it

Working Paper Series

32/14

STRUCTURAL CHANGE, GLOBALIZATION AND ECONOMIC GROWTH IN CHINA AND INDIA

VITTORIO VALLI and DONATELLA SACCONE

The Department of Economics and Statistics "Cognetti de Martiis" publishes research papers authored by members and guests of the Department and of its research centers. ISSN: 2039-4004

Structural Change, Globalization and Economic Growth in China and India

Vittorio Valli and Donatella Saccone [1]

Department of Economics and Statistics "Cognetti de Martiis"

University of Torino

Contact information: vittorio.valli@unito.it, donatella.saccone@unito.it

Abstract

In their period of rapid growth China and India have experienced profound structural transformations. The aim of the paper is to analyze the relation between structural change, the process of globalization and economic growth in the two great Asian countries, using a highly disaggregated dataset for the 1987-2009 period. While China had a longer and more intensive productivity growth than India, the latter had a somewhat more balanced growth. Both countries registered higher within-sectors gains in productivity than between-sectors ones. Our analysis also shows that there exist important feedbacks between structural change, globalization and economic growth over time. When the reallocation of labor is large, it may positively impact on the future rates of economic growth. At the same time, however, it seems that a too rapid economic growth may have hindered a smooth reallocation of labor. In China very rapid labor force movements between sectors and regions have contributed to social problems such as urban congestion, disproportionate rises in prices of housing in the cities, rapid increase in pollution, massive social problems for internal immigrants and a vast increase in social and economic inequalities. In India there has been a rising divide between urban and rural incomes and between workers employed in the formal and informal labor markets. New policies should be designed to favor labor movement across sectors and areas, to reduce the wage-productivity differentials and to integrate the informal sector in formal markets in India, in order to foster structural changes and enhance economic growth. However, if a too unbalanced economic growth has somewhat limited the extent of structural change, globalization has promoted it. High level of export, import and FDI not only has been related to higher rates of economic growth, but also to a deeper reallocation of resources across sectors, modifying the comparative advantage and reorganizing the production.

JEL codes: O11, O53, O57, P51
Key words: Structural change, globalization, economic growth, China's economy, India's economy.

[1] Paragraphs 1-5 are mainly due to Vittorio Valli, paragraphs 6-8 to Donatella Saccone.

1. Introduction

The aim of this essay is to analyze, in a comparative perspective, the relation between structural change, the process of globalization and economic growth in two great emerging economies, China and India, in their period of rapid development.

The studies on structural change and the patterns of economic development were introduced in Japan by Akamatsu (1935 and 1962) in a original way, the "wild-geese-flying approach" then generalized by Kiyoshi Kojima (2000) and Ozawa (2001) and (2010). The structural view was also independently furthered in a different way by other great authors such as Colin Clark (1940), who inaugurated the three-sectors approach, Simon Kuznets (1957) and Alexander Gerschenkron (1962).

Between the 1960s and the late 1980s the main contributions are due to Chenery (1960), Chenery and Taylor (1968), Taylor (1969), Keesinkg and Sherk (1971), Chenery and Syrquin (1975), Chenery et al. (1979), Kader (1985), Chenery, Robinson and Syrquin (1986), Syrquin (1988), Chenery and Syrquin (1989).

Recent contributions have mainly focused on cross-country analyses, more disaggregated approaches and country studies. For example, Haraguchi and Rezonja (UNIDO) (2010), De Vries, et al. (2012), McMillan and Rodrik. (2011), Lin (2011), Lin and Rosenblutt (2012) have carried out important cross-country analyses; Li, Menginstae et al. (2011) have focused on China and India; Kochhar et al. (2006) on India; Wang et al. (2007) on China. However, most of the cross-country studies have jointly studied market or mixed economies, often overlooking the particular structural features of Communist central planned economies like China up to 1978 as well as of heavily regulated mixed economies like India up to 1992. These features have heavily influenced the period of transition and rapid growth in the two great Asian economies. Countries in profound transition between different systemic mechanisms of regulation and control in the economy may have very different structural transformations with respect to countries that in the same period have fully maintained their systemic characteristics.

Moreover, few contributions have tried to analyze the relations between structural change, globalization and economic growth. The initial conditions, the pace of economic growth and the way in which a country has entered the globalization process are fundamental in order to understand the different economic structures of China and India and their change over time.

2. China and India: the initial structural conditions.

As table 1 shows, some important structural differences already existed between China's and India's economies in 1978, when China's radical economic reforms began.

In 1978, the percentage share of agriculture in total employment was about the same in the two countries, while the percentage in value added was much higher in India. Although in 1978 India had a level of per capita GDP in PPPs somewhat higher than China, the share of industry was already higher in China than in India, in terms both of value added and employment, while the share of services was much lower in China than in India. This is largely a consequence of a systemic difference, namely the fact that China was a Communist centrally planned economy, where services were usually overlooked and heavy industry was strongly privileged over light industry. Moreover, China's industry was essentially constituted by large state companies with an average productivity higher than that of India's

industry, sharply divided between a relatively small number of large state or private companies and many firms of the informal economy exhibiting a very low productivity.

Interestingly, as Kochhar et al.[2] pointed out, also in India in 1980, controlling for the level of development and the size of the economy, the percentage of services was somewhat lower than in the other developing and emerging countries, though larger than in China, while manufacturing industry's share was a little higher than in the other developing countries, though much lower than in China. However, in a few years China surpassed India in terms of per capita GDP and increased its industrial and service sectors much faster than India.

Table 1. Percentage sectorial shares in China and India in 1978

Sectors	Employment		Value added	
	China	India	China	India
Agriculture, forestry, animal husbandry, fishing	71	71	28	44
Industry, mining, quarrying, construction	17	13	48	24
Services	12	16	24	32
Total economy	100	100	100	100

Sources: National Bureau of Statistics of China (2008) for China. For India, see Bosworth, Collins (2008), p. 49.

It is also important to notice that in 1978 China's percentage of value added in agriculture on total value added was much lower than the percentage of employment on total employment. Moreover, the percentage in agriculture's value added was much lower than in India, while the percentage in industry was already double than in India. This implies that the ratio between industrial productivity and agricultural productivity was particularly high in China, and this was largely dependent on systemic differences and on the strategic choices of China's planners and India's policy makers.

3. Economic development and structural change in China and India: an overview

By comparing the trends of some of the most important macroeconomic indicators, it is possible to see that economic development was very different in terms both of the pace of economic growth and its duration in the two great Asian countries. Table 2 and 3 show that real GDP, real labor productivity, exports in volume and, above all, real investment have grown more rapidly in China than in India, while employment has grown faster in India than in China. The phase of rapid growth began in 1978 in

[2] See Kochhar et al. (2006).

China and in the second half of the 1980s or in 1992 in India[3], and the average rate of growth was considerably higher in China than in India especially in the 1978-92 years.

Table 2. China and India: some macroeconomic indicators.

Indicators	**China**			**India**		
	1978	**1992**	**2012**	**1978**	**1992**	**2012**
Total GDP in billions 2012 EKS US $	869.7	2310.1	14012.9	751.4	1.409.4	5.374.7
Per capita GDP in 2012 EKS US $	831	1983	10371	1160	1622	4431
Labor productivity per employed person in 2012 EKS US $	1872	3510	18325	3306	4324	11048
Total employment (millions)	464.5	658.2	764.6	227.3	325.9	486.5
Gross capital formation (a)	71.6	192.2	1910.4	39.1	84.0	452.5
Exports index in volumes (b)	100.0	474.0	9482.0	100.0	187.6	1468.6

(a) In billions US dollars at 2005 constant prices and 2005 constant exchange rates, 2011 instead of 2012.

(b) 1980 instead of 1978, volume index of merchandise exports 1980=100.

Sources: for the first four rows, Conference Board (2013), Total Dataset; for rows 5 and 6, UNCTAD (2014).

