

Structural Change and Productivity

Growth in India and China

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Scheme of Presentation

- Research Issues and Objectives
- The patterns of structural change
- Factors of structural change
- Measurement of structural change effect
- The empirical evaluation
- Policy implications of structural change to economic growth
- Conclusions

Issues and Objectives of the Study

- To examine patterns of structural change and its sources.
- To measure the contribution of reallocation of labour or structural change to over all labour productivity growth (LPG).
- To empirically evaluates the effect of structural change on LPG by controlling the broad measures of economic globalization and types of human capital.
- To examine the role of capitalization in LPG

Data sources

- The study uses annual data by classifying the entire economy into 25 sectors. The study mainly uses the disaggregated World KLEMS (26 for India and 37 sectors for China).
- Further, (Groningen Growth & Development Center) GGDC 10 sector database provides data on gross value added at constant prices and persons employed in 10 sectors across various countries, which is internationally comparable (1980-2010).
- WIOT provide annual record by using 35 sectoral classification at current prices in USD units from 1995-2010. These 35 sectors are merged into 25 sectors.

Table 1: 25 sectors and their concordance with IKLEMS and CIP data

IKLEMS	25 sector	CIP	25 sector
Agriculture, Hunting, Forestry and Fishing	1	Agriculture, forestry, animal husbandry & fishery	1
Mining and Quarrying	2	Coal mining	2
Food Products, Beverages and Tobacco	3	Oil & gas excavation	
Textiles, Textile Products, Leather and Footwear	4	Metal mining	
Wood and Products of wood	5	Non-metallic minerals mining	
Pulp, Paper, Paper products, Printing and Publishing	6	Food and kindred products	3
Coke, Refined Petroleum Products and Nuclear fuel	7	Tobacco products	
Chemicals and Chemical Products	8	Textile mill products	4
Rubber and Plastic Products	9	Apparel and other textile products	
Other Non-Metallic Mineral Products	10	Leather and leather products	
Basic Metals and Fabricated Metal Products	11	Saw mill products, furniture, fixtures	5
Machinery, nec.	12	Paper products, printing & publishing	6
Electrical and Optical Equipment	13	Petroleum and coal products	7
Transport Equipment	14	Chemicals and allied products	8
Manufacturing, nec; recycling	15	Rubber and plastics products	9
Electricity, Gas and Water Supply	16	Stone, clay, and glass products	10
Construction	17	Primary & fabricated metal industries	11
Trade	18	Metal products (excluding rolling products)	
Hotels and Restaurants	19	Industrial machinery and equipment	12
Transport and Storage	20	Electric equipment	13
Post and Telecommunication		Electronic and telecommunication equipment	
Financial Services	21	Instruments and office equipment	
Public Administration and Defense; Compulsory Social Security	22	Motor vehicles & other transportation equipment	14
Education	23	Miscellaneous manufacturing industries	15
Health and Social Work	24	Power, steam, gas and tap water supply	16
Other services	25	Construction	17
		Wholesale and retail trades	18
		Hotels and restaurants	19
		Transport, storage & post services	20
		Information & computer services	
		Financial Intermediations	21
		Real estate services	25
		Leasing, technical, science & business services	5

Table 2: Concordance table WIOT

NIC codes	Name of Industries	IOT code	25 sectors
A to B	Agriculture, Hunting, Forestry and Fishing	c1	1 (AGR)
C	Mining and Quarrying	c2	2 (MQ)
15t16	Food, Beverages and Tobacco	c3	3 (FBT)
17t18	Textiles and Textile Products	c4	
19	Leather, Leather and Footwear	c5	4 (TEXLP)
20	Wood and Products of Wood and Cork	c6	5 (WWP)
21t22	Pulp, Paper, Printing and Publishing	c7	6 (PPPPPP)
23	Coke, Refined Petroleum and Nuclear Fuel	c8	7 (CRPPNF)
24	Chemicals and Chemical Products	c9	8 (CHEP)
25	Rubber and Plastics	c10	9 (RUPL)
26	Other Non-Metallic Mineral Products	c11	10 (ONMMP)
27t28	Basic Metals and Fabricated Metal	c12	11 (BFMP)
29	Machinery, Nec	c13	12 (MAC)
30t33	Electrical and Optical Equipment	c14	13 (EOEQ)
34t35	Transport Equipment	c15	14 (TEQ)
36t37	Manufacturing, Nec; Recycling	c16	15 (OMRE)
E	Electricity, Gas and Water Supply	c17	16 (EGW)
F	Construction	c18	17 (CON)
50	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	c19	18 (TRA)
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 (HOR)
60	Inland Transport	c23	20 (TRSPT)
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 (FS)
70	Real Estate Activities	c29	25 (OS)
71t74	Renting of M&Eq and Other Business Activities	c30	
L	Public Admin and Defence; Compulsory Social Security	c31	22 (PADCSS)
M	Education	c32	23 (EDU)
N	Health and Social Work	c33	24 (HESW)
O	Other Community, Social and Personal Services	c34	25 (OS)

Variables and Data sources

Variables	Measurement	Sources
Gross Value added	GVA at constant prices	World KLEMS and Groningen and Growth development center (GGDC) 10 sector
Employed person (1000)		do
Labour productivity growth (LPG)	The annual growth of labour productivity level	do
Growth of Trade (GTR)	The export and import at constant prices with local currency unit are used to calculate the growth of trade.	World Bank
Foreign direct investment (FDI)	FDI net inflows in percent of GDP	do
Gross enrolment ratio for primary (GER1), secondary (GER2) and tertiary (GER3) education		do
Human capital indices (HK)	The index indicates the human capital per person, which is based on years of schooling (Barro and Lee, 2012) and returns to education (Psacharopoulos, 1994).	PWT
Total population (POP)	-	World Bank
Components of GDP expenditure	In terms of per cent in GDP	do
Growth accounting approach includes aggregate gross valued added, capital stock, human capital, labour person and labour income share	used all the data from a single sources to maintain consistence of the estimates.	PWT

A. Structural Change in India and China

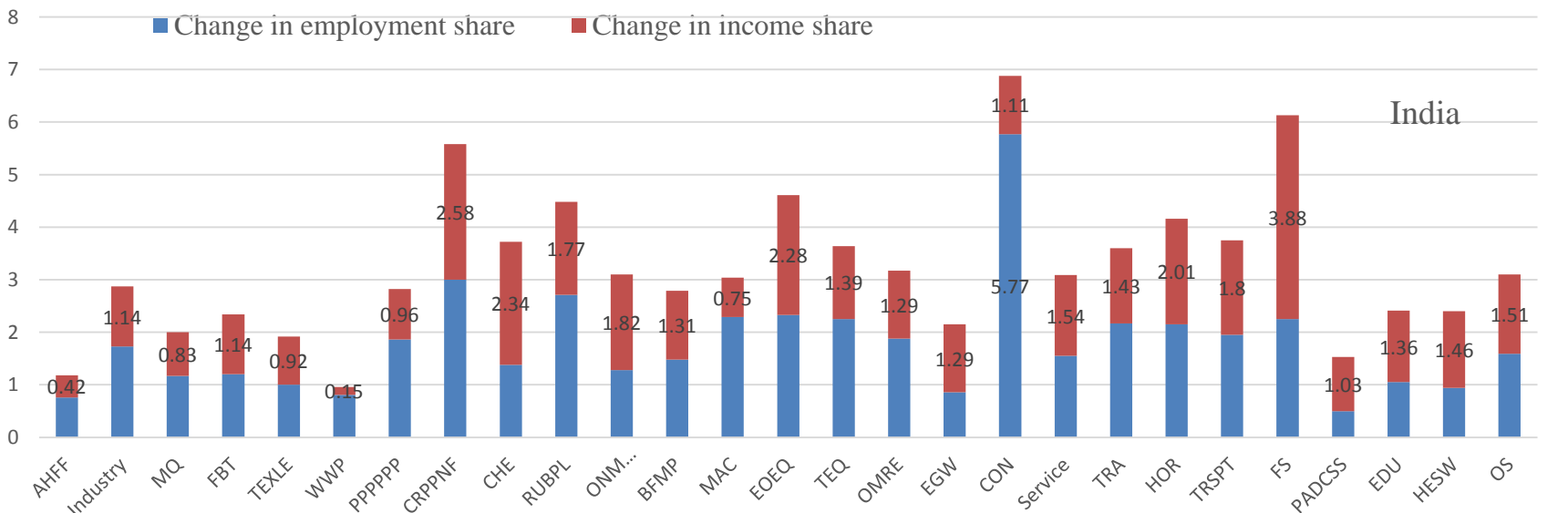
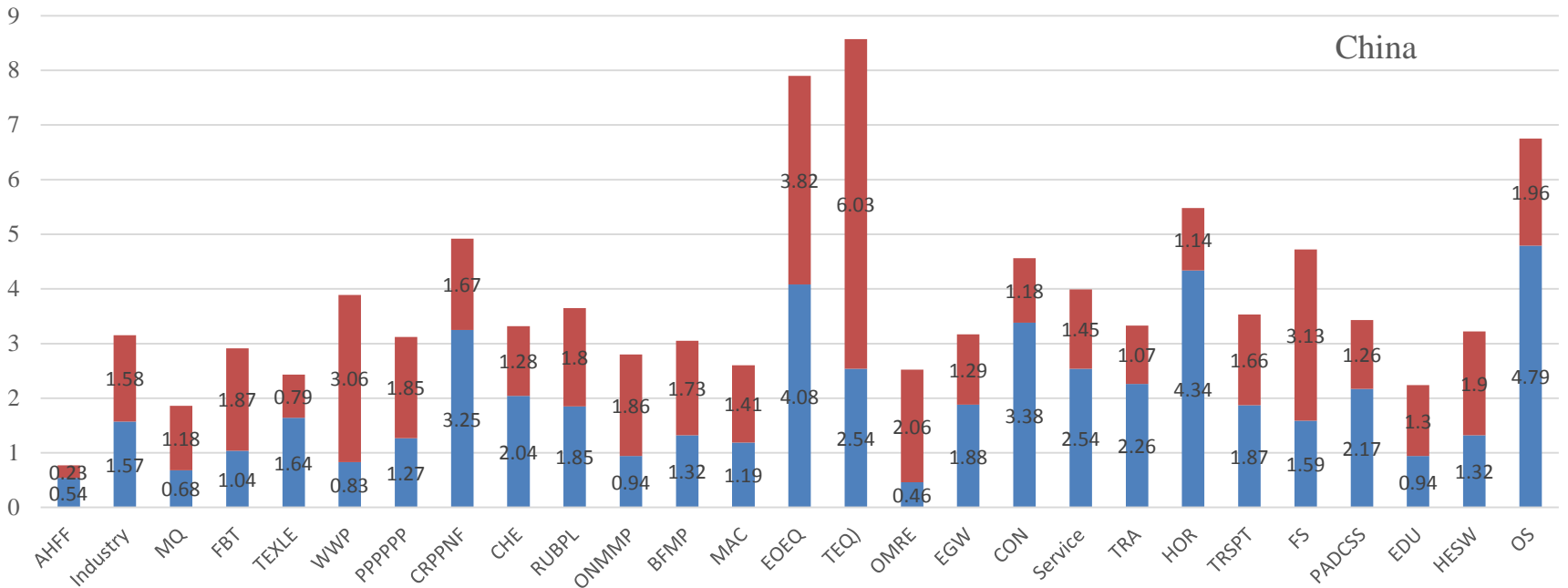
Table.4: Employment and value added share (in %) in India

