



# **Regional Structure Change in China: -- Based on IO Ananlysis1987-2007**

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**Note: views presented in this report are those of the author rather than those of the organization where the author works.**



# Background



# 31 Provinces

<b>Beijing</b>	北京	京	<b>Jing</b>	<b>Hubei</b>	湖北	鄂	<b>E</b>
<b>Tianjin</b>	天津	津	<b>Jin</b>	<b>Hunan</b>	湖南	湘	<b>Xiang</b>
<b>Hebei</b>	河北	冀	<b>Ji</b>	<b>Guangdong</b>	广东	粤	<b>Yue</b>
<b>Shanxi</b>	山西	晋	<b>Jin</b>	<b>Guangxi</b>	广西	桂	<b>Gui</b>
<b>Inner Mongolia</b>	内蒙古	内蒙	<b>Neimeng</b>	<b>Hainan</b>	海南	琼	<b>Qun</b>
<b>Liaoning</b>	辽宁	辽	<b>Liao</b>	<b>Chongqing</b>	重庆	渝	<b>Yu</b>
<b>Jilin</b>	吉林	吉	<b>Ji</b>	<b>Sichuan</b>	四川	川	<b>Chuan</b>
<b>Heilongjiang</b>	黑龙江	黑	<b>Hei</b>	<b>Guizhou</b>	贵州	黔	<b>Qian</b>
<b>Shanghai</b>	上海	沪	<b>Hu</b>	<b>Yunnan</b>	云南	滇	<b>Dian</b>
<b>Jiangsu</b>	江苏	苏	<b>Su</b>	<b>Tibet</b>	西藏	藏	<b>Zang</b>
<b>Zhejiang</b>	浙江	浙	<b>Zhe</b>	<b>Shaanxi</b>	陕西	陕	<b>Shaan</b>
<b>Anhui</b>	安徽	皖	<b>Wan</b>	<b>Gansu</b>	甘肃	甘	<b>Gan</b>
<b>Fujian</b>	福建	闽	<b>Min</b>	<b>Qinghai</b>	青海	青	<b>Qing</b>
<b>Jiangxi</b>	江西	赣	<b>Gan</b>	<b>Ningxia</b>	宁夏	宁	<b>Ning</b>
<b>Shandong</b>	山东	鲁	<b>Lu</b>	<b>Xinjiang</b>	新疆	新	<b>Xin</b>
<b>Henan</b>	河南	豫	<b>Yu</b>				



# 31 Provinces: Population (million)

<b>Guangdong</b>	104.30	<b>Yunnan</b>	45.97	<b>Inner Mongolia</b>	24.71
<b>Shandong</b>	95.79	<b>Jiangxi</b>	44.57	<b>Shanghai</b>	23.02
<b>Henan</b>	94.02	<b>Liaoning</b>	43.75	<b>Xinjiang</b>	21.81
<b>Sichuan</b>	80.42	<b>Heilongjiang</b>	38.31	<b>Beijing</b>	19.61
<b>Jiangsu</b>	78.66	<b>Shaanxi</b>	37.33	<b>Tianjin</b>	12.94
<b>Hebei</b>	71.85	<b>Fujian</b>	36.89	<b>Hainan</b>	8.67
<b>Hunan</b>	65.68	<b>Shanxi</b>	35.71	<b>Ningxia</b>	6.30
<b>Anhui</b>	59.50	<b>Guizhou</b>	34.75	<b>Qinghai</b>	5.63
<b>Hubei</b>	57.24	<b>Chongqing</b>	28.85	<b>Tibet</b>	3.00
<b>Zhejiang</b>	54.43	<b>Jilin</b>	27.46		
<b>Guangxi</b>	46.03	<b>Gansu</b>	25.58		