Table 3: China and India: annual average rates of change (1978-2012)

	China		**India**	
	1978-1992	**1992-2012**	**1978-1992**	**1992-2012**
Real total GDP in EKS	7.2	9.4	4.6	7.0
Real per capita GDP in EKS	6.4	8.7	2.4	5.2
Real labor productivity in EKS	4.7	8.6	2.0	4.9
Total employment	2.5	0.8	2.6	2.1
Real gross capital formation (a)	7.4	12.8	6.5	9.3
Exports in volumes (b)	13.7	18.1	5.4	10.8

(a) In billions US dollars at 2005 constant prices and 2005 constant exchange rates, 2011 instead of 2012.

(b) 1980 instead of 1978, volume index of merchandise exports 1980=100.

Sources: for the first four rows, Conference Board (2013), Total Dataset; for rows 5 and 6, UNCTAD (2014).

[3] An acceleration of economic growth occurred in India in the second half of the 1980s and was strengthened after the economic reforms of 1992.

In the second period (1992-2012) although China continued to have a higher rate of growth of India, there was a marked acceleration of economic growth in both the economies. China and India rapidly increased their exports, capital accumulation and attraction of FDI. However, after the global financial crisis begun in the US in 2007-8, in both the countries there was a consistent reduction in the rate of growth.

If we concentrate the analysis on the structural changes occurred in the two countries in the period covered by our disaggregated data set (1987-2009), we can see that China reduced the percentage of agriculture both in employment and in valued added, and increased the absolute and relative size of its industrial sector much more than India. The exceptionally rapid rise in investment, value added and productivity in China has mainly regarded the industrial sector, while agriculture and services have contributed less. However, the share of services in employment constantly grew also in China surpassing in the 1990s the share of industry (see Table 4).

Table 4: Employment and value added by sectors in China and India (1987-2009)

Employment (%)	**China**				**India**			
	1987	**1992**	**2004**	**2009**	**1987**	**1992**	**2004**	**2009**
Agriculture	58	58	47	38	65	63	56	54
Industry	23	21	22	28	16	16	19	20
Services	19	20	31	34	19	21	25	26
Total economy	100	100	100	100	100	100	100	100

Value added (%)	**China**				**India**			
	1987	**1992**	**2004**	**2009**	**1987**	**1992**	**2004**	**2009**
Agriculture	30	27	13	9	30	29	19	14
Industry	36	38	52	53	27	27	27	26
Services	34	35	35	38	43	44	54	60
Total economy	100	100	100	100	100	100	100	100

Sources: See our database for 1987-2009 (paragraph 5).

Indeed, if compared to India (but also to other developing and emerging economies), China's process of industrialization has been much more rapid and extensive, while the service sector, starting from a very low level, has grown substantially. However, it has remained less extensive than in India. India has reached, and then surpassed, the average percentage level of the tertiary sector of several other developing and emerging countries, improving in particular the specialization in the production and export of software and other ICT services.

If we consider the internal composition of industry and services in the two countries, we discover other important differences, that we will discuss in detail in paragraph 6. Here we can anticipate that China has progressively built an industry much larger and stronger than India especially for office machines and ITC equipment, but also for steel, textile, automobiles and clothes, while India has reached a good position in the pharmaceutical and steel industries and in software services.

Some of the main determinants of the different patterns of development in the two countries may be so summarized:

A) In 1978 China had already a larger industrial base than India, although China had then a lower per capita GDP.

B) Since 1978 China has introduced radical economic reforms that have strongly favored industrialization much earlier than India (about 14 years in advance).

C) China's rate of saving and investment has been much larger than in India, and investment went mainly to manufacturing industry, constructions and a part of the services sector.

D) China favored industrialization more than India maintaining relatively low prices for agricultural goods and for some basic inputs provided by state corporations.

E) China had an extensive use of the fordist- toyotist model of growth[4], while India limited it almost exclusively to the formal sector, which employs only about one tenth of the total labor force.

F) China opened its economy to external trade and foreign investment earlier and much more extensively than India, as we will see in next paragraph.

G) In the 1978-2012 period in China there was a vast increase in income and wealth inequalities, while absolute poverty diminished. In India the rise in inequalities was less severe, but there remained a large level of absolute and relative poverty.

H) In China the extraordinarily rapid process of industrialization and urbanization and the absence of adequate environmental policies led to a great rise of pollution. In India the rise in pollution was substantial, but lower than in China.

As regards India, it is interesting to quote a passage from Kochhar et al.[5] "[…] we argue that the nature of the policies India followed after independence in 1947 created unique specializations prior to the economic reforms that started in the 1980s. Relative to other comparable poor countries, India's emphasis on tertiary education, combined with a variety of policy distortions, may have channeled the manufacturing sector into more skill-intensive industries. Furthermore, the government's desire to create capital goods production capability, especially through public-sector involvement, implied that India had a greater presence in industries that required scale (and capital) than other developing countries. Regulatory penalties and constraints on large private enterprise implied, however, that within most industries, the average scale of enterprise was relatively small. Finally, rigid labor laws as well as constraints on the scale of private enterprises may well have limited India's presence in labor- intensive manufacture, the usual specialization in a populous developing country."

[4] See, for a more detailed analysis, Valli and Saccone (2009), pp. 102-105.
[5] Kochhar et al (2006), p. 4.

4. The globalization process

The period of very rapid economic growth in China (from 1978-up to now) and in India (from the late 1980s or 1992 up to now) fully occurred during the second wave of economic globalization. This wave started at the beginning of the 1970s and was greatly extended and strengthened in the 1990s and 2000s, after the collapse of the Soviet empire and the growing trade and FDI liberalization in China and India. Since the 1990s there was a sort of feedback between rapid economic growth and the progressive insertion of China and India in the globalization process[6].

The main steps of the globalization process in both countries are summarized in tables 5 and 6.

In the 1980s, 1990s and 2000s China has rapidly transformed its economy from a closed, heavily protected one to an open and interconnected economy. Its degree of openness went up from 12.8 % in 1990 to 26.4 % in 2012 (see table 5), while its share in world merchandise exports rapidly rose from 1.8 % in 1990 to 11.1 % in 2012, almost seven times India's level.

Thanks to SEZs (Special Economic Zones) and a gradual FDI liberalization, China attracted a massive inflow of FDI, usually consisting in joint ventures of foreign multinationals with Chinese firms. In this way, China could briskly increase its capital accumulation, its exports and its technical knowledge. In the 2000s China began also to rapidly increase its outward FDI [7].

Table 5. China and India: some globalization indicators.

	CHINA				**INDIA**			
Years	**1990**	**2000**	**2010**	**2012**	**1990**	**2000**	**2010**	**2012**
Degree of openness (%) (a)	12.8	22.2	27.5	26.4	8.0	14.2	23.5	26.8
Inward FDI stock as % of GDP (b)	5.1	16.2	9.9	10.3	0.5	3.5	12.3	12.2
Outward FDI stock as % of GDP (b)	1.1	2.3	5.3	6.3	0.1	0.4	5.8	6.4
Current account balance, % of GDP (b)	3.0	1.7	4.0	2.4	- 2.2	- 1.0	- 3.1	-4.9
Simple average tariff rates (manufactured goods, ores and metals) (b), (c)	42.5	15.9	9.0	8.9	81.3	31.4	9.0	n.a.
Merchandise exports (in % of world exports) (b)	1.8	3.9	10.3	11.1	0.5	0.7	1.5	1.6

(a) (Exports + Imports of goods and services) / 2 in % of GDP at current prices and current rates of exchange (source: UNCTAD, 2014). (b) Source: UNCTAD (2014). (c) For China: 1992 instead of 1990 and 2011 instead of 2012; for India: 2009 instead of 2010.

[6] On the globalization process and the two great Asian countries see, for example, Srinivasan (2006); Winters and Yusuf (2007); Bensidoun, Lemoine and Unal (2009), and Marelli, Signorelli (2011). Beretta and Targetti Lenti (2012) have in particular analysed the trade relations between China and India in the globalization period.

[7] On the theoretical determinants of this trend see, for example, Andreff and Balcet (2013).

Table 6: Main steps towards globalization in China and India.