	1981	1991	2001	2010	Ratio of	1981	1991	2001	2010	Ratio of
	Employment share					Value added share				
	2010 to 1981	2010 to 1981	2010 to 1981	2010 to 1981	2010 to 1981	2010 to 1981	2010 to 1981	2010 to 1981	2010 to 1981	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
Food Products, Beverages and Tobacco	2.2	2.4	2.5	2.0	0.92	2.1	2.1	2.1	2.2	1.07
Textiles, Textile Products, Leather and Footwear	3.5	3.2	2.4	2.7	0.77	2.5	2.2	2.2	2.1	0.86
Wood and Products of wood	1.3	1.0	1.1	0.8	0.63	1.7	0.7	0.3	0.2	0.14
Pulp, Paper, Paper products, Printing and Publishing	0.2	0.3	0.3	0.4	1.43	0.5	0.7	0.4	0.5	0.91
Coke, Refined Petroleum Products and Nuclear fuel	0.0	0.0	0.0	0.0	1.56	0.2	0.5	0.4	0.6	2.42
Chemicals and Chemical Products	0.4	0.4	0.5	0.4	1.09	1.3	1.8	2.5	2.8	2.19
Rubber and Plastic Products	0.1	0.1	0.2	0.2	1.94	0.3	0.5	0.7	0.6	1.65
Other Non-Metallic Mineral Products	0.9	0.9	0.9	0.9	0.98	0.5	0.8	0.8	0.9	1.69
Basic Metals and Fabricated Metal Products	0.7	0.8	0.9	0.8	1.13	2.0	1.9	2.0	2.4	1.22
Machinery, nec.	0.2	0.3	0.3	0.3	1.78	1.1	1.0	0.7	0.8	0.70
Electrical and Optical Equipment	0.2	0.2	0.3	0.3	1.80	0.6	0.8	1.1	1.4	2.13
Transport Equipment	0.2	0.2	0.2	0.3	1.78	0.7	0.7	0.8	0.9	1.28
Manufacturing, nec; recycling	0.7	0.9	0.9	1.0	1.45	0.6	0.6	0.7	0.7	1.21
Electricity, Gas and Water Supply	0.3	0.4	0.3	0.3	0.98	1.7	2.4	2.3	2.0	1.22
Construction	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
Trade	5.9	7.4	9.2	10.4	1.75	10.7	11.1	13.6	14.5	1.36
Hotels and Restaurants	0.8	0.9	1.2	1.4	1.74	0.7	0.9	1.3	1.4	1.92
Transport and Storage	2.2	2.8	3.8	4.6	2.10	6.1	6.6	8.2	13.5	2.23
Post, Telecommunication, and Financial Services	0.3	0.5	0.6	0.9	2.75	2.5	4.5	5.7	7.3	2.98
Public Administration and Defense; Compulsory Social Security	2.7	2.8	2.4	1.8	0.68	5.6	6.4	6.5	5.5	0.99
Education	1.6	1.7	2.2	2.5	1.57	2.6	3.2	3.9	3.7	1.39
Health and Social Work	0.6	0.6	0.7	0.8	1.39	1.0	1.3	1.7	1.5	1.51

Table.5: Employment and value added share (in %) in China

	1981	1991	2001	2010	Ratio of 2010 to 1981	1981	1991	2001	2010	Ratio of 2010 to 1981
	Employment share					Value added share				
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
Food Products, Beverages and Tobacco	2.2	2.0	1.6	1.6	0.70	3.8	5.2	4.0	4.2	1.11
Textiles, Textile Products, Leather and Footwear	3.8	3.9	3.2	4.2	1.11	6.1	4.3	3.8	2.9	0.47
Wood and Products of wood	1.7	0.6	0.6	1.0	0.56	0.5	0.4	0.9	0.9	1.80
Pulp, Paper, Paper products, Printing and Publishing	0.9	0.9	0.7	0.7	0.86	0.9	1.3	1.6	1.0	1.09
Coke, Refined Petroleum Products and Nuclear fuel	0.1	0.1	0.1	0.1	1.95	1.5	1.0	0.7	1.5	0.99
Chemicals and Chemical Products	0.8	1.0	0.9	1.1	1.39	4.1	4.7	3.7	3.1	0.76
Rubber and Plastic Products	1.0	0.9	0.9	1.2	1.26	1.1	1.1	1.5	1.2	1.07
Other Non-Metallic Mineral Products	1.7	1.8	1.2	1.1	0.64	2.2	3.0	2.0	2.4	1.10
Basic Metals and Fabricated Metal Products	1.9	1.9	1.6	1.7	0.89	4.5	4.1	3.9	4.6	1.02
Machinery, nec.	1.9	1.7	1.0	1.5	0.80	4.2	4.4	3.1	3.5	0.84
Electrical and Optical Equipment	1.1	1.2	1.6	3.0	2.77	2.5	3.7	4.4	5.5	2.26
Transport Equipment	0.5	0.5	0.6	0.9	1.71	1.1	1.4	2.0	3.8	3.58
Manufacturing, nec; recycling	2.8	1.9	1.3	0.9	0.31	0.6	1.7	1.9	0.7	1.20
Electricity, Gas and Water Supply	0.2	0.3	0.4	0.5	2.13	3.2	1.8	3.2	2.7	0.83
Construction	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
Trade	4.1	6.1	7.3	8.7	2.11	4.7	4.4	8.2	8.5	1.80
Hotels and Restaurants	0.7	0.9	2.1	2.7	4.01	1.1	0.7	2.1	2.1	1.92
Transport and Storage	3.2	3.8	3.5	3.1	0.97	4.6	6.5	7.9	6.9	1.51
Post, Telecommunication, and Financial Services	0.2	0.4	0.5	1.6	6.65	1.6	5.3	4.1	5.1	3.10
Public Administration and Defense; Compulsory Social Security	1.4	1.7	1.7	5.1	3.58	2.8	3.0	3.4	4.0	1.44
Education	3.0	3.4	5.1	4.6	1.56	2.0	2.2	2.6	2.9	1.49
Health and Social Work	1.1	1.3	2.3	2.3	2.20	0.6	0.7	1.3	1.3	2.17

The Indian service sector could not absorb labour proportionately with the pace of income growth



B. The Sources of Structural Change

- WIOT provides matrices on gross output (Y) which decomposes into the matrices for intermediary demand (B) and the components of final demand (F) for 35 sectors. Final demand consists of private (PC) and public consumption (GC), investments (I; includes inventories), and exports (X).
- This relationship (i.e. $B + F = Y$) can be written as; $(ID - B)^{-1}F = Y$, where B reflects the direct input requirement coefficients of the matrix for intermediary demand and 'ID' is the conformable identity matrix. The term $(ID - B)^{-1}$ is called the Leontief-inverse (L), which requires the matrix (ID-B) to be non-singular.
- The components of final demand at current prices in USD are converted into constant prices by using deflator at 2005 from World Bank.
- The gross output is converted into constant prices 2005 by using 25 sectoral level deflators from WORLD KLEMS data.