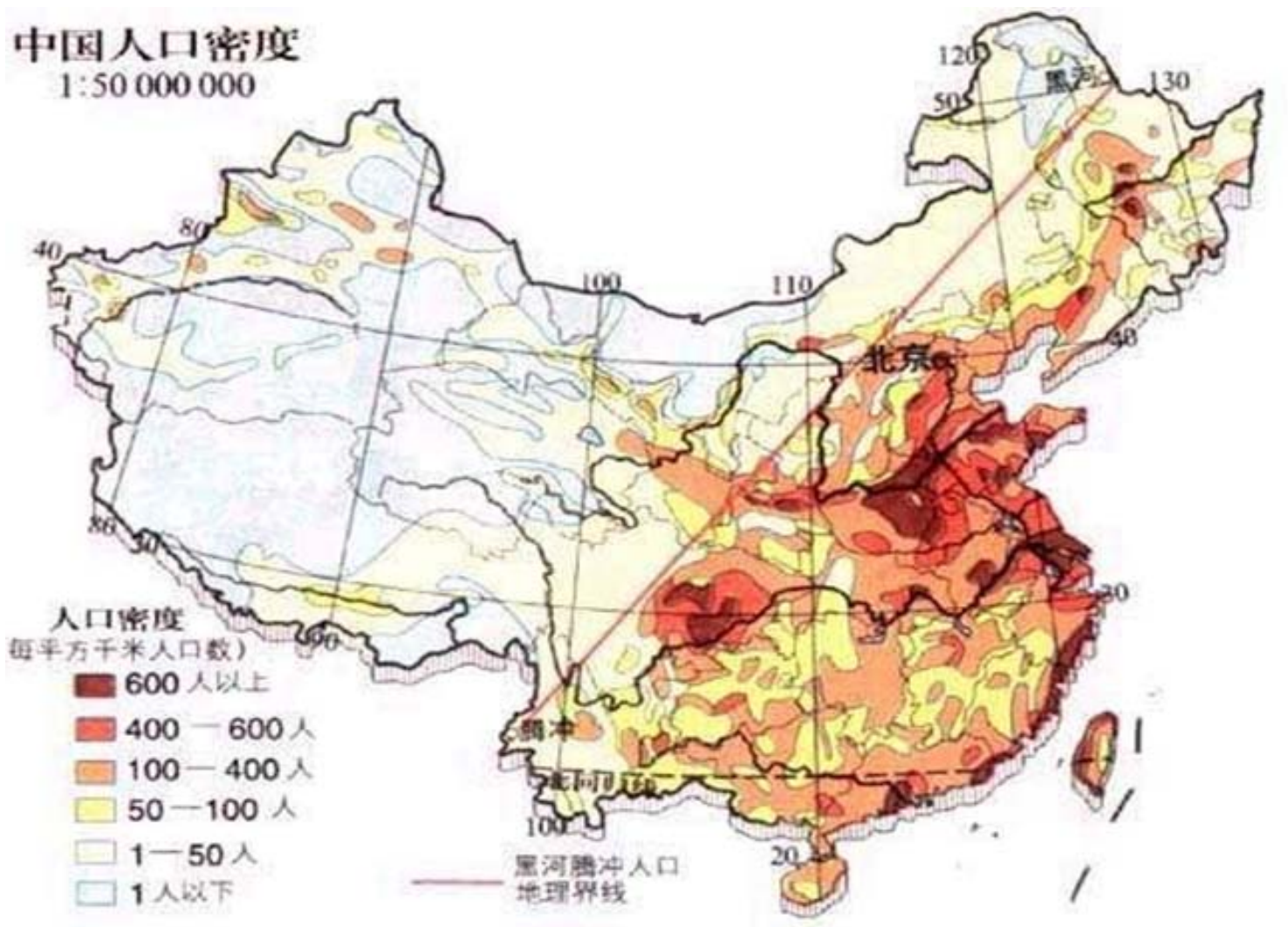


# 31 Provinces: Area (km<sup>2</sup>)

<b>Xinjiang</b>	1,660,000	<b>Hebei</b>	190,000	<b>Fujian</b>	121,400
<b>Tibet</b>	1,228,400	<b>Jilin</b>	187,400	<b>Jiangsu</b>	102,600
<b>Inner Mongolia</b>	1,183,000	<b>Hubei</b>	185,900	<b>Zhejiang</b>	101,800
<b>Qinghai</b>	722,000	<b>Guangdong</b>	179,800	<b>Chongqing</b>	82,400
<b>Sichuan</b>	485,000	<b>Guizhou</b>	176,100	<b>Ningxia</b>	66,400
<b>Gansu</b>	455,000	<b>Henan</b>	167,000	<b>Hainan</b>	35,000
<b>Heilongjiang</b>	454,000	<b>Jiangxi</b>	166,947	<b>Beijing</b>	16,807
<b>Yunnan</b>	394,000	<b>Shandong</b>	157,100	<b>Tianjin</b>	11,305
<b>Guangxi</b>	236,300	<b>Shanxi</b>	156,000	<b>Shanghai</b>	6,341
<b>Hunan</b>	211,875	<b>Liaoning</b>	145,700		
<b>Shaanxi</b>	205,600	<b>Anhui</b>	139,600		