China	India
Major economic reforms since 1978: A) Responsability system in agriculture. B) Institution of SEZs (Special Economic Zones): Shenzhen, chosen in 1978, officially declared SEZ in 1980. Other SEZs introduced, at first mainly on the coast, then also in some internal zones. They have attracted many FDI in the form of joint ventures with Chinese firms, mainly aimed at increasing exports. C) Institution and expansion of TVEs (township and village enterprises).	1980s: First timid economic reforms, especially in the second half of the decade, but maintenance of high protectionism, import substitution policies and heavy internal economic regulations.
D) 1990s: Gradual recognition of private ownership and expansion of private enterprises and joint ventures with foreign corporations. Increasing liberalization and rapid expansion of foreign trade and FDI inflows.	1991-92: Major economic reforms: progressive internal and external liberalization and sharp reduction of economic regulations. 1995: Entry in WTO
E) 2001: Entry in WTO. Strong expansion in external trade, accumulation of huge surpluses in the balance of current accounts and of large international reserves. Some problems for the expansion of exports after the great US-EU 2008-2013 financial crisis. Maintenance of capital movements controls which contributed to lessen the adverse effects of 2008-2013 financial crisis, but some limited steps towards a reductions of capital controls, such as QFII = qualified foreign institutional investment and QDII = qualified domestic institutional investment, in 2002 and 2006.	2000s: Rapid rise in FDI inflows and then of FDI outflows. Maintenance of strategic forms of international capital movements controls, which contributed to lessen the adverse effects of 2008-2013 financial crisis.

Up to 1991, India had severely constrained both international trade and FDI inflows. It gradually opened FDI inflows in the second half of the 1990s and especially in the 2000s, also creating its own SEZs. In recent years, India has registered a rapid rise in inward and outward FDI. As regards trade, India has lagged about a decade after China in the opening process, but has increased very rapidly its openness degree in the 2000s. However, India has exhibited a lower international competitiveness than China in several industrial sectors. This was partly due to higher unit labor cost in the formal sector of India' economy, but also to the less extensive and less diversified industrial base, the small size, poor productivity and low propensity to export of a large number of enterprises in the informal sector, the lower exploitation of scale economies, and the inadequate system of infrastructures. This resulted in less export opportunities in manufacturing than in China, although for some sectors, such as refined petroleum, jewels, pharmaceutical products, cars, India's exports are very large, while for software and

other ICT services India has become the second largest international net exporter. However, in the field of raw materials, the imports of oil, coal and gold are huge, while India mainly exports raw cotton and iron ore. In sum, while China has maintained a structurally positive balance of current accounts since 1994, India has often registered deficits. However, both countries preserved different degrees of control on capital movements and thus suffered less than Western countries from the impact of the 2008-2013 great financial crisis.

5 Structural change, globalization and social problems

The timing and the particular way in which China and India structurally transformed their economy and entered into the globalization process had important consequences on various social problems.
First of all there was the rise in economic inequalities. The rise was dramatic in China both between households and regions. It was more limited in India between households, but substantial between regions.
China gradually passed from very low levels of economic inequalities between household in 1978 to high levels in 2012, superior to the United States and to most European countries. The period of rapid growth and the expansion of industrial and services activities and of exports favored in particular the urban-industrial areas on the coast, the ZES and the rural villages near them, which could easily sell a large part of their agricultural goods on rich urban markets. These rural villages could invest in industrial and tertiary activities part of their agricultural profits building new TVEs (Township and village enterprises) and thus creating more wealth for their citizens. On the contrary poor rural villages in the internal part of the country had much less growth opportunities. So structural change and export possibilities contributed to increase inequalities both between households and between provinces.
In India the great gap between rural and urban incomes and between workers in the formal and informal sector increased when there was, especially since 1992, an acceleration in the expansion of exports, of modern services and the formal sector of industry. This contributed to enlarge regional income inequalities and wages disparities between workers in the formal and the informal sectors.
A second deep social problem was poverty. Notwithstanding the phase of rapid growth, in India poverty remained important, especially in rural areas and in urban slums. In China absolute poverty decreased considerably over time, but it persisted significantly especially in some internal rural areas. Moreover, the large mass of internal immigrants without hokou (the permit to move from rural to urban areas) had in general worse job opportunities, lower wages and scarce welfare benefits if compared with the citizens of the towns where they migrated. Rapid structural change had led to more migration opportunities and very rapid urbanization, but also to a steep rise in the price of housing in the big cities, forcing internal immigrants and the poorest part of the population to move to cheaper, but more desolated, suburban areas.
A third important social problem was the environment. In China rapid growth, industrialization and urbanization led to a huge rise of pollution and of consumption of the soil as well as a large destruction of precious old buildings and beautiful traditional landscapes. In the 1990s and 2000s there was the enforcement of some anti-pollution policies and in 1998 the institution of SEPA (State Environmental Protection Agency) and in 2008 of a Ministry for environmental protection, but the results were meager. The policies were, in fact, utterly inadequate to cope with the effects of the dramatic rise in energy consumption and electricity, mainly provided with heavily polluting coal, of the massive rise in automobiles and trucks circulation, of urban expansion and congestion, etc[8].
In India the growth of pollution was slower than in China partly because of the less rapid growth and industrialization process. The environmental policies were a little more effective than in China, and in several cases they were spurred by the judiciary system and by local authorities. However, also in India the level of air and water pollution has considerably increased over time, contributing, together with the modest hygienic conditions and poor wastes disposal treatment, to several health problems.

[8] For a comparison between China's and Indi's environmental policies, see. for example, Garrone, Tecco, Vecchione (2012), pp. 215-264.

Finally, the two Asian countries had experienced several socio-political problems associated to the high level of corruption, the deficit of democracy in the Chinese political system and the great ethnic, religious, and caste divisions in India.

6. A disaggregated analysis on labor productivity

A more disaggregated analysis is based on decomposing the changes in aggregate labor productivity for China and India. Our database consists in time series data from 1987 to 2009 on the value added at 1995 constant price, employment and productivity at a detailed 33 sector level for China and 31 for India (see the list of sectors in appendix 1). In order to construct our database and obtain consistent time series from 1987 to 2009, we matched two different sources of data both elaborated as projects of the Groningen Growth and Development Centre (GGDC).

The first is the BRICs sector database introduced by de Vries *et al.* (2012), that provides a harmonized annual time series on the variables of our interest -value added, price deflators and employment by 35 sectors-for Brazil, Russia, India and China. The BRICs database covers the period 1987-2008 for China and 1981-2008 for India. The second database is the Social Economic Account (SEA) as a part of the World Input Output Database project (WIOD) covering 40 countries from 1995 to 2009 (Timmer, 2012), including China and India. The SEA offers a wide set of variables, among which value added, price deflators and employment by 35 sectors. Both the two databases use 1995 as the base year to deflate the value added, so that 1995 can be used as the joining link between the two sources of data. However, if we compare the employment and the value added in 1995, we notice some inconsistencies between the absolute values of the two databases, due to the fact that the SEA uses updated data, while the BRICs sector database is based on early data. Because the SEA represents the last vintage of data, we selected it as the data source of reference[9].

Since we wanted to cover a time span as long as possible and equal for China and India, we exploited the fact that from the BRICs database we can obtain a series starting from 1987, while the SEA data start from 1995. To solve the problem, we matched the two databases by applying the following methodology. In order to cover the period 1987-2009, we calculated the growth rates of value added at 1995 constant price and employment from the BRICs database for the period 1987-1995 and, then, we applied backward the resulting rates of growth to the 1995 SEA data to get consistent absolute values. In this way, data from 1987 to 1994 are estimates that use 1995 as the joining link between the two databases to match them, while data from 1995 to 2009 are the original data provided by the SEA database.

In this way, we constructed a new database for China and India, providing the value added at 1995 constant price, employment and productivity per employed person for the period 1987-2009. For China, we have data at a detailed 33 sectors, while for India at a detailed 31 sectors (see appendix 1 for further explanations).

The database is then used to analyze the changes in the aggregate productivity level. Indeed, the latter can originate from both changes in productivity within each sector and the movement of labor across sectors presenting different levels of productivity. To take into account these two different effects, the first called 'within effect' and the second called 'reallocation effect', we use the methodology originally proposed by Fabricant (1942) and adopted in recent studies on structural change (see de Vries et al., 2012; McMillan and Rodrik, 2011).