Let E number of number of person is required to produce output Y is for an individual sector in the year t . Hence, the labour input ratio $e_t = \frac{E_t}{Y_t} = \frac{E_t}{L_t F_t}$. Now, the change in labour is; $dE_t = E_t - E_{t-1} = e_t L_t F_t - e_{t-1} L_{t-1} F_{t-1}$ (1)

The change in E can be decomposed into its technological component, i.e. due to changes of the Leontief-inverse matrix (L), change in labour input coefficients, and changes resulting from shifts in final demand (**Miller and Blair, 2009**).

$$dE_t = \frac{de(L_t F_t + L_{t-1} F_{t-1})}{2} + \frac{dL(e_t F_t + e_{t-1} F_{t-1})}{2} + \frac{(e_t L_t + e_{t-1} L_{t-1}) dF}{2} \quad (2)$$

Now, dividing E_{t-1} by both side of equation (2);

$$\frac{E_t - E_{t-1}}{E_{t-1}} = \frac{de(L_t F_t + L_{t-1} F_{t-1})}{2E_{t-1}} + \frac{dL(e_t F_t + e_{t-1} F_{t-1})}{2E_{t-1}} + \frac{(e_t L_t + e_{t-1} L_{t-1}) dF}{2E_{t-1}} \quad (3)$$

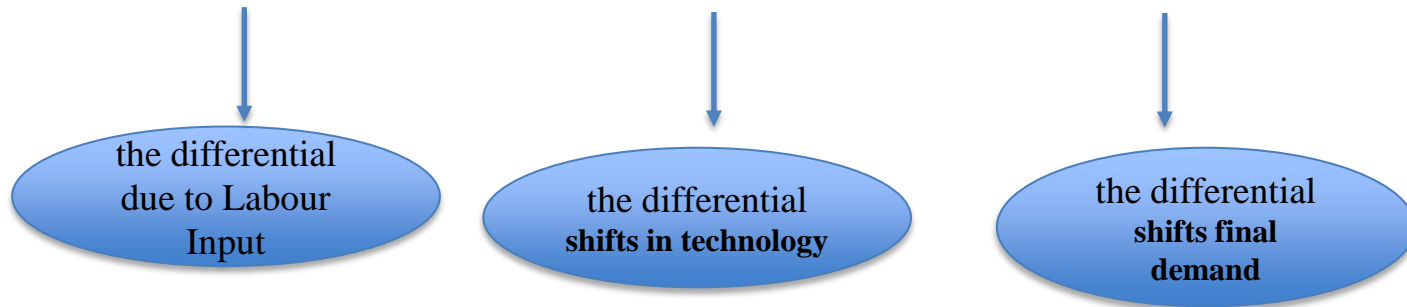


Table.6: Decomposition of annual change in employment (in million) in 1995-2010 in India

Sector code	dE	dLIC	dT	dFD	GE	dE	dLIC	dT	dFD	GE
	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

The growth in labour force is driven by change in final demand in India

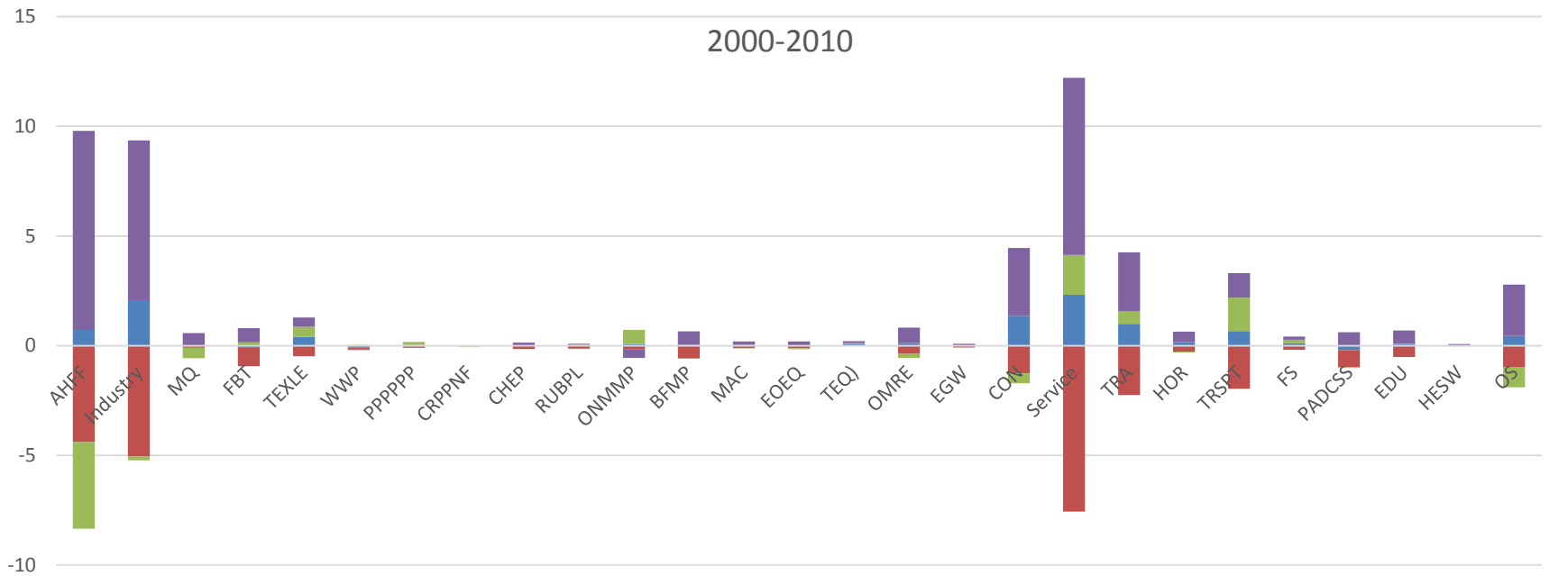
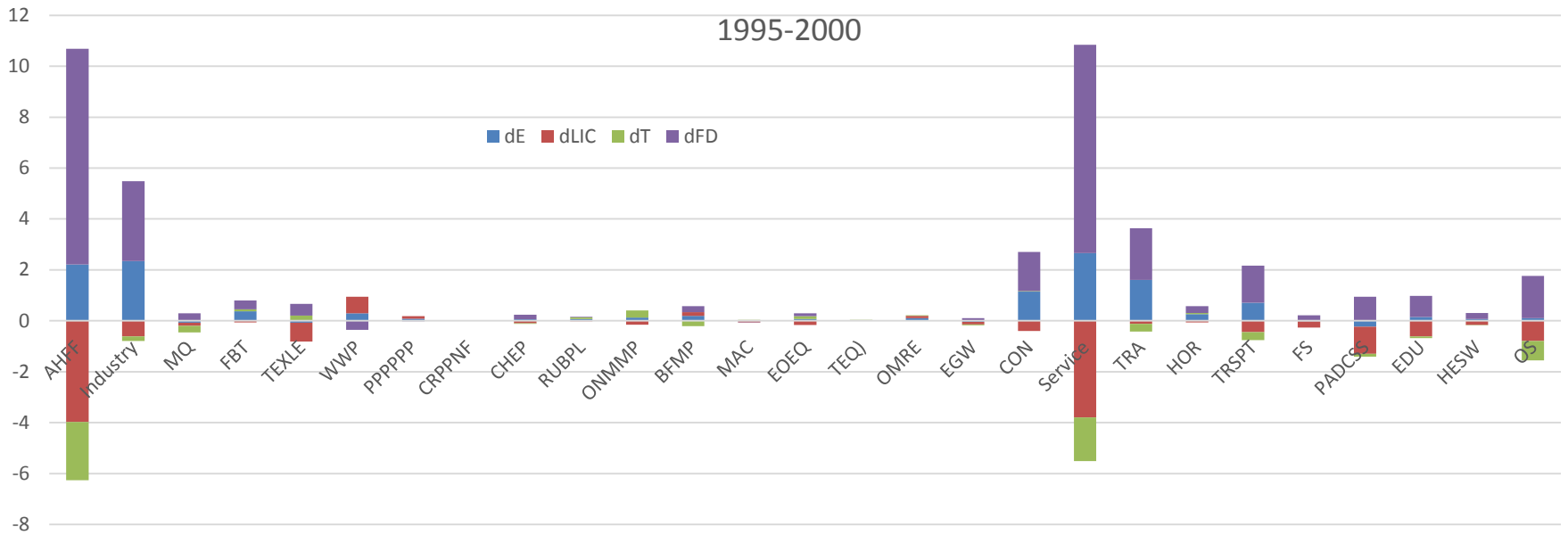
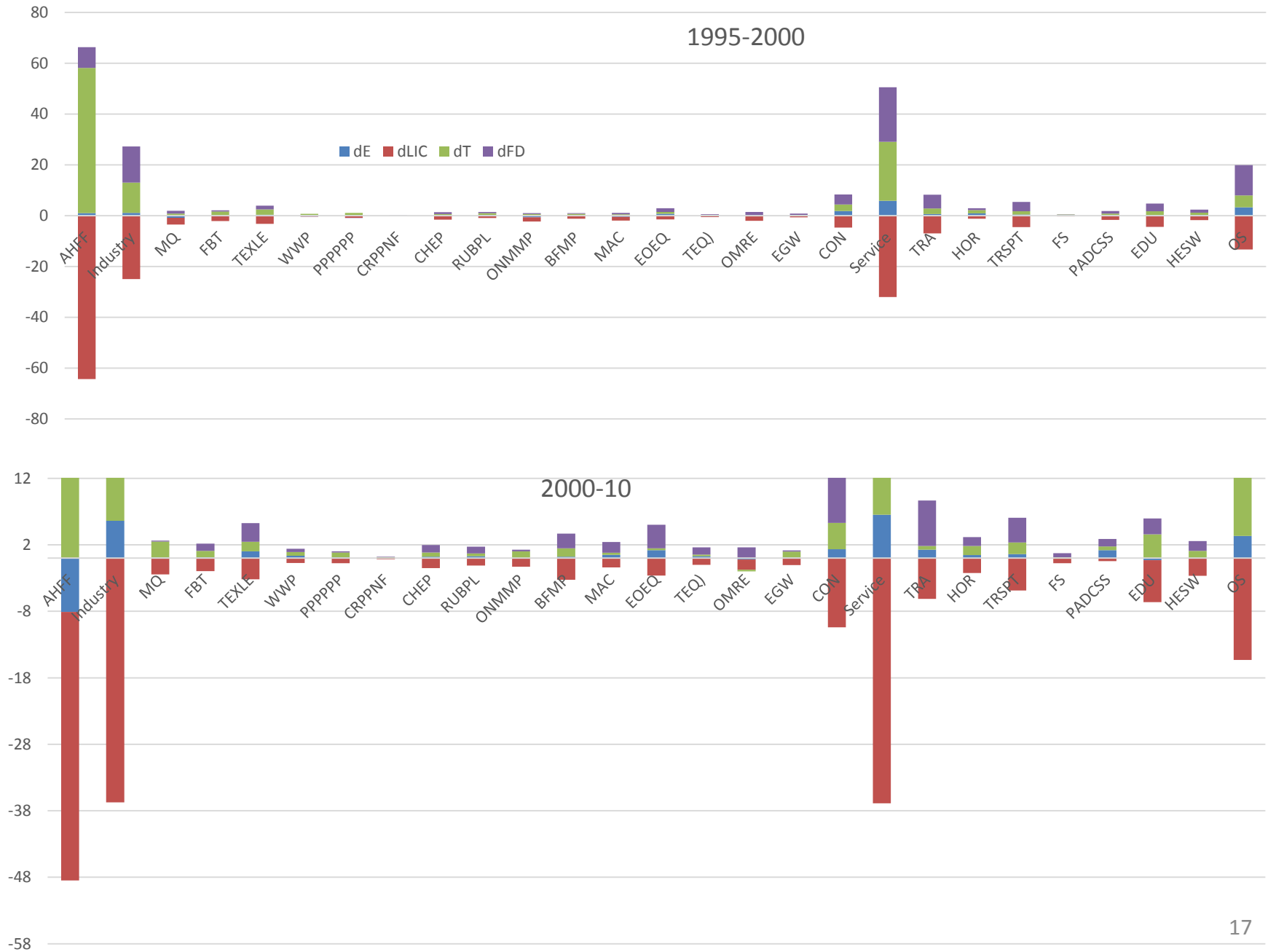