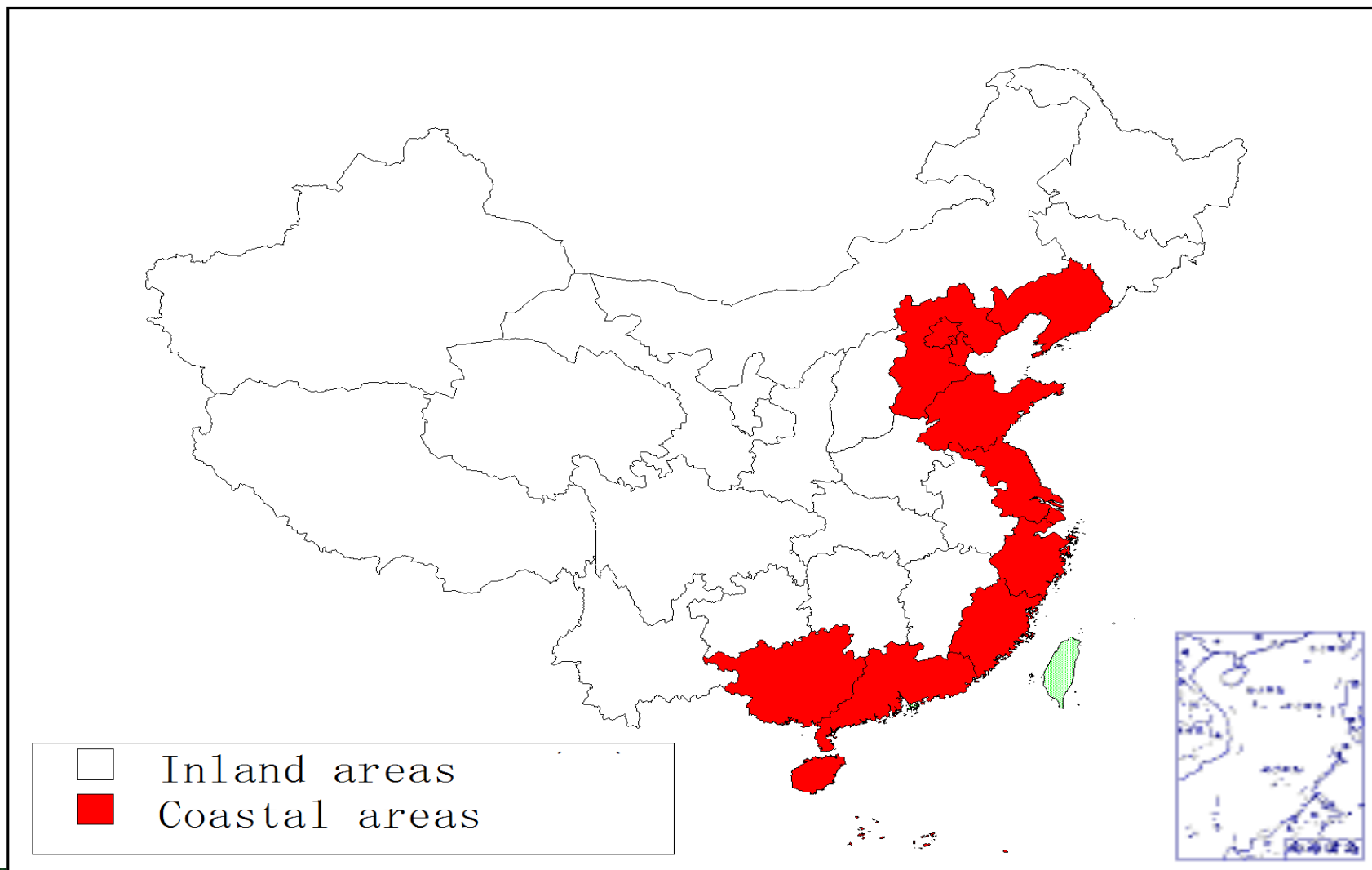


# Hu Huanyong Line (1935)



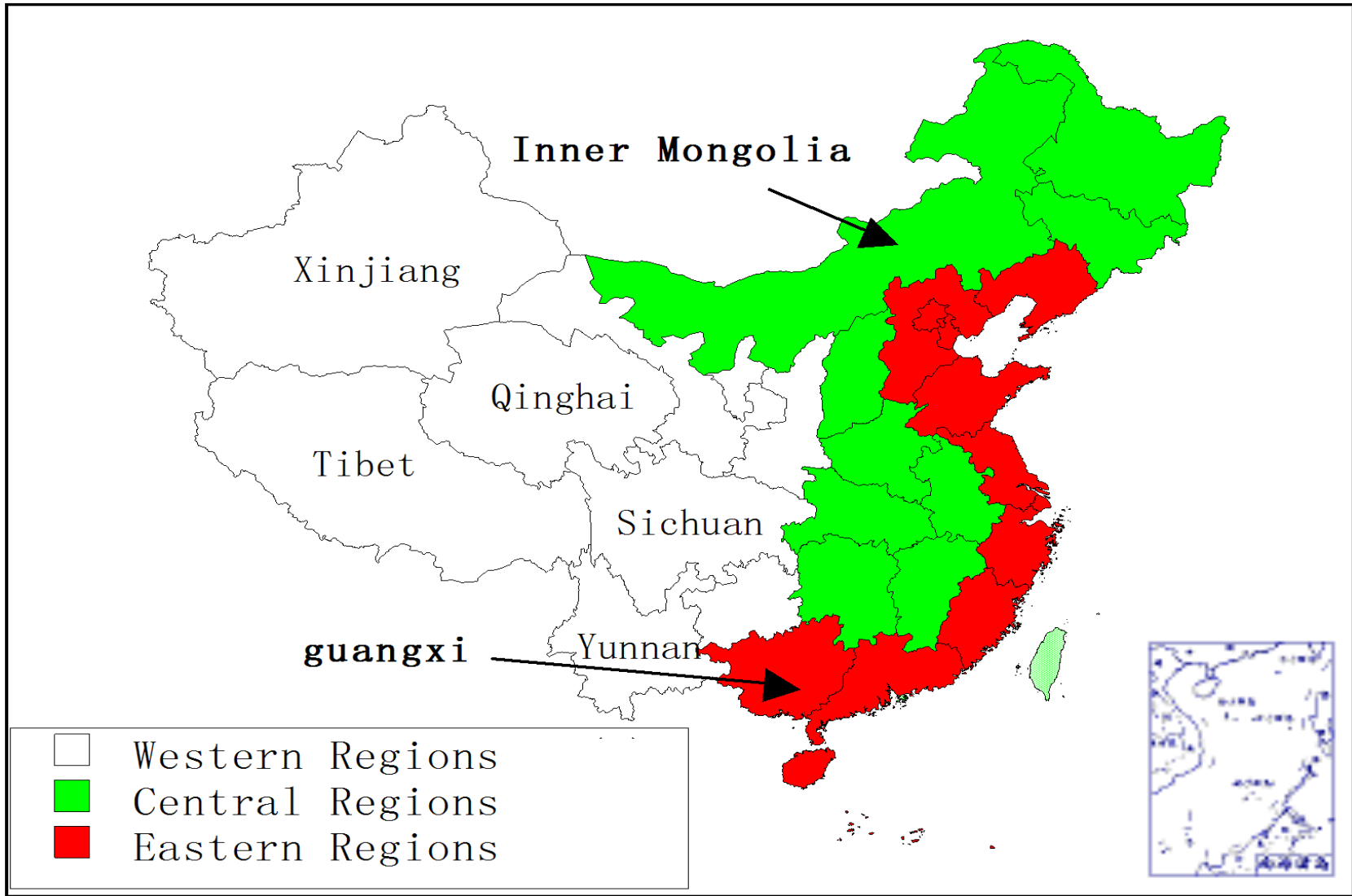


# Coastal region and Inland region





# Eastern, Central, and Western regions







# Four Regions( Western, North-Eastern, Central, Eastern)

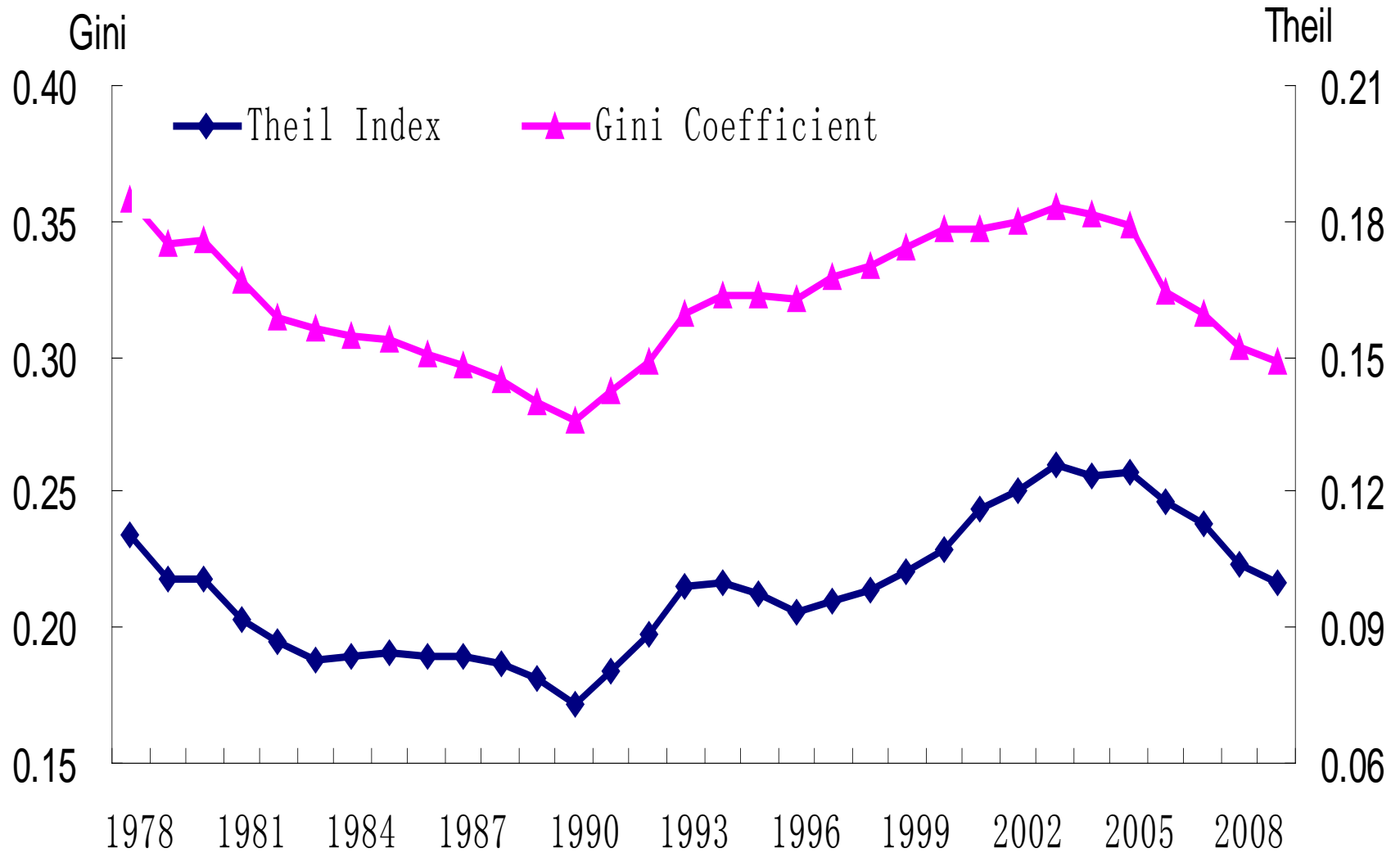