At first, we just consider the three main economic sectors, i.e. agriculture, industry and services. The change in the aggregate productivity level can be written as a sum of the two effects:

[9] We want to thank Gaaitzen de Vries for his support in selecting the most reliable source of data and for his precious suggestions on how to match the two databases.

$$\Delta Y = \sum_i \Delta Y_i \overline{\vartheta_i} + \sum_i \Delta \vartheta_i \overline{Y_i} \quad [1]$$

where ⊿*Y* is the aggregate productivity change between two periods of time, ΔY_i and $\Delta \vartheta_i$ respectively the productivity change and the change of the employment share in sector *i*, while $\overline{Y_i}$ and $\overline{\vartheta_i}$ respectively the average productivity and the average employment share of sector *i* in the two periods of time. The first addend represents the 'within effect' and the second addend the 'reallocation effect'. The 'reallocation effect' can be also considered as a residual given by the difference between the aggregate productivity change and the 'within effect' (de Vries et al., 2012), and it can be seen as an index of structural change.

However, as suggested by de Vries et al. (2012), we could lose important information on the structural change if we limit the analysis to the disaggregation by the three main economic sectors. Then, we carry out the decomposition of the aggregate productivity changes by considering both the changes across the three main economic sectors *i* and the changes across the subsectors *j* within each of the three sector *i*. Specifically, we consider 33 subsectors for China and 31 for India. By adopting the methodology suggested by de Vries et al. (2012), we write the change in aggregate productivity between two periods of time as follows:

$$\Delta Y = \sum_j \Delta Y_j \overline{\vartheta_j} + \left(\sum_i R_i \overline{\vartheta_i} + R \right) \quad [2]$$

The first addend represents the 'within effect', i.e. the sum of the productivity changes in each subsector *j* (ΔY_j), weighted by its average share on overall employment ($\overline{\vartheta_j}$). The second addend in brackets, representing the total 'reallocation effect', is composed by two parts. The first part is the sum of the reallocation effect within each sector *i* across its subsectors *j* (R_i), weighted by the average employment share of the sector *i* ($\overline{\vartheta_i}$). We will call it reallocation effect 1. The second part, R, is given by the reallocation effect calculated for the 3-sectors equation: $\sum_i \Delta \vartheta_i \overline{Y_i}$ (see equation 1). It represents the 'reallocation effect' across the sectors *i*. We will call it reallocation effect 2. The above equation can then be re-written as:

$$\Delta Y = \sum_j \Delta Y_j \overline{\vartheta_j} + \left(\sum_i R_i \overline{\vartheta_i} + \sum_i \Delta \vartheta_i \overline{Y_i} \right) \quad [3]$$

In sum, using this method, the overall reallocation effect is given by both the movement of labor across sectors *i* and the movement of labor across subsectors *j* within each sector *i*.

If we divide equations 1 and 3 by Y, we can obtain the contribution of both the within effect and the reallocation effects to the productivity growth. The productivity growth rate is then decomposed by three factors: the changes in weighted productivity within subsectors *j*, the movement of workers across the three main sectors *i* (agriculture, industry, services), and the movement of workers across subsectors *j* within each of the three sectors *i*.

China

The decomposition results for China are reported in table 7. Apart from a slowdown from 1988 to 1990, the productivity per employed person always increased at high rates over the analyzed period and, especially, from 1991 to 1995 and from 2004 to 2007, with growth rates over the 10%. If we look at the growth decomposition, we can notice that the within effect was always greater than the total reallocation effect (reallocation effect 1 plus reallocation effect 2). However, if we disjointedly look at

the two components of the total reallocation effect, it emerges that the reallocation effect 2, i.e. the reallocation of workers across the three sectors (agriculture, industry and services), played an important role in determining the total productivity growth. In particular, we can divide the path of structural change in four sub-periods.

Table 7: Productivity growth decomposition – China.

YEARS	PRODUCTIVITY GROWTH	WITHIN EFFECT	% contribution	REALLOCATION EFFECT 1	% contribution	REALLOCATION EFFECT 2	% contribution
1987-1988	6.9	5.6	80.6	0.9	13.0	0.4	6.5
1988-1989	-1.9	-1.5	80.0	0.8	-40.6	-1.2	60.6
1989-1990	-1.5	-0.8	53.1	0.3	-17.4	-1.0	64.3
1990-1991	4.2	3.2	76.9	0.2	4.6	0.8	18.5
1991-1992	12.4	11.7	94.5	-0.4	-3.6	1.1	9.1
1992-1993	12.6	11.9	94.4	-1.6	-12.5	2.3	18.0
1993-1994	13.6	12.0	88.1	-1.1	-8.3	2.8	20.3
1994-1995	15.4	12.9	83.9	0.0	0.2	2.4	15.9
1995-1996	8.3	6.5	78.5	-0.2	-2.7	2.0	24.2
1996-1997	7.7	6.9	89.0	0.1	1.7	0.7	9.3
1997-1998	6.6	9.2	139.9	-2.6	-38.8	-0.1	-1.1
1998-1999	6.5	7.2	110.8	0.0	0.4	-0.7	-11.2
1999-2000	7.3	9.0	123.5	-1.3	-18.2	-0.4	-5.3
2000-2001	6.8	7.6	111.2	-0.6	-8.3	-0.2	-2.9
2001-2002	7.9	9.4	118.1	-0.5	-5.9	-1.0	-12.3
2002-2003	9.2	7.3	79.4	0.8	8.3	1.1	12.4
2003-2004	9.0	5.5	60.8	0.3	3.8	3.2	35.4
2004-2005	10.3	6.6	64.4	0.2	1.7	3.5	33.9
2005-2006	12.0	8.8	72.9	-0.1	-1.2	3.4	28.3
2006-2007	13.6	10.7	78.6	-0.3	-2.1	3.2	23.6
2007-2008	9.6	8.0	83.4	0.0	0.1	1.6	16.5
2008-2009	8.5	6.6	78.5	0.0	0.0	1.8	21.5

Source: Our calculations are based on de Vries et al. (2012) and Timmer (2012). The sum of column 3, 5 and 7 gives the productivity growth. The sum of column 4, 6 and 8 gives 100%.

The first sub-period, 1987-1991, was characterized by negative or relatively low growth rates of total productivity, determined by a low weighted productivity growth within subsectors and a misdirected reallocation of workers across sectors, partially counterbalanced by a movement of workers, within each sector, from subsectors with lower to higher productivity. In the second sub-period, 1991-1997, total productivity grew at rates sometimes over the 12%, supported by productivity gains within subsectors and a suitable reallocation of labor across the three main sectors, notwithstanding a misallocation of workers across subsectors. In particular, in this period there was a movement of workers from agriculture to industry and, especially, services. From 1991 to 1997, the employment share in agriculture moved from 58.9% to 49.9%, from 21.6% to 23.7% in industry, and from 19.5% to 26.4% in services. In 1994, for the first time after the economic reforms, the employment share of services exceeded the employment share of industry. As can be noticed from table 8, the reallocation of workers towards industry and, above all, the tertiary sectors was an important factor behind the total productivity growth, even if a too high share of workers remained employed in agriculture.

Table 8 Productivity growth decomposition with sectoral structural change- China

YEARS	PRODUCTIVITY GROWTH	WITHIN EFFECT	REALLOCATION EFFECT 1	REALLOCATION EFFECT 2 :	agriculture	industry	services
1987-1988	6.9	5.6	0.9	0.4	-0.16	-0.23	0.83
1988-1989	-1.9	-1.5	0.8	-1.2	0.49	-1.52	-0.12
1989-1990	-1.5	-0.8	0.3	-1.0	0.39	-0.70	-0.67
1990-1991	4.2	3.2	0.2	0.8	-0.30	0.28	0.80
1991-1992	12.4	11.7	-0.4	1.1	-0.41	0.26	1.27
1992-1993	12.6	11.9	-1.6	2.3	-0.79	0.93	2.13
1993-1994	13.6	12.0	-1.1	2.8	-0.96	0.97	2.75
1994-1995	15.4	12.9	0.0	2.4	-0.89	0.55	2.79
1995-1996	8.3	6.5	-0.2	2.0	-0.67	1.07	1.61
1996-1997	7.7	6.9	0.1	0.7	-0.23	0.43	0.52
1997-1998	6.6	9.2	-2.6	-0.1	-0.04	-0.43	0.39
1998-1999	6.5	7.2	0.0	-0.7	0.11	-1.09	0.26
1999-2000	7.3	9.0	-1.3	-0.4	-0.03	-1.13	0.78
2000-2001	6.8	7.6	-0.6	-0.2	0.00	-0.46	0.26
2001-2002	7.9	9.4	-0.5	-1.0	0.00	-2.15	1.18
2002-2003	9.2	7.3	0.8	1.1	-0.26	0.50	0.90
2003-2004	9.0	5.5	0.3	3.2	-0.62	2.21	1.61
2004-2005	10.3	6.6	0.2	3.5	-0.59	3.19	0.91
2005-2006	12.0	8.8	-0.1	3.4	-0.61	2.97	1.04
2006-2007	13.6	10.7	-0.3	3.2	-0.48	3.52	0.18
2007-2008	9.6	8.0	0.0	1.6	-0.33	0.92	0.99
2008-2009	8.5	6.6	0.0	1.8	-0.37	1.11	1.07

Source: Our calculations are based on de Vries et al. (2012) and Timmer (2012).