Table.7: Decomposition of growth of employment (in %) in 1995-2010 (China)

Sector code	dE	dLIC	dT	dFD	GE	dE	dLIC	dT	dFD	GE
	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
TRSP	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

The growth in labour force is driven by change in both the final demand and technology in China



C. Measurement of structural Change effect on LPG and its empirical evaluation

Let V_t and L_t be total value added and employment *at period t*. Labour productivity (LP_t):

$$= \frac{V}{L} = \frac{v_1+v_2+\dots+v_{25}}{L} = \frac{l_1*(v_1/l_1)}{L} + \frac{l_2*(v_2/l_2)}{L} + \dots + \frac{l_{25}*(v_{25}/l_{25})}{L} = \sum s_t^i * lp_t^i \quad (4)$$

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

The change in LP between two points of time t and $t-1$ is

$$dLP_t = \sum (s_t^i * dlp_t^i) + \sum (lp_t^i * ds_t^i) + \sum (ds_t^i * dlp_t^i)$$

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

Equation (5) is modified by dividing *by* LP_{t-1} on both side.

$$\frac{LP_t - LP_{t-1}}{LP_{t-1}} = \frac{\sum_{i=1}^{25} (lp_t^i - lp_{t-1}^i) * \bar{s}_t^i}{LP_{t-1}} + \frac{\sum_{i=1}^{25} (s_t^i - s_{t-1}^i) * \bar{lp}_t^i}{LP_{t-1}} + \frac{\sum_{i=1}^{25} (lp_t^i - lp_{t-1}^i) * (s_t^i - s_{t-1}^i)}{LP_{t-1}} \quad (6)$$

LPG

Intra effect (ISE)

Between effect (BSE) or
structural change effect
(SC)

Dynamic sectoral
effect (DSE)

- The between-effect is positive when the labour moves from low to high productivity sectors
- ISE is positive, when change in LP is positive

The contribution of structural change effect in China is larger than India

Contribution of structural change to LPG

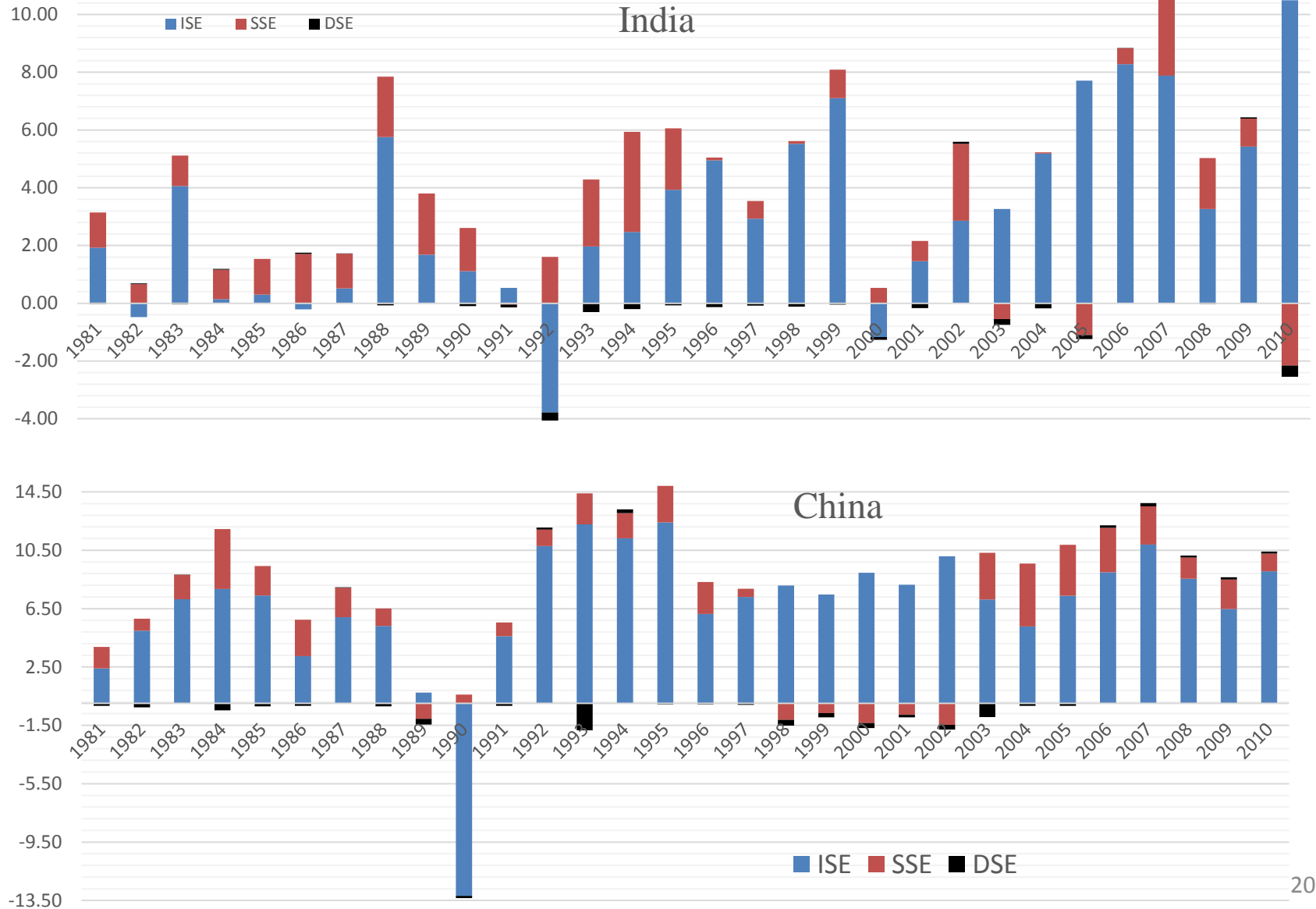
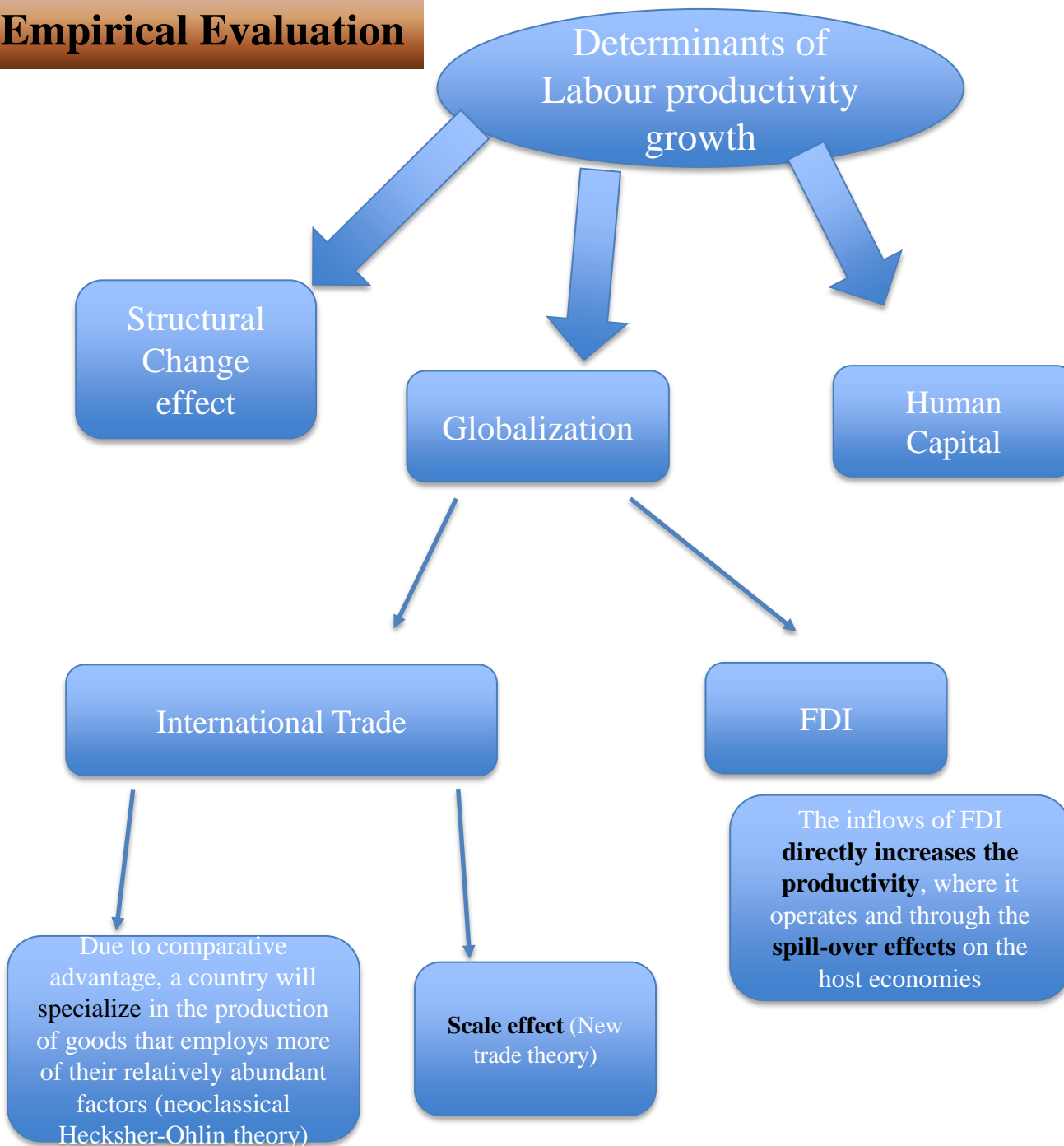