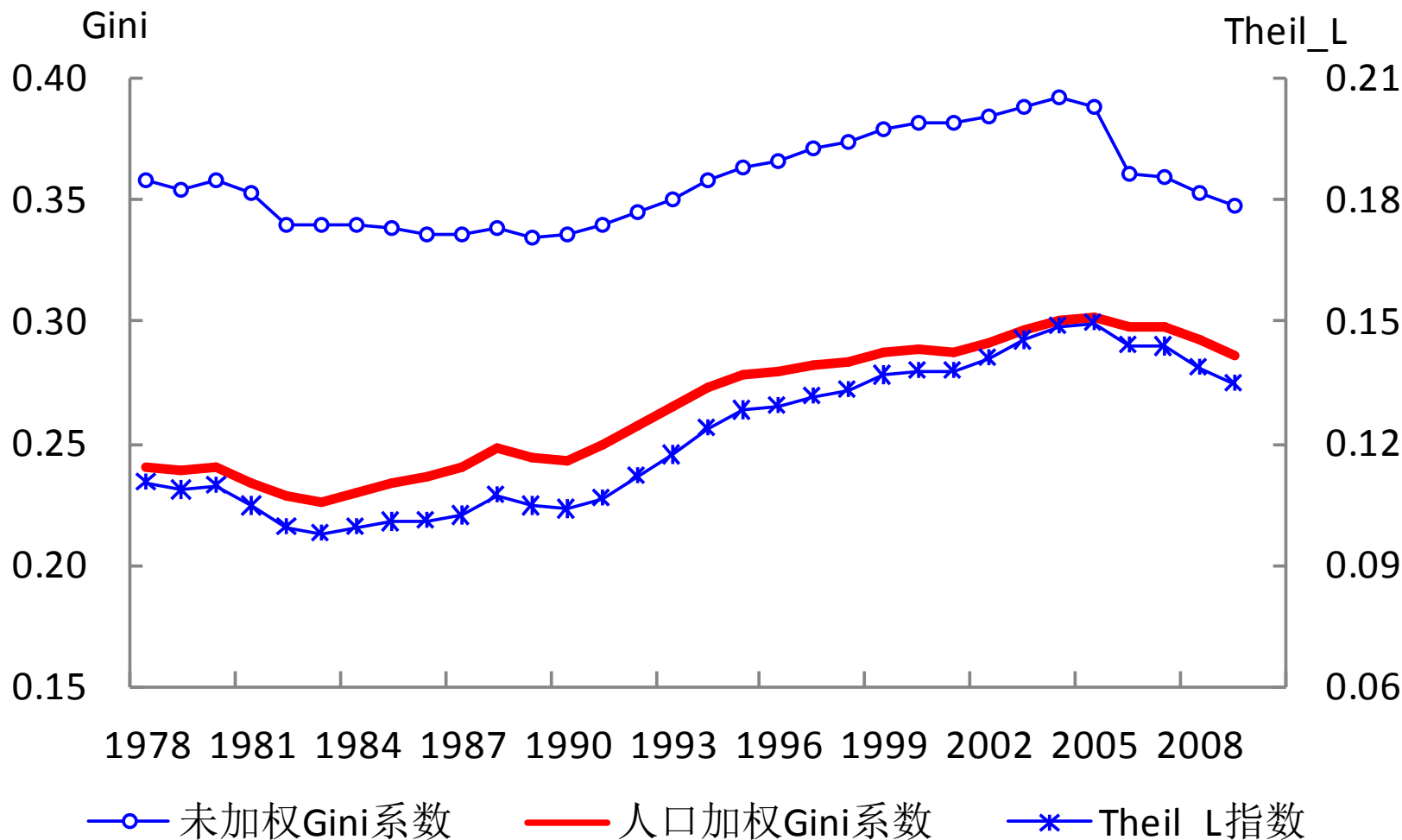
## Though the income disparity between the regions has been narrowed, the unbalanced development still exist there

- **In recent years, a trend of the income disparity between the regions has been narrowed**