Although high productivity gains within subsectors, over the third sub-period 1997-2002 the potential growth of total productivity was partially hindered by a misallocation of labor both across and within sectors, subtracting on average 1.5 percentage points to the total productivity growth. With regard to the reallocation of workers across sectors, we can see that while the employment share of services continued to increase, the employment share as well as the absolute number of workers in industry decreased until 2002, when the industrial employment share reached the level it presented in 1990 (21.4%). It seems, then, that the reallocation of workers towards the tertiary sector had a positive effect on the total productivity growth, until it started to subtract an excessive number of workers from the industry sector. In table 8, indeed, we can observe that in this period the contribution of the reallocation of labor in industry hindered the total productivity growth, probably due to the decrease in its employment share. Finally, in the sub-period 2003-2009, productivity gains within subsectors and a new well-directed reallocation of workers across sectors determined high growth rates of total productivity, with a moderate slowdown at the end of the period, probably caused by the world financial crisis. In this period, the employment share and the absolute number of workers in industry turned to increase and, as can be seen in table 7, this contributed by around 3 percentage points to the total productivity growth before its moderate slowdown.

Given the predominant contribution of the within effect to the total productivity growth, it is useful to individuate which sectors and subsectors have been more dynamic in terms of productivity over the

analyzed period. From 1987 to 2009, productivity grew by the 481% in the whole economy, while in each sector it increased by the 170% in agriculture, the 611% in industry and the 258% in services. It is evident that the major productivity gains occurred in industry. In particular, some industrial subsectors presented an outstanding performance of productivity: transport equipment (+ 1630%), other non-metallic mineral (+ 1618%), manufacturing not elsewhere classified and recycling (+ 1377%), machinery not elsewhere classified (+ 1162%), basic metals (+ 1029%), electrical and optical equipment (+ 1001%), followed by mining and quarrying (+814%), wood and cork (+ 722%), chemicals and chemical products (+ 624%), food , beverages and tobacco (+ 598%), rubber and plastics (+ 569%), and leather and footwear (+ 526%). In the remaining industrial subsectors (textiles; pulp, paper, printing and publishing; coke, refined petroleum and nuclear fuel; electricity, gas and water supply; construction) productivity increased but at a slower pace than total productivity. The service sector was, on the contrary, more polarized between subsectors with remarkable productivity gains and subsectors with a performance below or in line with the total productivity growth. Among the first: post and telecommunications (+ 2660%), water transport (+ 2195%), renting of machinery and equipment, and other business activities (+ 1071%), health and social work (+ 801%), and public administration, defence and compulsory social security (781%).

India

The decomposition results for India are shown in table 9. From the table, it is evident that the total productivity growth has been much lower in India than in China, even after the economic reforms. Moreover, if in China the within effect always represented the most important component of the total productivity growth, in India it seems that the total reallocation effect played a predominant role in some years. In particular, we can notice that, while in China the major reallocation effects occurred across sectors, in India the movement of workers both across and within sectors gave a great contribution to the total productivity changes, sometimes hindering and sometimes fostering them.

By analyzing the Indian path of structural change, we can underline some key-years. First, in 1990-91 there was a decrease in total productivity given by a huge fall of weighted productivity within subsectors, in part counterbalanced by a better reallocation of labor across and within sectors that avoided a further decrease of 6.3 percentage points in total productivity. In particular, as we can see from table 10, 5 percentage points were recovered by the movement of workers towards the secondary and, especially, the tertiary sector. Second, in the period 1994-1999, i.e. immediately after the economic reforms, there were notable increases in total productivity determined above all by important productivity gains within subsectors and, partially, by the movement of labor from sectors with lower to higher productivity, although a misallocation of workers within each sector. Third, in 1999-2000, total productivity fell, once again led by a negative weighted productivity growth within subsectors, partially counterbalanced by positive reallocation effects. After that, total productivity turned to grow, especially driven first by an appropriate reallocation of workers across and within sectors (2000-2003) with an important role of industry and services in 2000-2002, and then by huge productivity gains within subsectors (2004-2009). The highest rates of total productivity growth were registered between 2005 and 2007, with values over the 10%.

Table 9: Productivity growth decomposition - India

YEARS	PRODUCTIVITY GROWTH	WITHIN EFFECT	% contribution	REALLOCATION EFFECT 1	% contribution	REALLOCATION EFFECT 2	% contribution
1987-1988	8.2	6.9	83.8	0.2	2.8	1.1	13.4
1988-1989	5.7	6.1	105.8	0.7	12.9	-1.1	-18.7
1989-1990	4.7	5.4	113.8	0.5	10.4	-1.1	-24.1
1990-1991	-2.1	-8.4	406.8	2.4	-114.9	3.9	-191.9
1991-1992	3.1	2.3	75.6	0.8	24.3	0.0	0.0
1992-1993	3.3	3.0	90.0	0.5	16.1	-0.2	-6.1
1993-1994	1.6	0.8	50.7	0.4	22.5	0.4	26.8
1994-1995	6.5	6.1	93.7	-0.3	-4.7	0.7	10.9
1995-1996	4.7	5.2	109.0	-0.7	-15.4	0.3	6.4
1996-1997	3.4	3.1	91.3	-0.7	-20.1	1.0	28.8
1997-1998	5.6	5.9	105.4	-0.9	-16.0	0.6	10.6
1998-1999	7.9	7.2	91.2	-0.9	-11.1	1.6	19.9
1999-2000	-0.5	-2.2	433.0	0.9	-178.6	0.8	-154.5
2000-2001	1.9	0.2	11.5	0.6	30.3	1.1	58.2
2001-2002	6.2	2.4	38.7	0.6	10.3	3.2	51.0
2002-2003	2.5	1.0	40.7	1.2	48.1	0.3	11.2
2003-2004	5.5	4.4	80.4	1.1	20.1	0.0	-0.6
2004-2005	7.4	8.5	115.4	0.0	0.0	-1.1	-15.4
2005-2006	10.0	9.5	95.1	0.5	5.2	0.0	-0.3
2006-2007	12.6	8.7	69.0	0.8	6.5	3.1	24.5
2007-2008	6.8	5.0	72.7	0.3	4.9	1.5	22.5
2008-2009	8.8	7.2	81.8	0.4	4.4	1.2	13.9

Source: Our calculations are based on de Vries et al. (2012) and Timmer (2012). The sum of column 3, 5 and 7 gives the productivity growth. The sum of column 4, 6 and 8 gives 100%.

With regard to the productivity performance of sectors and subsectors over the whole analyzed period, we can observe a more equilibrated but slower path with respect to the Chinese case. From 1987 to 2009, total productivity grew by the 200%, with an increase of 67%, 135% and 209% in agriculture, industry and services respectively. The variance of productivity across subsectors was lower than in China, since only few subsectors showed a performance higher than the average. In industry: coke, refined petroleum and nuclear fuel (+ 849%), chemicals and chemical products (+ 324%), electrical and optical equipment (+ 277%), and electricity, gas and water supply (+ 226%). In service: post and telecommunications (+ 931%), public administration, defence and compulsory social security (+ 303%), and financial intermediation (300%).

