Comparative Study of Container Port Evolution in Japan, China and Korea:
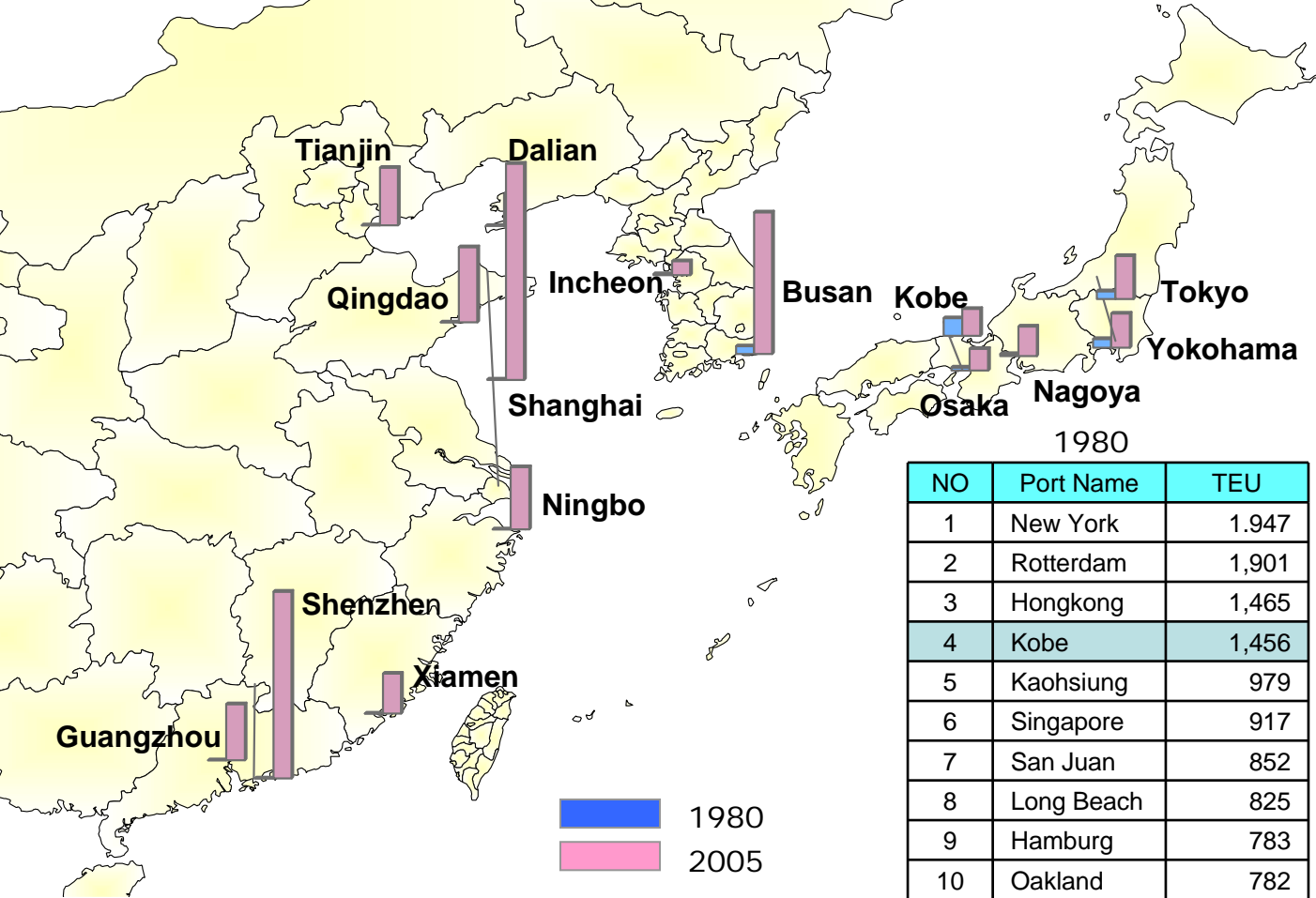
Considering Geographical Location and Market Concentration of Port System

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Le Yiping

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Container Throughput of Major ports in Japan, China and Korea

Map labels: Tianjin, Dalian, Qingdao, Incheon, Busan, Kobe, Tokyo, Yokohama, Shanghai, Nagoya, Osaka, Ningbo, Shenzhen, Xiamen, Guangzhou

Legend:
- 1980
- 2005

1980

NO	Port Name	TEU
1	New York	1.947
2	Rotterdam	1,901
3	Hongkong	1,465
4	Kobe	1,456
5	Kaohsiung	979
6	Singapore	917
7	San Juan	852
8	Long Beach	825
9	Hamburg	783
10	Oakland	782
13	Yokohama	722
16	Busan	634
18	Tokyo	632
39	Osaka	254
46	Nagoya	206