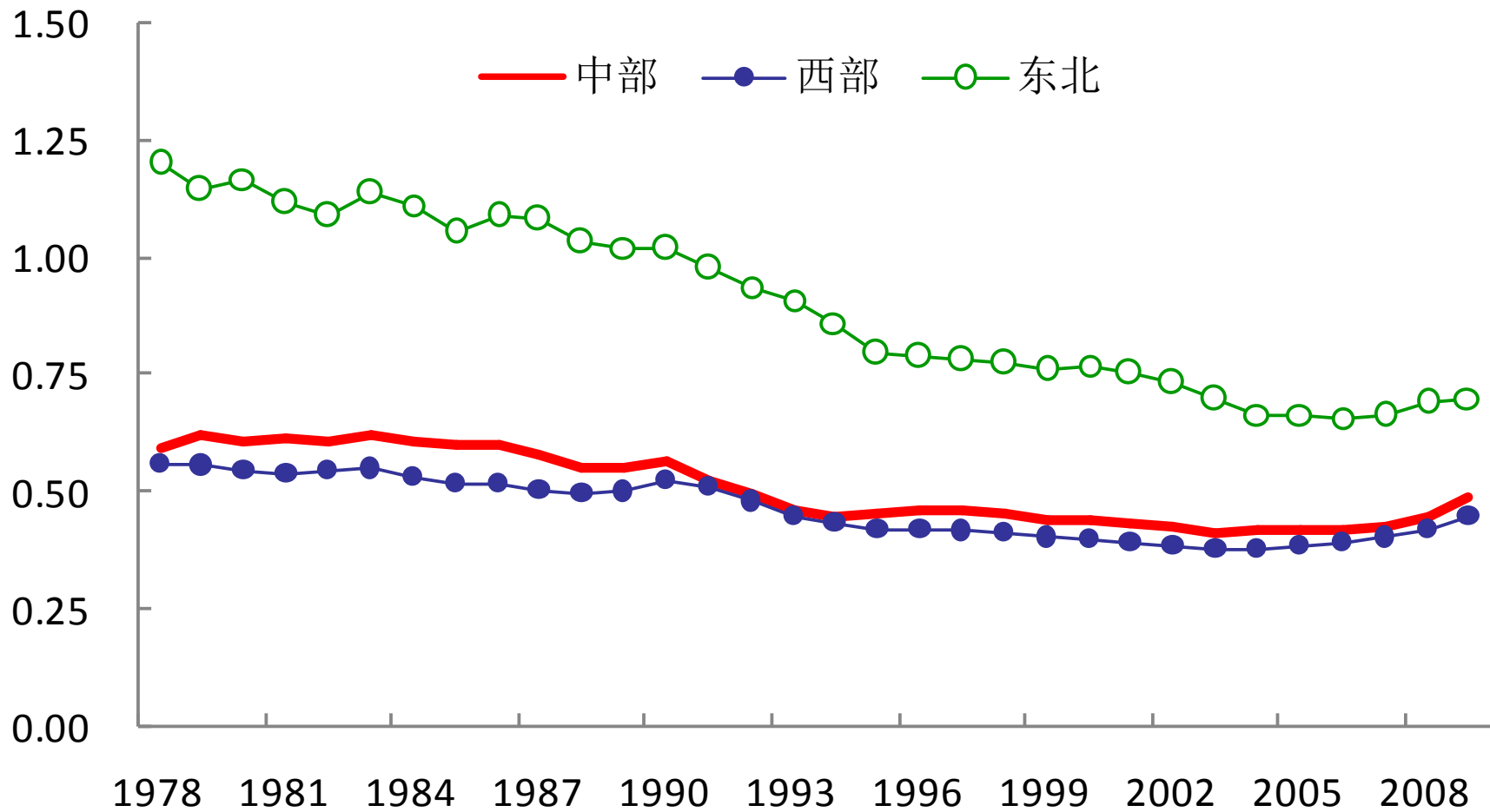
in 1980s the income disparity between the regions has been greatly narrowed by calculating current per capita income of GDP. Gini coefficient without weighted average of population decreased from 0.357 in 1978 to 0.276 in 1990. But, in 1990s, especially in the first half of 1990s, there was a notable expansion of regional income disparity between the provinces; After entering the new century, the expansion speed of the income disparity between the provinces has slowed down, especially since 2004, this income disparity began to be narrowed.



Gini Coefficient and Theil index based on Per Capita GDP at Current Prices



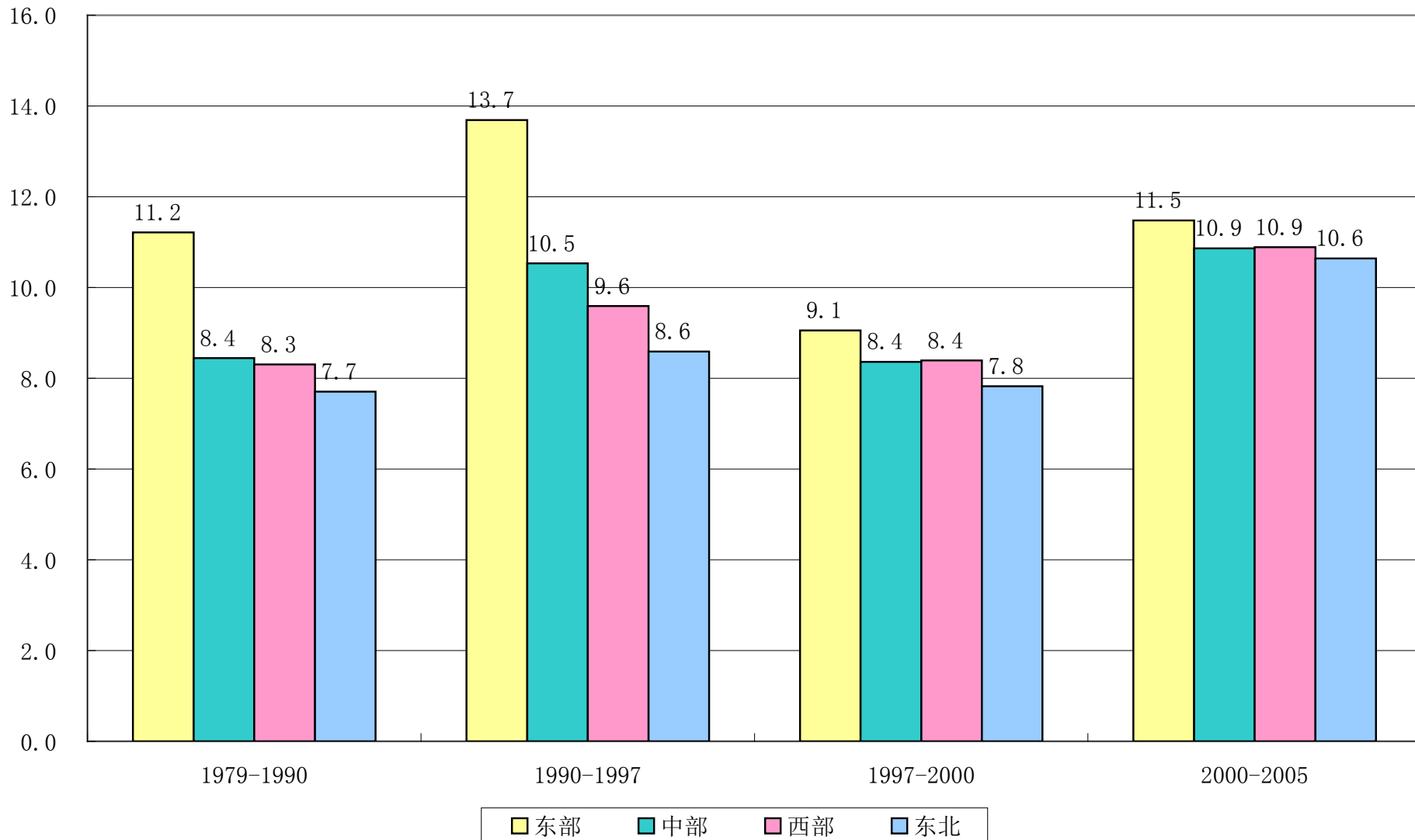
**Gini Coefficient and Theil index based on Per Capita GDP at 1978 Constant Prices**