Table 10: Productivity growth decomposition with sectoral structural change- India

YEARS	PRODUCTIVITY GROWTH	WITHIN EFFECT	REALLOCATION EFFECT 1	REALLOCATION EFFECT 2 :	agriculture	industry	services
1987-1988	8.2	6.9	0.2	1.1	-0.39	0.79	0.70
1988-1989	5.7	6.1	0.7	-1.1	0.38	-0.87	-0.58
1989-1990	4.7	5.4	0.5	-1.1	0.36	-0.88	-0.61
1990-1991	-2.1	-8.4	2.4	3.9	-1.12	0.95	4.11
1991-1992	3.1	2.3	0.8	0.0	0.02	-0.40	0.38
1992-1993	3.3	3.0	0.5	-0.2	0.08	-0.45	0.17
1993-1994	1.6	0.8	0.4	0.4	-0.11	-0.19	0.73
1994-1995	6.5	6.1	-0.3	0.7	-0.20	0.27	0.64
1995-1996	4.7	5.2	-0.7	0.3	-0.10	0.57	-0.18
1996-1997	3.4	3.1	-0.7	1.0	-0.25	0.39	0.83
1997-1998	5.6	5.9	-0.9	0.6	-0.14	0.06	0.68
1998-1999	7.9	7.2	-0.9	1.6	-0.38	0.41	1.54
1999-2000	-0.5	-2.2	0.9	0.8	-0.25	1.13	-0.10
2000-2001	1.9	0.2	0.6	1.1	-0.33	1.05	0.40
2001-2002	6.2	2.4	0.6	3.2	-0.83	1.88	2.13
2002-2003	2.5	1.0	1.2	0.3	0.01	-0.67	0.95
2003-2004	5.5	4.4	1.1	0.0	-0.04	0.51	-0.50
2004-2005	7.4	8.5	0.0	-1.1	0.26	-0.82	-0.58
2005-2006	10.0	9.5	0.5	0.0	-0.01	0.19	-0.21
2006-2007	12.6	8.7	0.8	3.1	-0.58	1.46	2.22
2007-2008	6.8	5.0	0.3	1.5	-0.29	0.74	1.08
2008-2009	8.8	7.2	0.4	1.2	-0.19	0.30	1.10

Source: Our calculations are based on de Vries et al. (2012) and Timmer (2012).

If compared to the Chinese path of structural change, it can be noticed that India followed a more balanced, but slower and less definite path. In China, the increase in the productivity within sectors and subsectors, in particular in industry, was the driving force of total productivity growth. After an initial slowdown in the total productivity growth, it constantly increased over the analyzed period, with a moderate deceleration from 1997 to 2002 caused by a too pronounced decrease in the employment share in industry rather than a reduction of productivity growth. On the contrary, in India the increases in total productivity were lower and not constant, with important effects deriving from smaller productivity gains within sectors and subsectors, misallocation of labor across subsectors and a still high share of workers employed in agriculture (54% in 2009). Only in recent years, and in particular from 2005, it seems that in India the rates of productivity growth reached levels similar to the Chinese performance. Of course, among many differences between the two countries, we have to take into particular account two of these. First, the economic reforms in China began around 15 years before than in India and, then, it is possible that a clearer path of structural change will occur in India in the next years. Second, India is characterized by a huge presence of the informal sector, that could have decelerated the possibility of high productivity gains and hindered a stable path of structural change.

7. An econometric investigation: growth, structural change and globalization

As McMillan and Rodrik (2011) pointed out, along with the productivity growth, the extent of structural change is a key driver of development. However, there may exist complex feedbacks between structural change and economic growth. On the one hand, structural change may either enhance economic growth if it is well-directed, or hinder it if the reallocation of labor mismatches the productivity changes across sectors. On the other hand, the pace of economic growth may influence the size of structural change. Indeed, a too fast economic growth, mainly led by high productivity gains within sectors rather than by a well-directed reallocation of labor, may further result in small contribution of structural change to overall labor productivity. As occurred in both China and India, a rapid economic growth is more likely to be geographically unbalanced, with the consequence that the movement of workers across sectors, regions and areas may be hindered. This may be further aggravated by the presence of barriers to internal migration as well as of restrictions to the transfer of labor between sectors. Moreover, when economic growth derives from impressive increase in productivity, the wage adjustment to labor productivity levels may not be immediate, creating important wage-productivity differentials and misleading labor reallocation. Finally, fast rise in economic growth and in productivity within sectors are also due to technical progress, with the adoption of capital intensive technologies, reducing the demand of labor and the absorption of workers in the higher-productivity sectors. These issues have been partially discussed by Ding and Knight (2009).

At the same time, both the size of structural change and economic growth are expected to be interrelated to the higher exposure to globalization and the progressive openness to international markets. High level of export, import and FDI not only impact on economic growth but also on the reallocation of resources across sectors, modifying the comparative advantage and reorganizing production. As a consequence, it is reasonable to expect not only that there are feedbacks between economic growth and structural change over time, but also that both depend, in part, on the degree of economic openness. Starting from our assumption, we will consider economic growth and structural change as endogenous, given their potential reciprocal feedbacks, and will try to understand how they have been related to the globalization. To this purpose, the best candidate is a vector autoregressive model (VAR), allowing to verify and catch the feedbacks between economic growth and structural change over time, as well as to estimate how globalization has been jointly related to both of them.

In VAR models, the endogenous variables are explained by their past values along with the past values of all the other endogenous variables. To satisfy the stability condition, the VAR requires that the variables in the model result to be absolute stationary. In our case, we consider two endogenous variables: structural change (i.e. the 'reallocation effect' in equation 2, calculated at a disaggregated level) expressed in percentage terms, and the rate of growth of the per-capita GDP. To test the hypothesis of endogeneity, a Granger causality test can be performed after the VAR. The Granger causality test is based on the fact that time does not run backward. The event X is said to "Granger causes" the event Y if past values of event X can help to explain the event Y (Koop, 2008). Even if it has been often pointed out that caution should be used to interpret the results of the Granger causality test as a strict relation of causality, the test turns to be useful to check for endogeneity. Indeed, when past values of event X help to explain the event Y and simultaneously past values of event Y help to explain the event X, it suggests that there are continuous feedbacks between the two events and that they have to be considered as endogenous in the model.

Another advantage of VAR models is that they can be extended to add exogenous regressors jointly related to all the endogenous variables. In our case, this is useful to account for the relation of both structural change and economic growth (endogenous variables) with economic openness (exogenous

term). We use VAR to regress the structural change and the growth rate of per-capita GDP on alternative variables of economic openness: the KOF index of economic globalization (Dreher et al., 2008)[10], and export, import and FDI as a percentage of GDP.

Our data suffer from a restricted time-span, from 1987 to 2009, that can limit the explanatory capacity of our estimations. To manage with this problem, we make some adjustments. First, to smooth and de-trend data, we transform all the variables in five-years moving averages. Second, we estimate the VAR adjusting with a small-sample degrees-of-freedom[11]. Furthermore, we use small-sample adjustment by adopting t and F statistics instead of the large-sample normal and chi-squared statistics. Finally, an important issue in VAR is the selection of the optimal lag order, based on minimizing the values of FPE (final predictor error), AIC (Akaike information criterion), HQIC (Hannan-Quinn information criterion) and SBIC (Schwarz-Bayesian information criterion). Fortunately, we notice that the difference in AIC, HQIC and SBIC is not so large with different lag orders (from 1 to 4) in all the specifications of the model. As a consequence, we choose to use a first-lag order avoiding to lose further observations: even if it does not result to be the optimal specification according to all the criteria, the first-lag order keeps low the values of AIC, HQIC and SBIC.

Results are reported in tables 11 and 12 for China and India respectively. All the VARs satisfy the stability condition. In general, the Granger causality tests reveal that there is a continuous interaction between structural change and economic growth. The null hypotheses that structural change "does not Granger cause" the growth of per-capita GDP and that the growth of per-capita GDP "does not Granger cause" structural change are both rejected. This confirms that both the variables have to be considered endogenous and that the VAR is the appropriate model to our analysis.