Table.8: Growth of LP in three sub-periods.

- Relatively China has a larger structural change effects to LPG

	LPG	ISE	BSE	DSE
	India			
1980-90	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
	China			
1980-90	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

Empirical Evaluation



$$LPG = f(SC, FDI, GTR, HC) \quad (7)$$

Where, LPG: labour productivity growth,

SC: structural change effect.

FDI: foreign direct investment

GTR: international trade

HC: human capital.

● FDI is measured as the percent of GDP and trade is represented as the growth of trade (GTR) (sourced from World Bank).

● Human capital is measured by –

(1) over all human capital index [from Pen World table (PWT)]

[The human capital per person, which is based **on years of schooling** (Barro and Lee, 2012) and **returns to education** (Psacharopoulos, 1994).]

(2) Gross enrolment ratio in primary, secondary and tertiary education (sourced from World Bank).

Alternative measures of SC to check robustness

- First measure is SC, which includes BSE and DSE.
- Second measure is the change in employment share of the high productivity sectors (dES).
- Third measure is a statistical index known as modified Lilien index (MLI).

This is an extended version of the Lilien-Index (Lilien (1982), which is modified by Stamer (1999). This is

defined as; $MLI_{t,t-1} = \sqrt{\sum_t^{t-1} s_t^i \cdot s_{t-1}^i \left[\ln \frac{s_t^i}{s_{t-1}^i} \right]^2}$, where s is the sectoral employment share.

Table.10: Basic statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
LPG	56	6.465179	3.829099	-2.54	14.86
GER3	56	8.674286	5.803439	1.79	23.32
GER2	56	48.96143	13.05359	29.93	83.13
GER1	56	106.9723	13.321	84.24	132.34
HK	56	1.94375	0.339645	1.39	2.58
SC	56	0.95	0.99	-1.91	3.11
MLI	56	1.923929	2.293577	0.14	10.83
dES	56	0.641964	0.721555	-0.74	2.72
GTR	56	13.33214	13.13155	-16.34	55.47
FDI	56	1.824464	1.822085	0	6.21

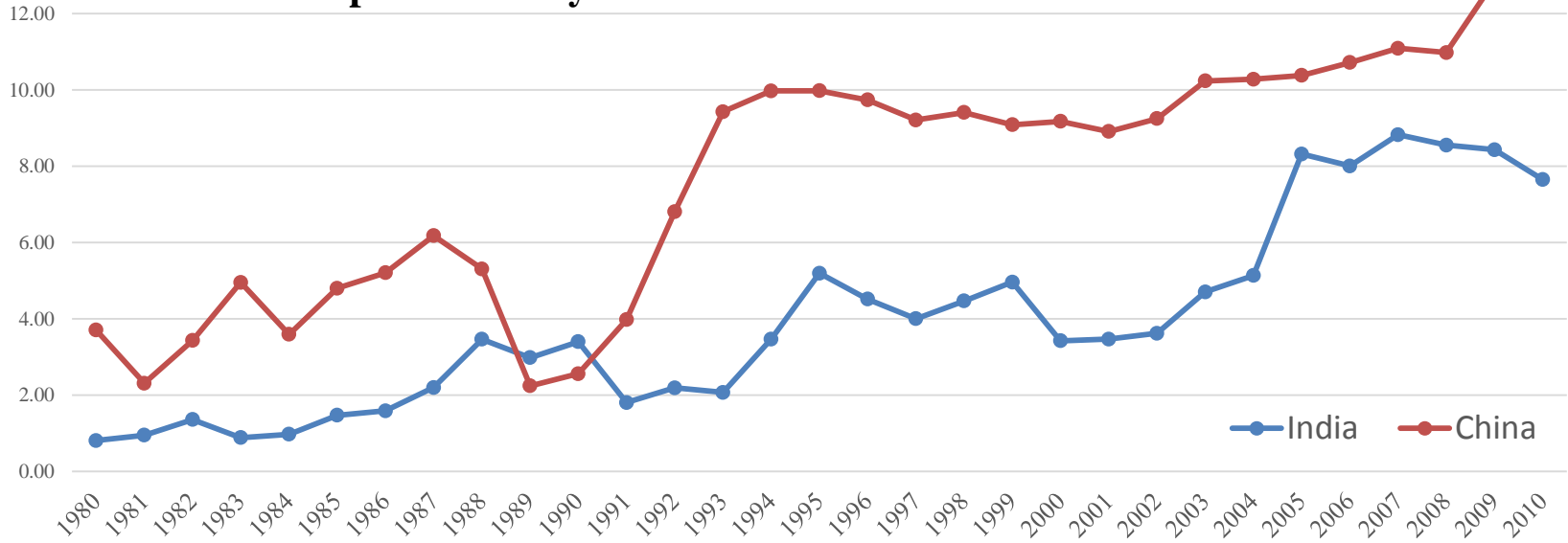
Table.11: Impact of structural change on LPG

Independent Variables	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5	Reg. 6	Reg. 7
Structural Change							
SC	0.84 (0.30)***	0.95 (0.30)***	0.86 (0.34)**	0.95 (0.25)***	0.88 (0.22)***		
dES						1.99 (0.47)***	
MLI							0.62 (0.16)***
Human capital							
GER1	0.13 (0.03)***						
GER2		0.14 (0.03)***					
GER3			0.17 (0.08)**				
HK				7.40 (1.01)***	2.95 (1.54)**	4.17 (1.55)***	3.36 (1.55)**
Globalisation							
GTR					0.05 (0.02)**	0.05 (0.02)**	0.04 (0.03)*
FDI					0.96 (0.29) ***	0.51 (0.30)**	0.59 (0.30)**
Constant	-8.65 (3.44)***	-1.32 (1.67)	3.90 (0.88)***	-9.08 (2.01)***	-2.81 (2.60)	-3.46 (2.62)	-2.86 (2.6)
Observations	56	56	56	56	56	56	56
R-sq.	0.35	0.35	0.21	0.57	0.67	0.68	0.67