Four Regions: ratio of per capita GDP to Eastern region

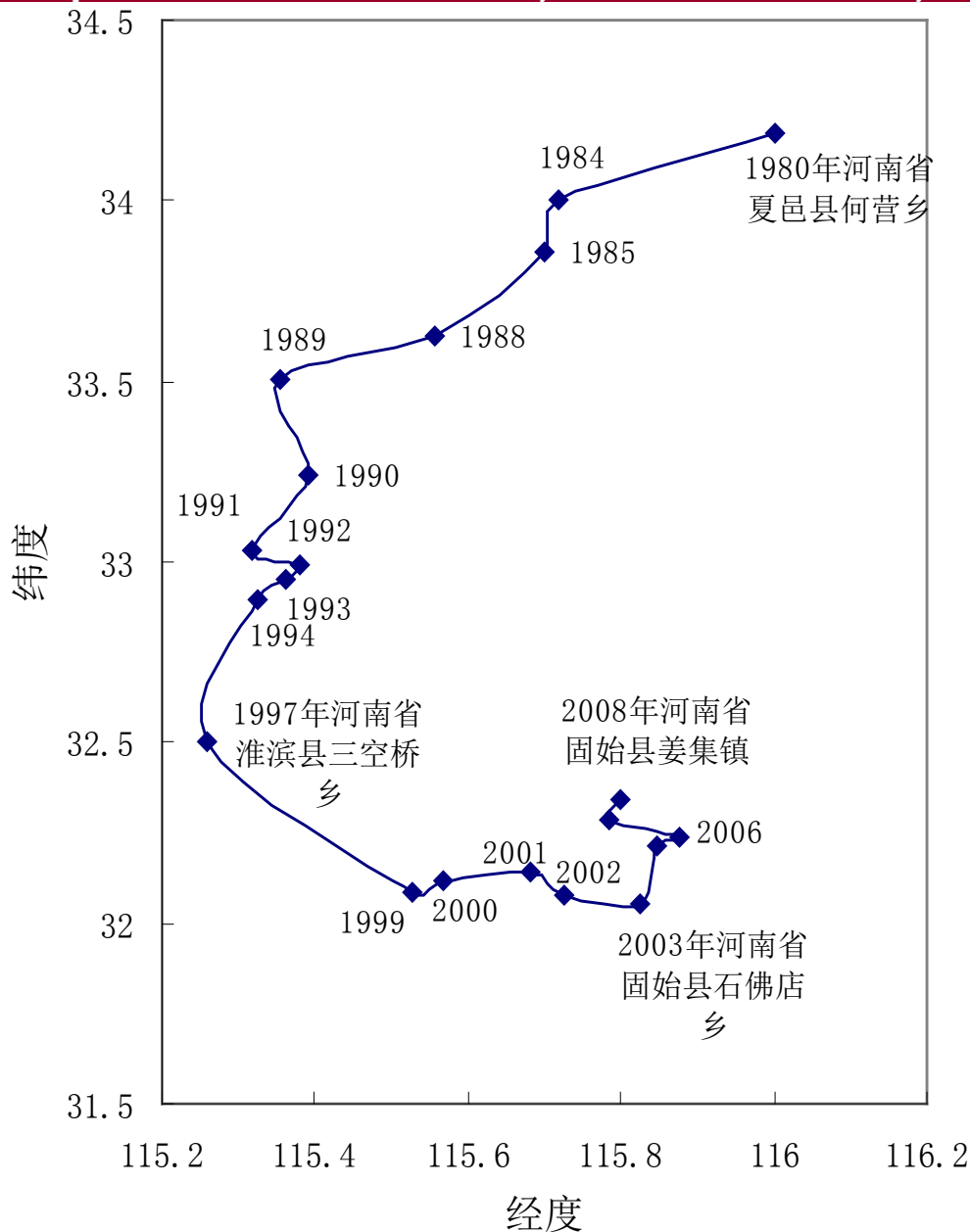


# East, Central, West, and Northeast regions: Growth Rate of per capita GDP





# Change of center of gravity position of manufacture industry since 1980





# Regional Input Output Analysis





- We collect Provincial Input Output Tables of 1987, 1992, 1997, 2002, and 2007
- Considering the changes of coverage and classification since 1987, the provincial IO tables compiled into 27 sectors



Sector		Sector		Sector	
Agriculture	1	Chemical Industry	10	Other Manufacturing	19
Coal, Crude Oil and Natural Gas	2	Nonmetal mineral products	11	Power, Heat Power and Water	20
Other mining	3	Metals smelting and pressing	12	Construction	21
Foods, Beverage & Tobacco	4	Metal products	13	Transport, Storage, Post and Telecommunication	22
Textile	5	Machinery and equipment	14	Real estate and social services	23
Apparel & Leather Products	6	Transport equipment	15	Education, social welfare and health services	24
Sawmills and furniture	7	Electric equipment and machinery	16	Commerce	25
Paper, printing and record medium reproduction	8	Electronic and telecommunication equipment	17	Finance and insurance	26
Coking, Gas and Processing of Petroleum	9	Instruments, meters, office machinery	18	Public administration and other sectors	27



- Source of Growth
  - ✧ Demand side
  - ✧ Supply side
  - ✧ Income
- Economic Structure Changes
- Interregional trade and domestic Market Integration



# One Application—Change of Complexity of Production System (1987—2007)



- **Average Propagation Lengths (APLs)** (Dietzenbacher *et al.*, 2005; Dietzenbacher and Romero, 2007; Dietzenbacher and Temurshoev, 2008).
- The paper (Hewings *et al.*, 1998a, b; Guo *et al.*, 2005) illustrates the theoretical considerations with the case of the Chicago regional economy, as a representative example of a highly developed area being affected by fragmentation.