Results for China reveal that both structural change and economic growth are cumulative process, since the coefficients of their lagged values are positive and highly significant. For India, only structural change appears to be a cumulative process, even if at a lower level of significance. These difference are probably due to the fact that economic reforms as well as the impressive economic growth in India began around 15 years later than in China, so that a cumulative path of growth and structural change in India is not well captured by our data.

In the equation for structural change, the coefficients of the lagged per-capita GDP growth are negative and significant both for China and India (except in specification 4 for China). It seems that high past values of the rate of growth are related with a lower contribution of structural change to overall labor productivity. This can be explained by what we discussed above: in China, as well as in India, the rapid economic growth has been associated with geographically unbalances, barriers to internal migration, difficulties in the transfer of labor between sectors, slow wage adjustment to labor productivity, and the adoption of capital intensive technologies. Moreover, in India the huge presence of the informal sector may have further distorted the reallocation of labor. All these factors have reduced the size of structural change, in a process of productivity growth mainly due to within-sectors productivity gains rather that to labor reallocation. If the unbalanced economic growth has created cumulative obstacles to an well-directed reallocation of labor, it seems on the contrary that the process of economic openness has favored it in both countries. The coefficients of the globalization indicators are all positive and significant, except for FDI/GDP in China. The reorganization of production and the change in the economic structure as a consequence of a higher openness to international markets have impacted on the reallocation of workers towards the higher-productivity sectors.

[10] The KOF index of economic globalization is a weighted index accounting for trade as a percentage of GDP, FDI stocks as a percentage of GDP, portfolio investment as a percentage of GDP, income payments to foreign nationals as a percentage of GDP, hidden import barriers, mean tariff rate, taxes on international trade, and capital account restrictions. The advantage to adopt it relies on the possibility of taking into account the various dimensions of economic globalization.
11 Specifically, in STATA, 1/(T-mparms) is used instead of the large-sample divisor 1/T, where mparms is the average number of parameters in the functional form for y_t over the K equations.

Table 11: China. VAR estimation. Endogenous variables: structural change and per-capita GDP growth.

dep. variable: structural change	*(1)*	*(2)*	*(3)*	*(4)*
structural change L1.	0.9932***	0.9212***	0.9289***	0.9091***
pc GDP growth L1.	-1.9388**	-1.9393**	-2.0810***	-0.0315
globalization index	0.5313***			
exp/GDP		0.6184***		
imp/GDP			0.9639***	
FDI/GDP				-0.0155
cons	-6.3825	2.4471	-1.9446	1.1513
R-sq	0.91	0.91	0.93	0.85
Prob>F	0.00	0.00	0.00	0.00
dep. variable: pc GDP growth				
structural change L1.	0.0218**	0.0177*	0.0184**	0.0066
pc GDP growth L1.	0.6858***	0.6820***	0.6578***	0.8600***
globalization index	0.0305			
exp/GDP		0.0366		
imp/GDP			0.0642**	
FDI/GDP				0.0124*
cons	1.3953*	1.9052***	1.6273**	1.2310
R-sq	0.86	0.86	0.88	0.87
Prob>F	0.00	0.00	0.00	0.00
H_0: pc GDP growth "does not Granger cause" structural change: Prob>F	0.04	0.03	0.01	0.97
H_0: structural change "does not Granger cause" pc GDP growth: Prob>F	0.04	0.07	0.05	0.53

***, ** and * mean coefficients are significant respectively at 98% or more, 95% and 90%. Since the variable FDI/GDP does not satisfy the stability condition, it has been transformed in rates of growth. Analogous results are obtained if variables are first differenced. All the VAR estimations satisfy the stability condition.

Table 12. India. VAR estimation. Endogenous variables: structural change and per-capita GDP growth.

dep. variable: structural change	*(1)*	*(2)*	*(3)*	*(4)*
structural change L1.	0.4299*	0.4651**	0.5204**	0.5738**
pc GDP growth L1.	-18.172**	-22.391***	-26.706***	-22.262**
globalization index	4.8037***			
exp/GDP		7.9287***		
imp/GDP			6.9006***	
FDI/GDP				43.607***
cons	-78.990***	-10.328	11.568	55.249
R-sq	0.71	0.72	0.71	0.63
Prob>F	0.00	0.00	0.00	0.00
dep. variable: pc GDP growth				
structural change L1.	0.0081*	0.0088**	0.0098**	0.0102*
pc GDP growth L1.	0.2509	0.1712	0.1154	0.3377
globalization index	0.0976***			
exp/GDP		0.1595***		
imp/GDP			0.1323***	
FDI/GDP				0.6282**
cons	0.4157	1.8056***	2.2016***	2.6040***
R-sq	0.92	0.92	0.91	0.87
Prob>F	0.00	0.00	0.00	0.00
H_0: pc GDP growth "does not Granger cause" structural change: Prob>F	0.04	0.02	0.01	0.05
H_0: structural change "does not Granger cause" pc GDP growth: Prob>F	0.07	0.05	0.04	0.09

***, ** and * mean coefficients are significant respectively at 98% or more, 95% and 90%. All the VAR estimations satisfy the stability condition.

As expected, in the equation for the per-capita GDP growth, it emerges that past values of structural change have a positive and significant relation with economic growth in both countries (except in specification 4 for China). When the reallocation of labor is productive and large, this positively impact on the future rates of economic growth, while the contrary happens when the contribution of structural change to overall labor productivity is low or negative. It seems then that a too rapid economic growth has hindered an efficient reallocation of labor, that however may in turn contribute to economic growth. Policies favoring labor movement across sectors and areas, reducing the wage-productivity differentials and integrating the informal sector in formal markets in India, may foster structural change and further enhance economic growth. As expected, the indicators of globalization are positively

related to economic growth, even if they are not always significant for China. This may be due to the fact that the equation for the per-capita GDP growth does not take into account other important factors helping to explain it. However, this is beyond our specific interest. The focus of our analysis was not to explain what has determined economic growth in the two countries, but rather to do a first step to study structural change and its relation with economic growth and globalization. The separate equation in the VAR for the per-capita GDP growth is functional to explain structural change, since the continuous feedbacks between the two variables confirmed by the Granger causality test imposed to consider both the variables as endogenous.

8. Conclusions

The aim of our paper was to investigate, in a comparative perspective, the relation between structural change, globalization and economic growth in China and India. After a general introduction on the patterns of structural changes, growth and globalization in the two countries and on the interrelation between some economic and social problems, we deeply studied the path of structural change in China and India and its contribution to the overall labor productivity, by using a database reporting data at a highly detailed sector level. The two countries, and in particular China, have experienced impressive increases in overall labor productivity. Even if India has shown a less rapid, but more balanced path, the gains in labor productivity have been especially concentrated in some specific industrial and tertiary subsectors. However, the main contribution to these gains has derived by within-sector increase in productivity, while the reallocation of labor has not always been directed to those sectors presenting the highest productivity levels.

We further investigated the relation of structural change with both economic growth and globalization by adopting VAR models. Three main results emerged from our analysis. First of all, there exist important feedbacks between structural change and economic growth over time. Present values of the index of structural change and per-capita GDP growth are related to past values of each other. Second, when the reallocation of labor is large, it may positively impact on the future rates of economic growth, At the same time, however, it seems that a too rapid economic growth may have hindered a suitable reallocation of labor. New policies should be designed to favor the voluntary labor movement across sectors and areas, to reduce the wage-productivity differentials and to integrate the informal sector in formal markets in India, in order to foster structural change and further enhance economic growth. Third, if a too unbalanced economic growth has limited the extent of structural change, globalization has promoted it. High level of export, import and FDI not only has been related to higher rates of economic growth, but also to a better reallocation of resources across sectors, modifying the comparative advantage and reorganizing production.

References

Akamatsu, K. (1935): Wagakuni yñmñ kñgyñhin no bñeki sòsei [The Trend of Foreign Trade in Manufactured Woolen Goods in Japan]. In: *ShØgyØ Keizai RonsØ* (Higher Commercial School of Nagoya) 13, July, pp. 129–212.

Akamatsu, K. (1962): A Historical Pattern of Economic Growth in Developing Countries. In: *The Developing Economies*, Tñkyñ, Preliminary Issue No. 1, pp. 3–25.