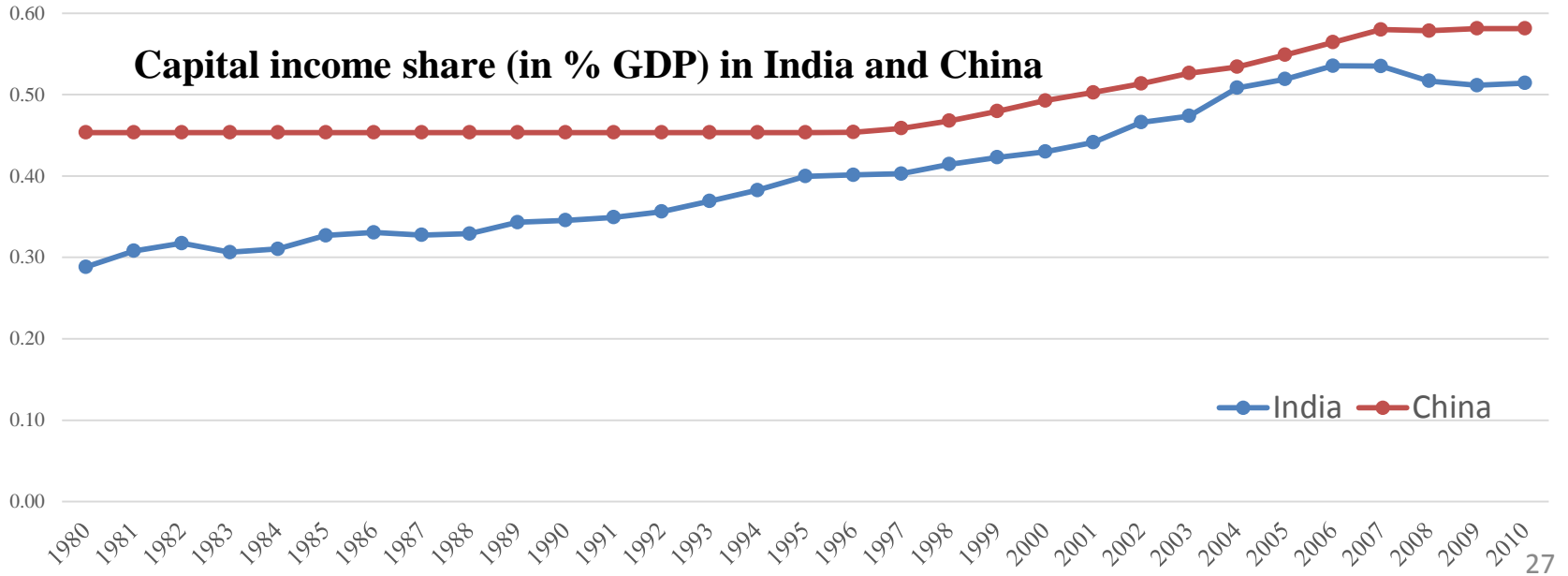
*Note: ***, ** and * indicates statistically significant at 1 percent, 5 percent and 10 percent levels.*

Capital Intensity and LPG

Growth of capital intensity in India and China



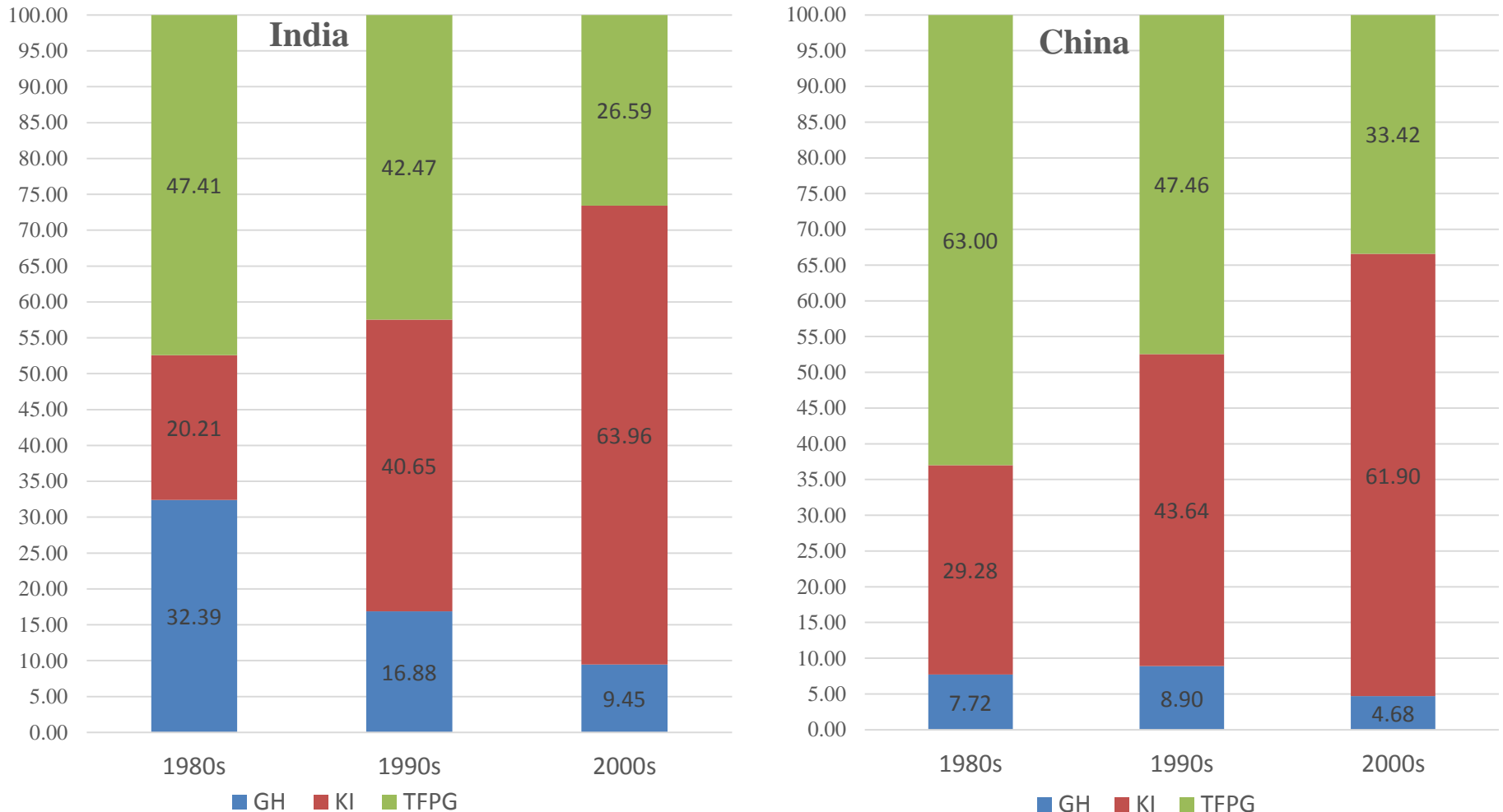
Capital income share (in % GDP) in India and China



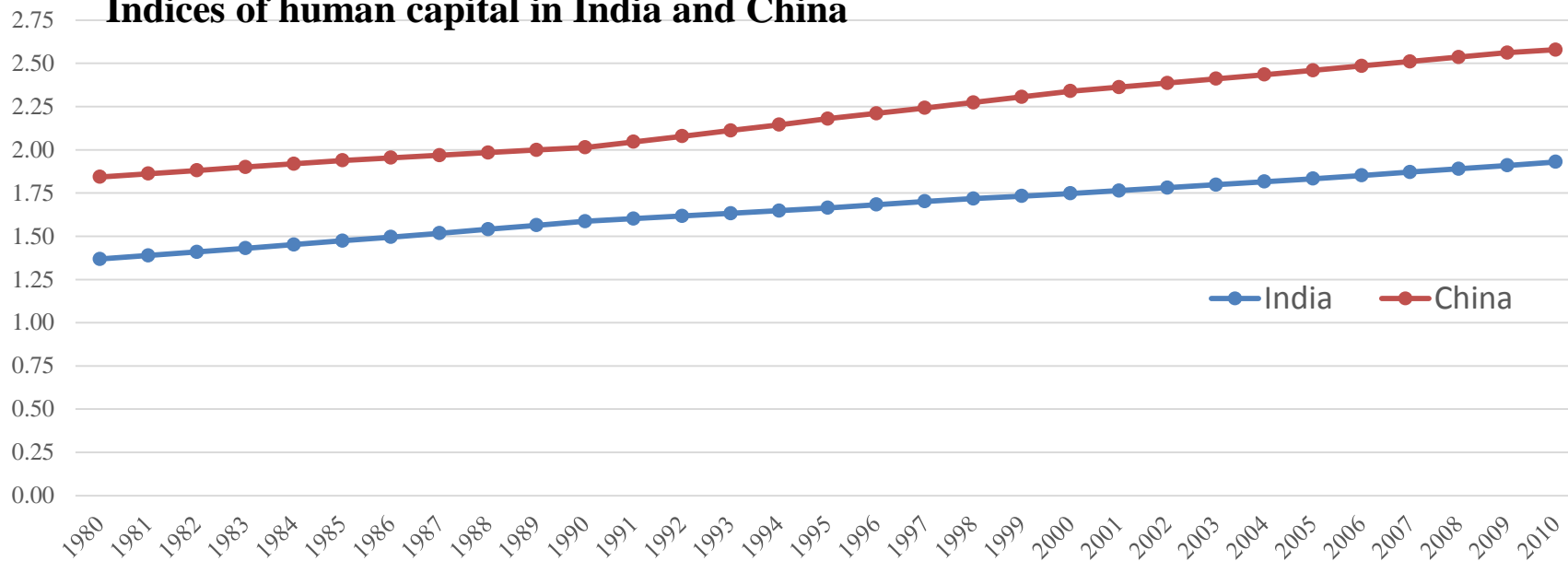
The contribution of capital intensity has been increasing in India and China

Relatively contribution of TFPG in China is greater than India.