$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix}$$

图 1 投入系数矩阵

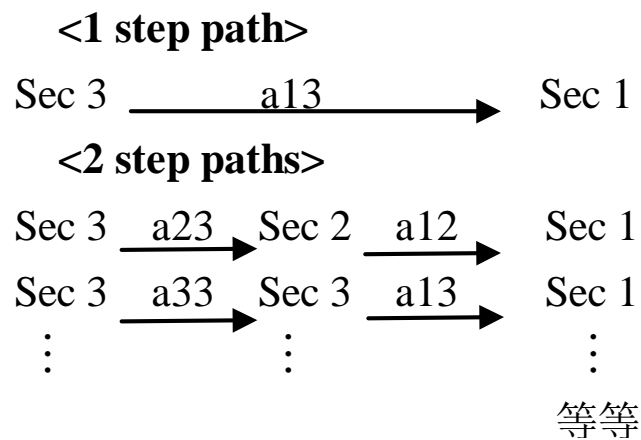


图 2 冲击波及路径



The change of output in sector j with increase of one unit of final demand on sector j:

$$\Delta x_j = l_{jj} = 1 + a_{jj} + \sum_k a_{jk} a_{kj} + \sum_k \sum_m a_{jk} a_{km} a_{mj} + \dots \quad (1)$$

The steps from the increase of final demand on sector j to growth of output in sector i

$$APL_{ij} = \frac{a_{ij} + 2 * \sum_k a_{ik} a_{kj} + 3 * \sum_k \sum_m a_{ik} a_{km} a_{mj} + \dots}{l_{ij}} \quad (2)$$



When considering the distances from one sector to any sector in the production system, we take averages. This may be done from two perspectives, a forward and a backward. The forward average APL is defined as:

$$FA_i = \frac{1}{n} \sum_{j=1}^n APL_{ij}$$

and the average backward APL is defined as:

$$BA_j = \frac{1}{n} \sum_{i=1}^n APL_{ij}$$

where  $n$  is the number of sectors.





- The forward average APL ( $FA_i$ ) gives the average distance from sector  $i$  to any sector  $j$  when considering the effects on the output value of sector  $j$  due to a cost-push in sector  $i$ .
- The backward average APL ( $BA_j$ ) gives the average distance from sector  $j$  to any sector  $i$  when considering the effects on the output value in sector  $i$  due to of a demand-pull from sector  $j$

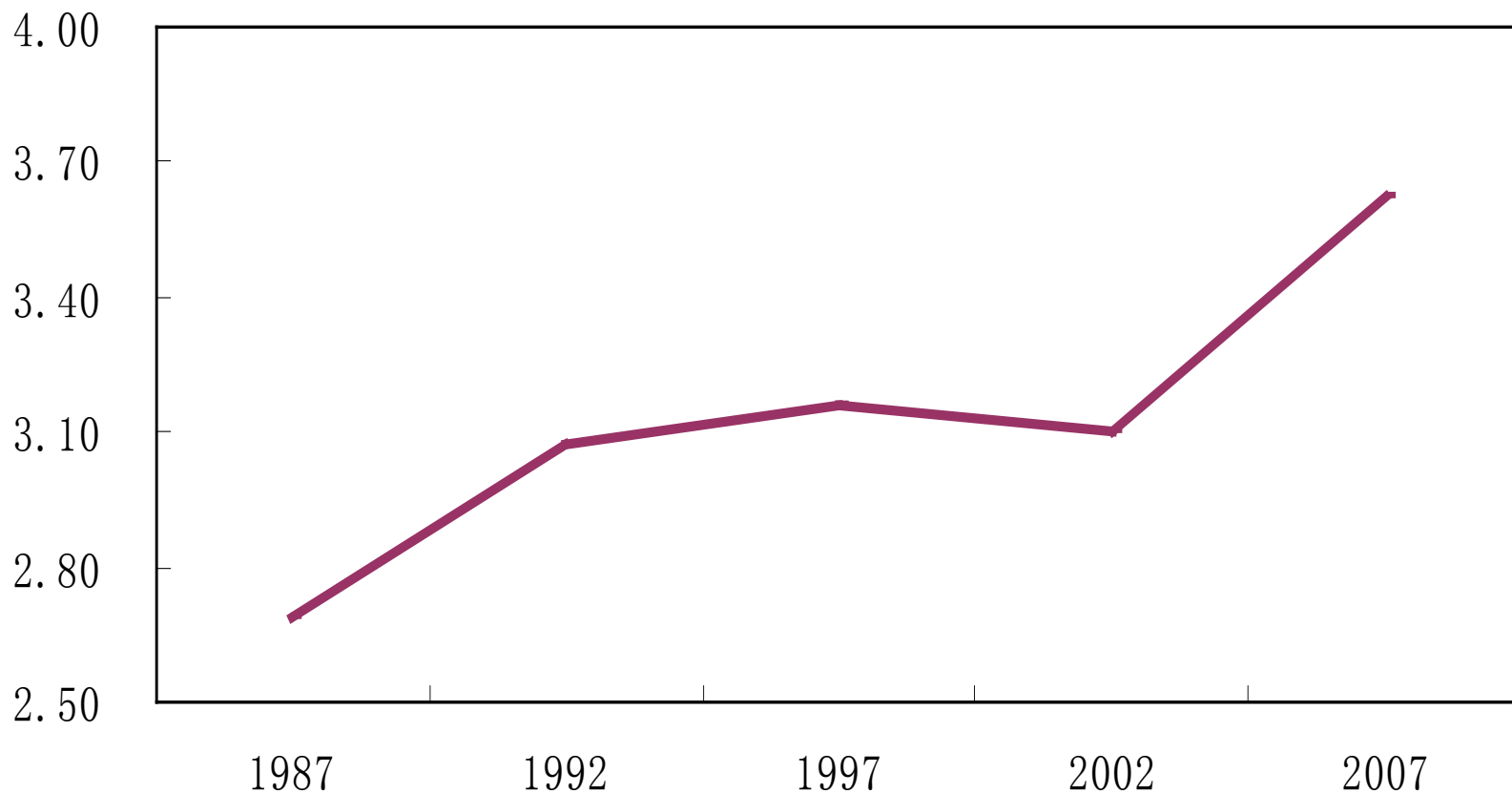


- The overall average of the APLs can be used as an index for measuring complexity of the production system. That complexity index ( $CI$ ) would be given by the following expression:

$$CI = \frac{1}{n^2} \sum_{i=1}^n \sum_{j=1}^n APL_{ij} = \frac{1}{n} \sum_{i=1}^n FA_i = \frac{1}{n} \sum_{j=1}^n BA_j$$



- Data of national analysis are based on national Input Output Tables of 1987, 1992, 1997, 2002, and 2007
- Data of regional analysis are based on Provincial Input Output Tables of 1987, 1992, 1997, 2002, and 2007



**Change of Complexity Index**

**Changes of CI in some OECD countries**

	Year	CI	Year	CI
Australia	1968	2.188	1998	1.919
Canada	1971	2.041	1998	2.037
Denmark	1972	1.705	1998	1.725
France	1972	1.959	1998	1.914
Germany	1978	2.046	2000	1.963
Japan	1970	2.272	2000	2.212
Sweden	1972	1.735	2000	1.728
UK	1968	2.014	2000	1.944
US	1972	2.187	2000	2.077

Source: J. Carlos Lopes, Joao Dias and J. Ferreira do Amaral.2008.Assessing Economic Complexity with Input-Output Based Measures. Department of Economics of Technical University of Lisbon Working Paper..