Andreff W., Balcet G. (2013), Emerging countries' multinational companies investing in developed countries: at odds with the HOS paradigm?. In: *The European Journal of Comparative Economics*, Vol. 10 , No 1, pp. 3-26.

Bensidoun. I., Lemoine F., Unal D. (2009), The integration of China and India into the world economy: a comparison, in *The European Journal of Comparative Economics*, Vol. 6 , n. 1, pp. 131-155.

Beretta S., Targetti Lenti R. (2012), "India and China. Trading with the World and Each Other", in *Economic and Political Weekly*, November 13, vol. xlvii, no 44.

Bosworth B., Collins S.M. (2008), Accounting for Growth: Comparing China and India, in *The Journal of Economic Perspectives,* Vol. 22.No 1, pp. 45-65.

Chenery, H.B. (1960), "Patterns of industrial growth" , *The American Economic Review*, 50(4): 624-654.

Chenery, H. B. and L. Taylor (1968), "Development Patterns: Among Countries and Over Time" *The Review of Economics and Statistics*, 50(4): 391-416.

Chenery H.B. et. al. (1979), *Structural Change and Development Policy,* Oxford University Press, New York.

Chenery, H. B., S. Robinson, and M. Syrquin (eds.) (1986), *Industrialization and Growth: A Comparative Study*, Oxford University Press, New York, London.

Chenery, H. B. and M. Syrquin (1975), *Patterns of development 1950–1970,* Oxford University Press, London.

Chenery, H. B. and M. Syrquin (1989), *Patterns of Development, 1950 to 1983*, World Bank Discussion paper, WBP41, World Bank, Washington D.C.

Clark C. (1940), *The Conditions of Economic Progress*, Macmillan, London.

De Vries G.J., Erumban A.A., Timmer M.P., Voskoboynikov I., Wu H. X. (2012), Deconstructing the BRICs: Structural Transformation And Aggregate Productivity Growth, Journal of Comparative Economics, 40 (2012), pp. 221-227.

Ding, Sai & Knight, John, 2009. "Why has China Grown so Fast? The Role of Structural Change," Proceedings of the German Development Economics Conference, Frankfurt a.M. 2009 7, Verein für Socialpolitik, Research Committee Development Economics.

Dreher, Axel, Noel Gaston and Pim Martens (2008), Measuring Globalisation – Gauging its Consequences (New York: Springer).

Gerschenkron, A. (1962), *Economic Backwardness in Historical Perspective,* Belknap Press of Harvard University Press, Cambridge, Mass.

Haraguchi N., Rezonja G., (UNIDO), 2010; In Search of General Patterns of Manufacturing Development, UNIDO, Working Paper 02/2010, Wien

Kader, A. (1985), Development Patterns among Countries Reexamined, in *The Developing Economies*, 23(3): 199-220.

Keesing, D. B. and D. R. Sherk (1971), "Population Density in Patterns of Trade and Development" *American Economic Review,* 61(5): 956-961.

Kochhar et al. (2006), *India's Pattern of Development: What Happened, What Follows?*, IMF Working Paper (WP/06/22), IMF, Washington D.C.

Kojima, Kiyoshi (2000), "The 'Flying-Geese' Model of Asian Economic Development: Origin, Theoretical Extensions, and Regional Policy Implications," *Journal of Asian Economics* 11, 375-401.

Koop, G. (2005), *Analysis of Economic Data*, John Wiley, & Sons, Chichester (UK).

Kuznets, S. (1957), "Quantitative Aspects of the Economic Growth of Nations: II. Industrial Distribution of National Product and Labor Force" *Economic Development and Cultural Change*, 5(4) Supplement: 1-111.

Li W., Menginstae T., Xu C. (2011), Diagnosing Development Bottlenecks: China and India, Policy Research Working paper, World Bank, http://elibrary.worldbank.org/doi/book/10.1596/1813-9450-5641

Lin J.Y. (2011), *From Flying Geese to Leading Dragons*, Policy Research Working paper, n. 5702, World Bank, Washington.

Lin J.Y., Rosenblutt D. (2012), *Shifting pattern of Economic Growth and Rethinking Development*, Policy Research Working paper n. 6040, World Bank, Washington.

Maizels, A. (1968), *Exports and economic growth of developing countries* Cambridge University Press, London.

Marelli E., Signorelli M. (2011), "China and India: Openness, Trade and Effects on Economic Growth", *European Journal of Comparative Economics*, 8 (1), pp 129-54.

McMillan, Rodrik (2011), Globalization, Structural Change and Productivity Growth, NBER Working Paper No. 17143.

National Bureau of Statistics of China (2008), *China Statistical Yearbook*.

Ozawa T. (2001) "The 'Hidden' Side of the 'Flying-Geese' Catch-Up Model: Japan's dirigiste institutional setup and a deepening financial morass," *Journal of Asian Economics* 12, 471-491.

Ozawa T. (2010), "The (Japan born), "Flying-Geeese" theory of economic development revisited-and reformulated from a structuralist perspective", *Columbia University, Working paper series*, October, n. 291, (www.gsb,columbiaedu/cjeb/research).

Srinivasan T.N. (2006), *China, India and the World economy*. Background paper for Winters, Yusuf (eds.) *Dancing with China*, World Bank, Washington D.C.

Syrquin, M. (1988), "Structural change and economic development: The role of the service sector" *Journal of Development Economics*, 28(1): 151-154.

Taylor, L. (1969), "Development Patterns: A Simulation Study" *The Quarterly Journal of Economics*, 83(2): 220-241.

UNCTAD (2014), http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

Valli V., Saccone D. (2009),"Structural Change and Economic Development in China and India", *European Journal of Comparative Economics*, 6 (1), pp. 101-29.

Wang X., Fan G., Liu P., (2007) . Pattern and Sustainability of China's Economic Growth towards 2020 .

Winters, Yusuf (eds.) (2007), *Dancing with Giants*, World Bank, Washington.

APPENDIX 1: SECTOR CLASSIFICATION AND CODES

SECTOR	SUBSECTORS	CODES
AGRICULTURE	agriculture, hunting, forestry and fishing	AtB
INDUSTRY	mining and quarrying	C
INDUSTRY	food , beverages and tobacco	15t16
INDUSTRY	textiles and textile	17t18
INDUSTRY	leather, leather and footwear	19
INDUSTRY	wood and of wood and cork	20
INDUSTRY	pulp, paper, paper , printing and publishing	21t22
INDUSTRY	coke, refined petroleum and nuclear fuel	23
INDUSTRY	chemicals and chemical	24
INDUSTRY	rubber and plastics	25
INDUSTRY	other non-metallic mineral	26
INDUSTRY	basic metals and fabricated metal	27t28
INDUSTRY	machinery, nec	29
INDUSTRY	electrical and optical equipment	30t33
INDUSTRY	transport equipment	34t35
INDUSTRY	manufacturing nec; recycling	36t37
INDUSTRY	electricity, gas and water supply	E
INDUSTRY	construction	F
SERVICES	sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	50
SERVICES	wholesale trade and commission trade, except of motor vehicles and motorcycles	51
SERVICES	retail trade, except of motor vehicles and motorcycles; repair of household goods	52
SERVICES	hotels and restaurants	H
SERVICES	other inland transport	60
SERVICES	other water transport	61
SERVICES	other air transport	62
SERVICES	other supporting and auxiliary transport activities; activities of travel agencies	63
SERVICES	post and telecommunications	64
SERVICES	financial intermediation	J
SERVICES	real estate activities	70
SERVICES	renting of m&eq and other business activities	71t74
SERVICES	public admin and defence; compulsory social security	L
SERVICES	education	M
SERVICES	health and social work	N
SERVICES	other community, social and personal services	O
SERVICES	private households with employed persons	P

For China data for subsector 50 are not available since this subsector is included partly in subsector 51 and partly in subsector 52. Moreover, subsector P is included in O. Therefore, the database distinguishes 33 subsectors for China. For India, the subsector 19 (leather and footwear) is included in subsector 17t18 (textile and textile products). Moreover, transport services (60, 61, 62, 63) are all accounted in subsector 60. Therefore, the database distinguishes 31 subsectors for India.