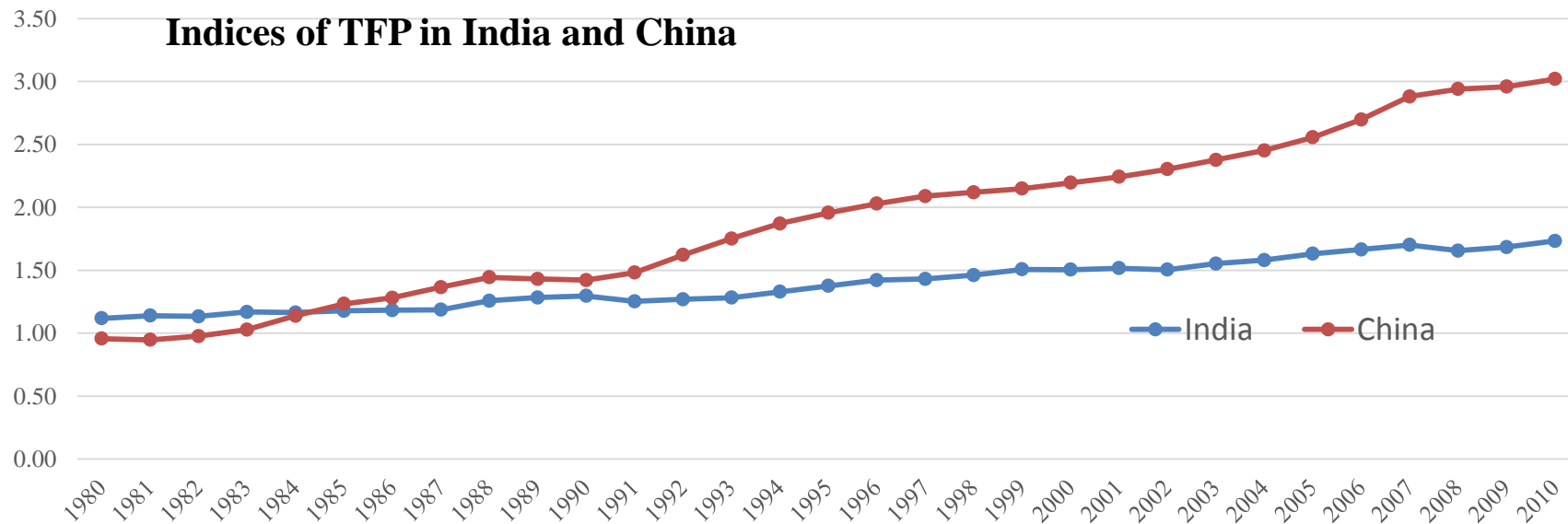
Contribution of Capital Intensity to LPG



Indices of human capital in India and China

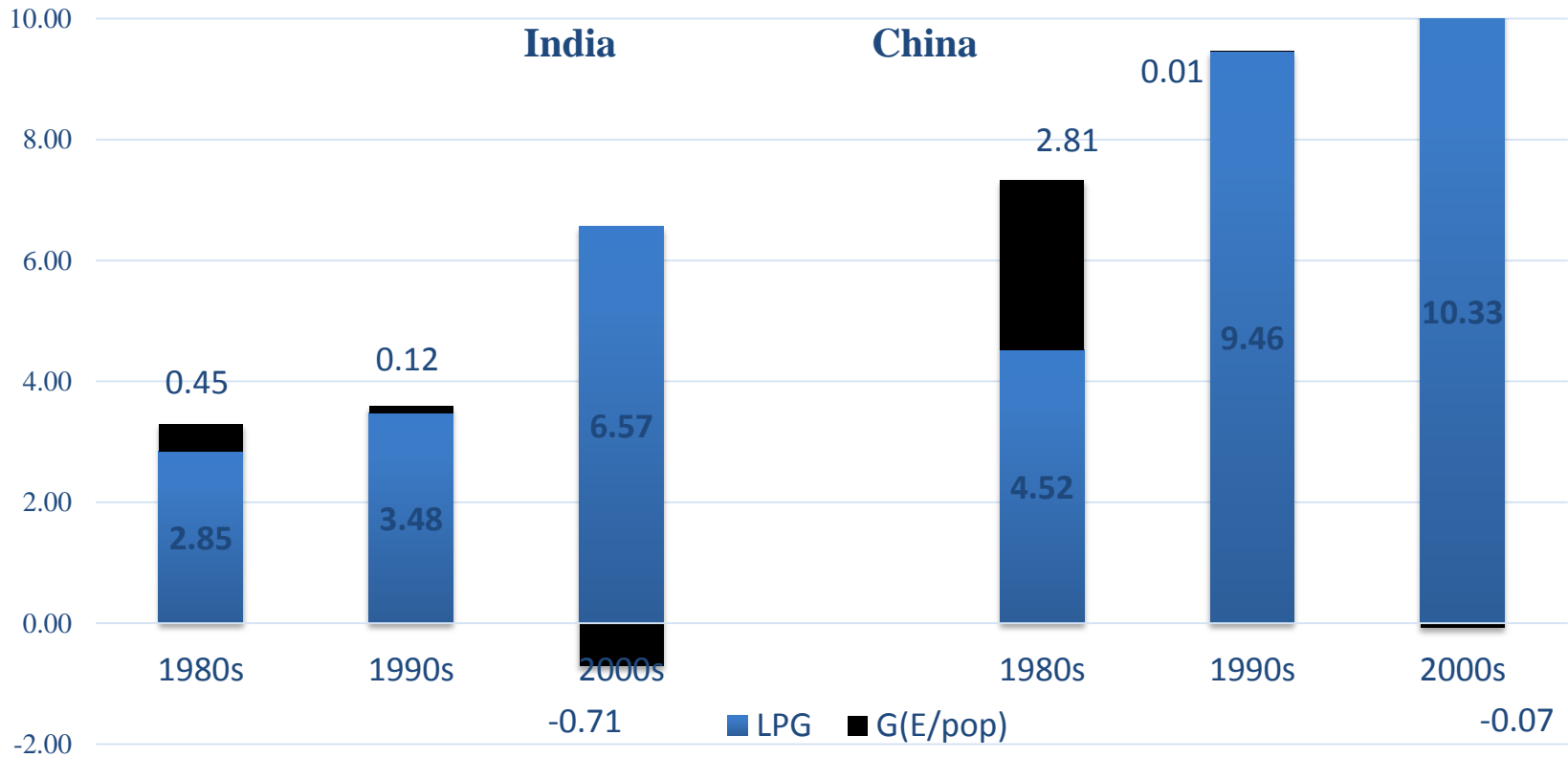


Indices of TFP in India and China



Policy Implications of Structural Change

Growth of LP, employment and per capita income



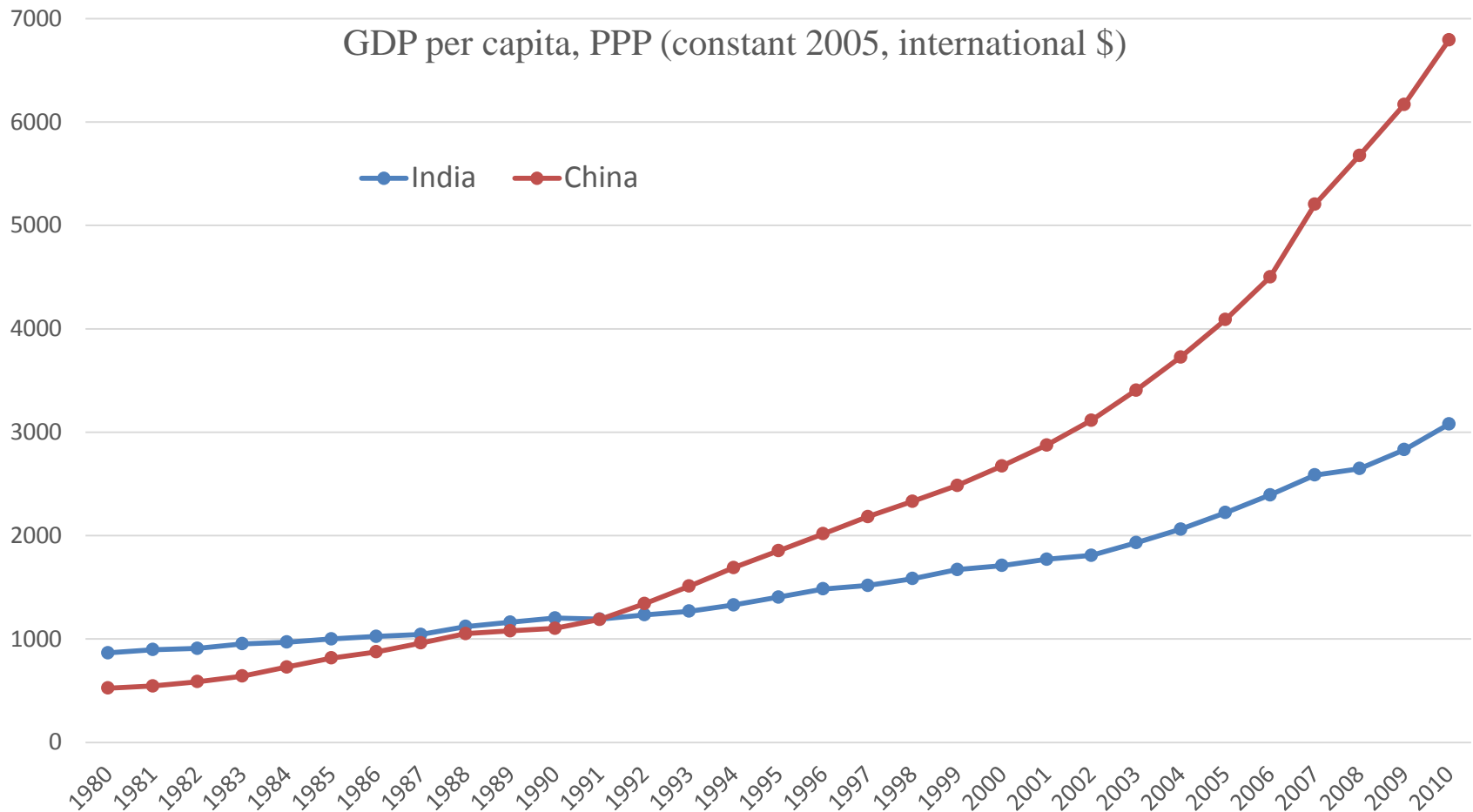
Per capita income = GDP/ total population = (GDP/employment)* (employment/total population)
 = LP*employment rate (E).