- China's CI increased during 1987-2007--CI was 2.69 in 1987, and was 3.63 in 2007, increased 34.9% in 20 years,
- Compare with results of some OECD countries(Joao Dias and J. Ferreira do Amaral ( 2008) )--CI decreased in some OECD countries from 1970's to 2000.

**Sectoral BA and FA (1987-2007) (1)**

	FA			BA		
	1987	2007	1987-2007	1987	2007	1987-2007
Agriculture	3.142	4.003	27.403	2.618	3.115	18.984
Coal, Crude Oil and Natural Gas	3.022	4.553	50.662	2.487	3.273	31.604
Other mining	2.841	4.557	60.401	2.321	3.192	37.527
Foods, Beverage & Tobacco	3.036	3.729	22.826	2.804	3.784	34.950
Textile	3.025	4.151	37.223	3.186	4.06	27.433
Apparel & Leather Products	2.250	3.175	41.111	3.054	4.062	33.006
Sawmills and furniture	2.309	3.413	47.813	2.564	3.516	37.129
Paper, printing and record medium reproduction	2.528	3.420	35.285	2.669	3.601	34.919
Coking, Gas and Processing of Petroleum	2.494	3.724	49.318	2.959	3.81	28.760
Chemical Industry	2.619	3.633	38.717	2.588	3.607	39.374
Nonmetal mineral products	2.323	3.438	47.998	2.471	3.412	38.082
Metals smelting and pressing	2.870	4.167	45.192	2.83	3.809	34.594
Metal products	2.218	3.181	43.417	2.711	3.280	20.989
Machinery and equipment	2.547	3.648	43.227	2.763	3.730	34.998
Transport equipment	2.637	3.691	39.970	2.916	3.837	31.584
Electric equipment and machinery	2.521	3.626	43.832	2.739	3.766	37.495
Electronic and telecommunication equipment	3.100	4.38	41.290	3.246	4.305	32.625



## Sectoral BA and FA (1987-2007) (2)

	FA			BA		
	1987	2007	1987-2007	1987	2007	1987-2007
Instruments, meters, office machinery	2.544	3.595	41.313	2.746	3.677	33.904
Other Manufacturing	2.218	3.195	44.049	2.559	3.27	27.784
Power, Heat Power and Water	2.526	3.873	53.325	2.69	3.727	38.550
Construction	3.095	3.368	8.821	2.756	3.452	25.254
Transport, Storage, Post and Telecommunication	2.200	3.103	41.045	2.655	3.764	41.770
Real estate and social services	2.352	3.153	34.056	2.345	3.587	52.964
Education, social welfare and health services	2.293	3.128	36.415	2.452	3.159	28.834
Commerce	2.255	3.098	37.384	2.283	3.319	45.379
Finance and insurance	2.549	3.255	27.697	2.623	3.717	41.708
Public administration and other sectors	2.095	2.35	12.172	2.57	3.188	24.047





Change of Provincial CI (1987—2007) (1)

	1987	1992	1997	2002	2007
Beijing	2.691	3.429	3.325	3.470	4.027
Tianjin	3.074	2.843	3.636	3.763	3.369
Hebei	2.028	3.345	3.092	3.004	3.375
Shanxi	2.690	3.209	3.249	2.947	2.876
Neimeng	2.475	2.694	3.105	3.164	2.849
Liaoning	2.538	2.994	3.704	3.146	3.320
Jilin	2.453	2.964	3.242	3.023	3.244
Heilongjiang	2.595	2.854	2.790	2.896	2.896
Shanghai	3.236	3.896	3.236	3.441	3.520
Jiangsu	3.111	3.377	3.726	3.719	3.525
Zhejiang	--	3.233	3.822	3.537	3.865
Anhui	--	2.904	2.925	3.414	3.061
Fujian	2.760	3.936	3.212	3.228	3.384
Jiangxi	2.602	3.132	2.860	3.123	3.303
Shandong	2.529	3.341	3.409	3.422	3.867
Henan	2.678	3.035	3.153	2.930	3.189
Hubei		3.045	3.450	2.947	2.893



## Change of Provincial CI (1987—2007) (2)

	1987	1992	1997	2002	2007
Hunan	2.557	3.636	3.484	3.045	2.979
Guangdong	2.825	3.640	3.462	4.210	3.825
Guangxi	2.458	2.982	3.225	2.749	2.864
Hainan	--	3.571	3.052	3.187	3.392
Chongqing	--	--	3.169	3.424	3.245
Sichuan	2.226	2.881	2.870	2.816	2.992
Guizhou	2.396	3.113	2.829	2.785	2.996
Yunnan	2.676	2.737	2.959	3.188	3.113
Xizang	--	--	--	--	--
Shaanxi	2.481	2.776	2.895	3.047	2.944
Gansu	2.759	2.969	2.644	3.051	2.944
Qinghai		2.642	2.730	2.793	2.817
Ningxia	2.591	2.980	2.780	3.106	3.054
Xinjiang	2.413	2.725	3.191	2.792	2.956



# Main Findings

- Compared with the decrease of complexity in OECD countries, China's complexity increase in last two decades, due to opening-up, industry transfer from developed countries etc.
- The forward effect on other sectors of energy and other mining sectors increases significantly, with increase of their FA; The backward effect on other sectors of commerce, real estate and social service also rises quickly, with increase of their BA.



# Main Findings

- After opening-up, the unbalanced development strategy changes the spatial distribution of China's economy and more and more economic activity concentrated to coastal area. This results in that the complexities in coastal provinces (Guangdong, Zhejiang and Jiangsu etc.) increase very quickly and are higher than that in inland provinces (Jiangxi, Hunan, Shaanxi and Xinjiang etc.) .



**Thank you very much!**  
**Comments are welcome!**