Now, $\log(\text{per capita income}) = \log(\text{LP}) + \log(\text{E})$.

Differentiating both side of the equation, yields;

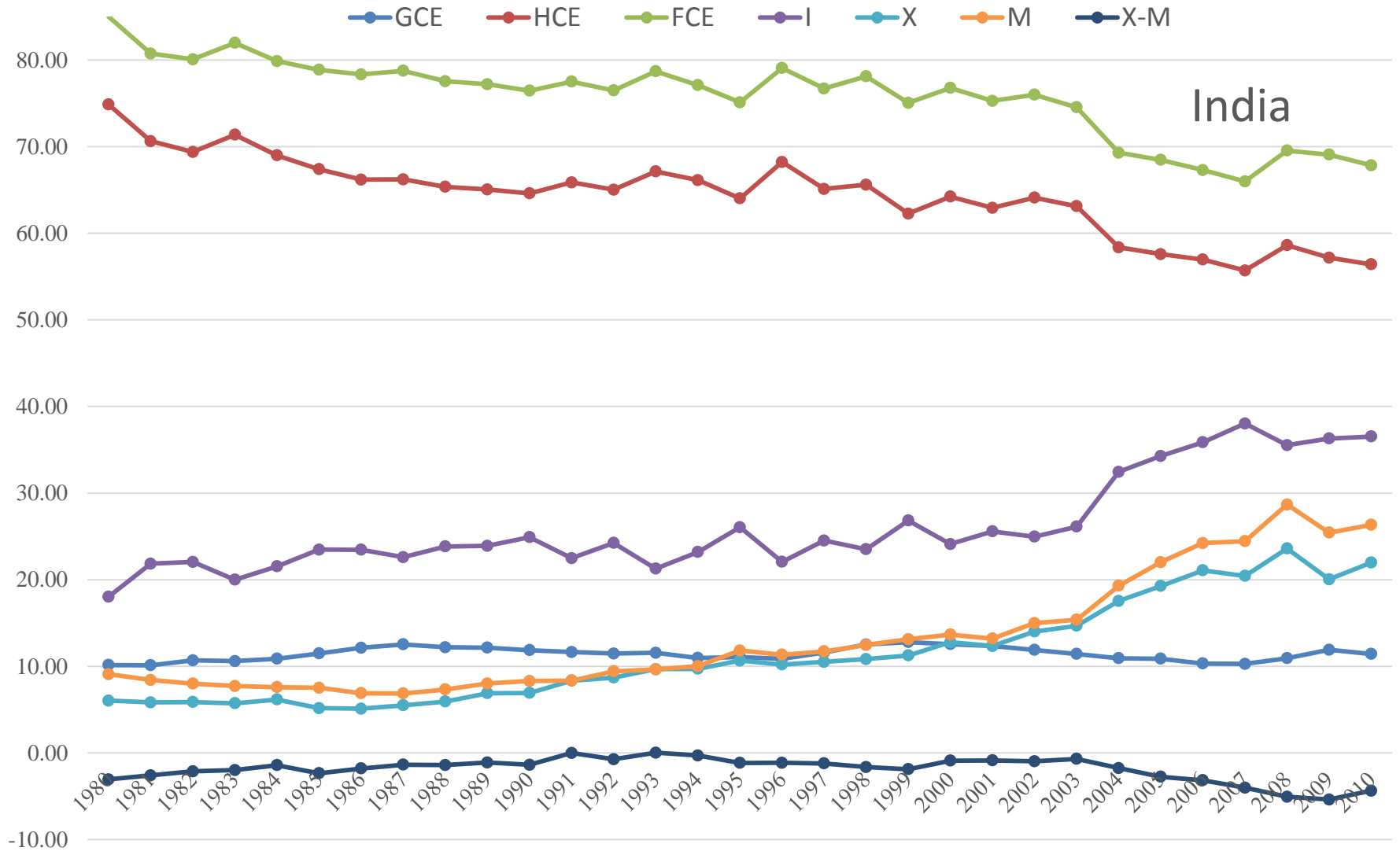
growth of per capita income = growth of LP (or LPG) + growth of employment rate (or GE).³¹

The per capita income of China was less than India before 1990s

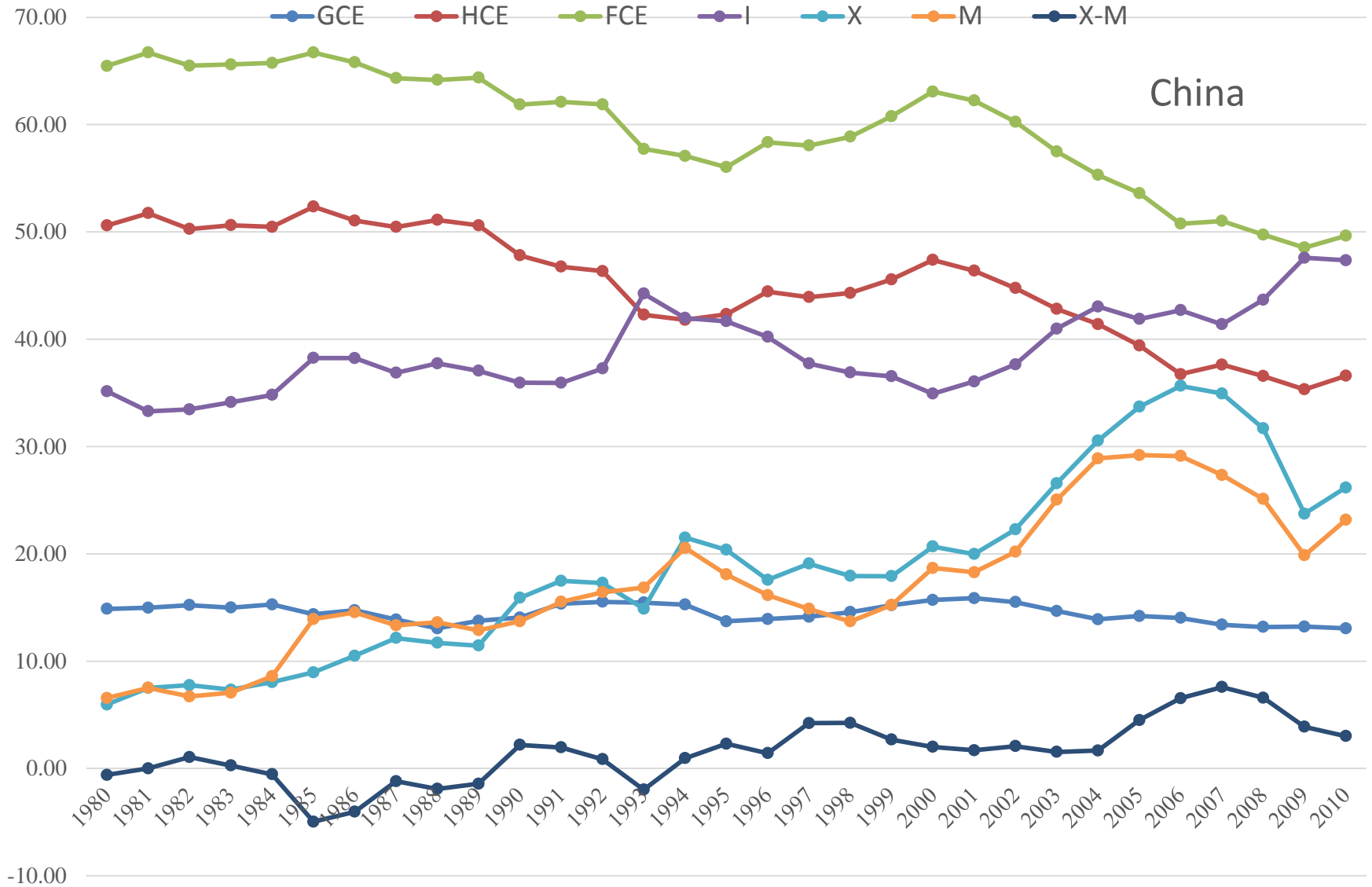


Sources: World Development Indicators (2008 and 2015)

The private consumption oriented demand structure in India



The Investment and relatively export oriented demand structure in China



Conclusions

- The labour has reallocated from agriculture to the non-agriculture sector in both India and China. Still, a larger proportion of labour force is concentrated in Indian agriculture.
- The main source of the pattern of reallocation of labour is the final demand change in India (while, the final demand change along and technology change in China.)
- Empirical results confirm that structural change effect along with FDI inflows, international trade and human capital are significant for LPG.
- To achieve higher labour productivity, the relevant policies related to knowledge must be pursued in direction of incentive and encouraging investments in human capital, technology and innovations.
- To achieve long-run and sustainable higher economic growth, India has to take faster economic reform measures and more outward oriented policies to trade
-- -----(in the fronts of infrastructure development; market supporting institutions; conducive business law & regulations; and flexible & conducive labor markets policies, which can promote exports, and encourage foreign investment to accumulate capital and acquire the advanced technologies). -----

India can be the leader of global economic growth in the years to come

- A major portion of labour force is concentrated in agricultural sector, which is generally low productive
- Still India is a low wage cost country
- Self-reliable country with a larger domestic market. Exports need to be promoted.
- The demographic advantage (Bloom, 2011)

THANK YOU