World Ranking 2005
(Unit: 1000TEU)

| NO	Port Name	TEU
1	Singapore	23,192
2	Hongkong	22,427
3	Shanghai	18,084
4	Shenzhen	16,197
5	Busan	11,843
6	Kaohsiung	9,471
7	Rotterdam	9,300
8	Hamburg	8,087
9	Dubai	7,619
10	Los Angeles	7,484
13	Qingdao	6,307
15	Ningbo	5,208
16	Tianjin	4,801
18	Guangzhou	4,685
22	Tokyo	3,593
23	Xiamen	3,342
27	Yokohama	2,873
32	Dalian	2,655
34	Nagoya	2,491
39	Kobe	2,262
51	Osaka	1,802

Source: Containerisation International Yearbook
1982 and 2007

* Hongkong and Taiwan's ports are not included in this research

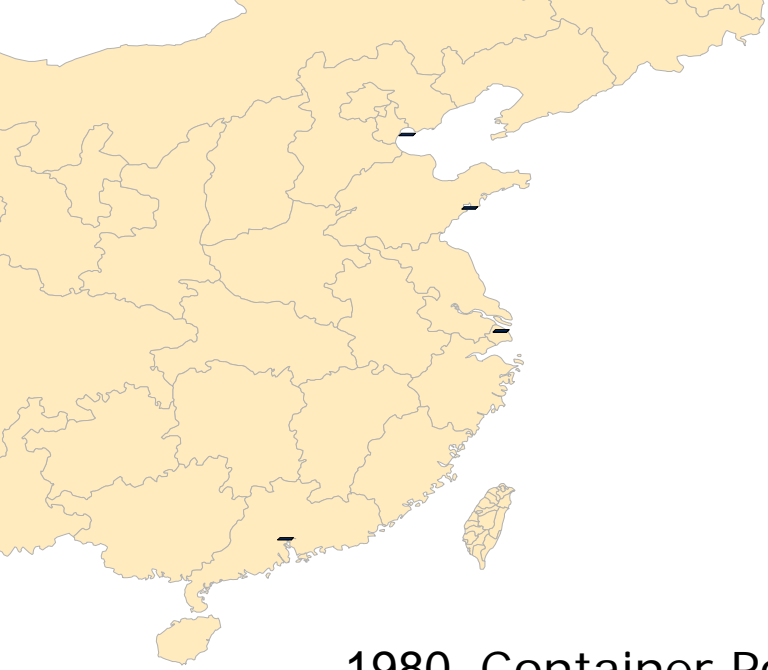# Introduction
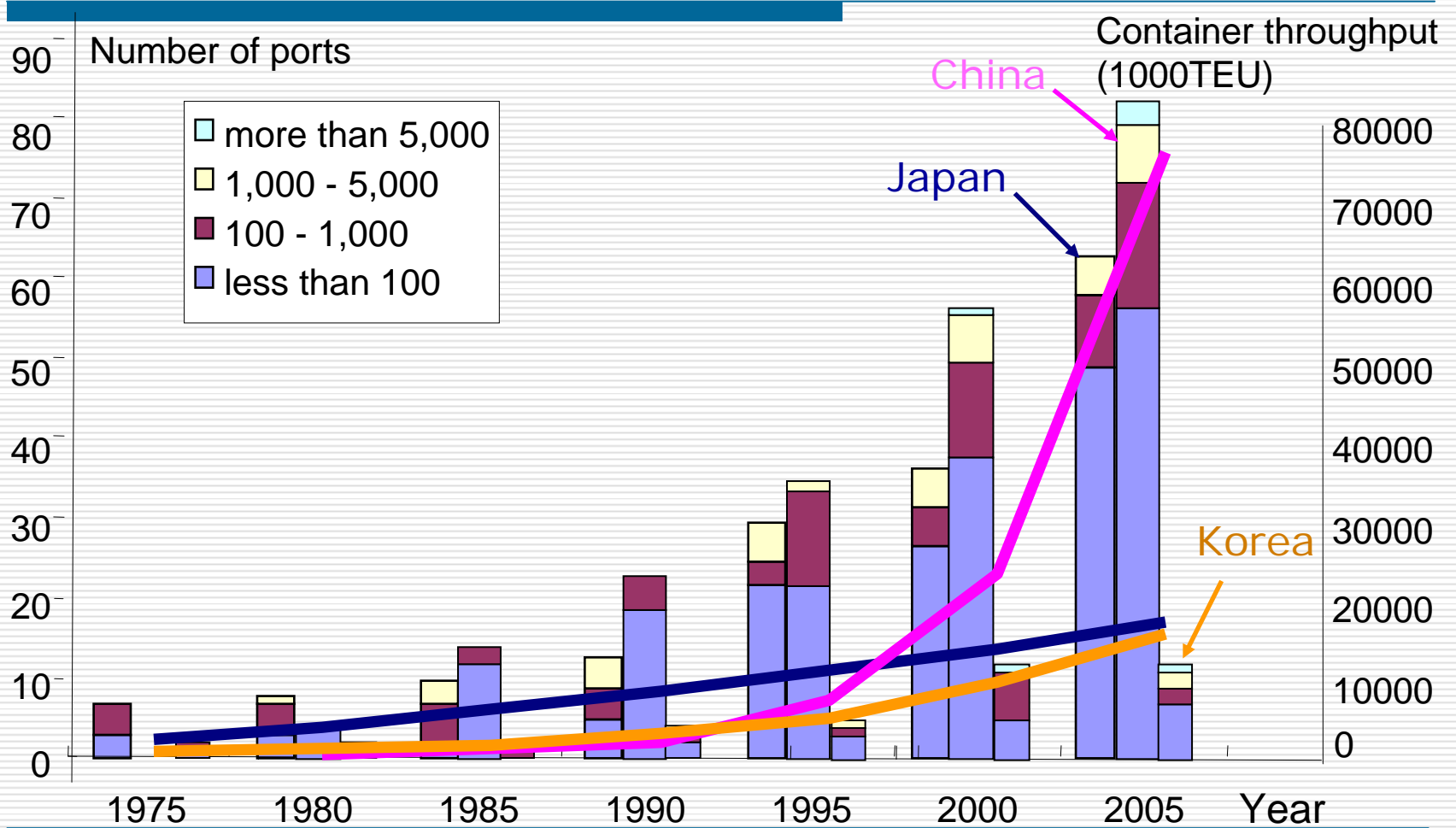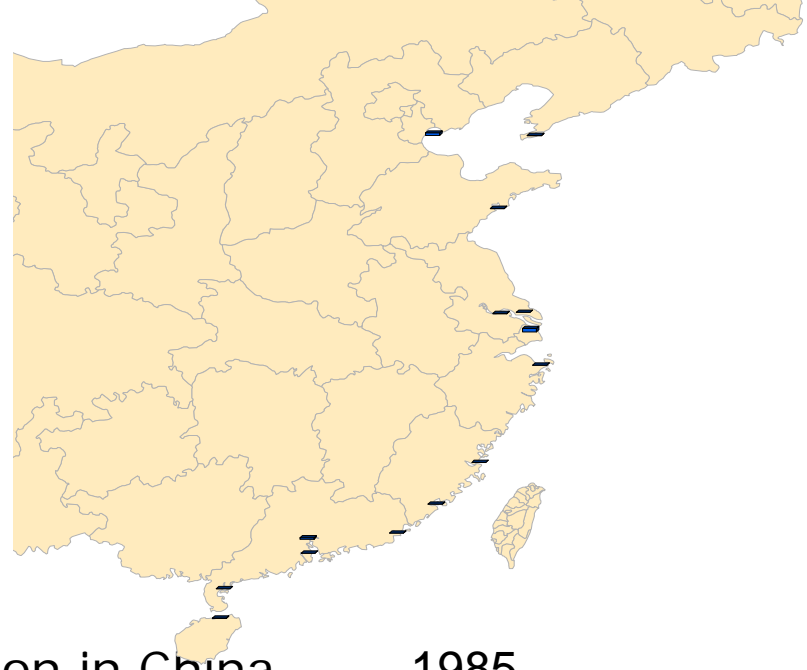
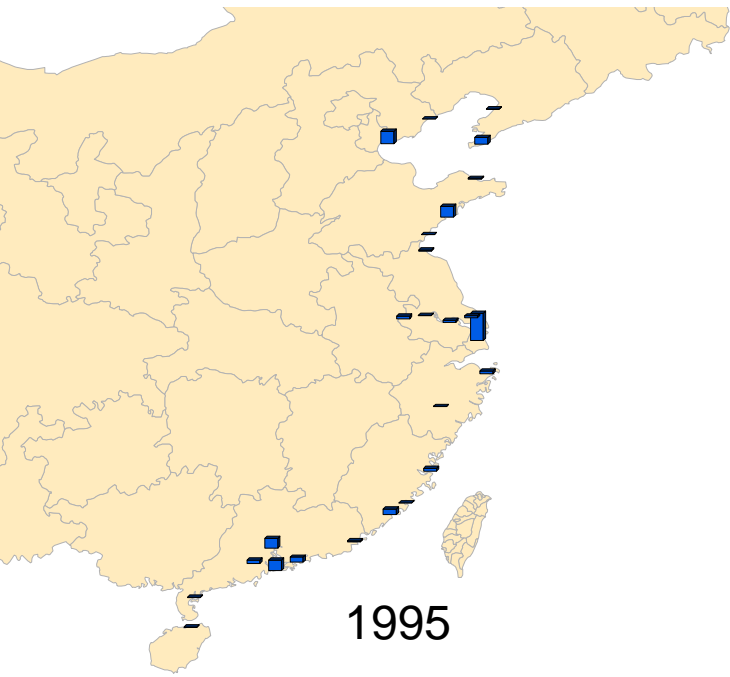# Container Port Evolution in Japan
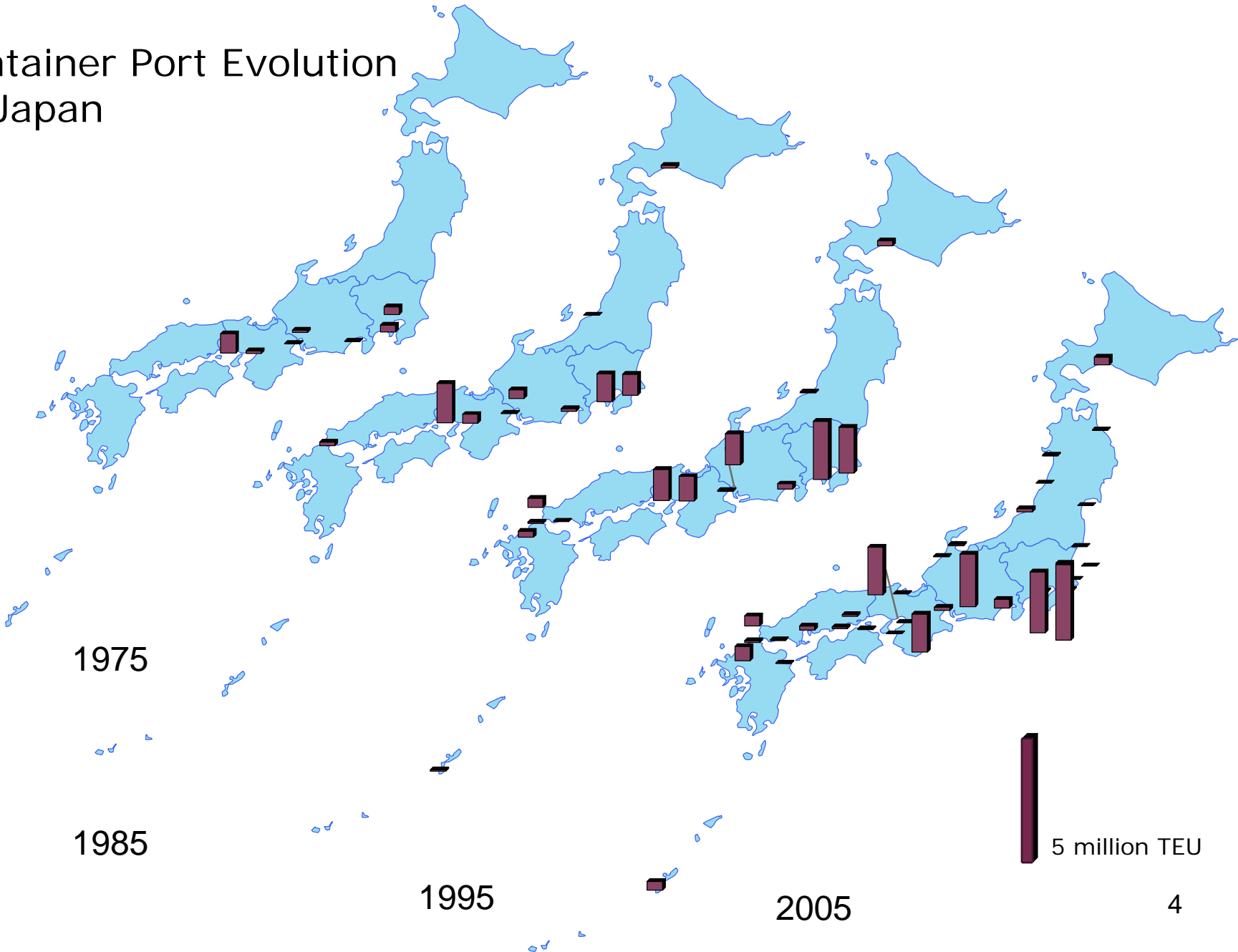
1975

1985

1995

2005

5 million TEU
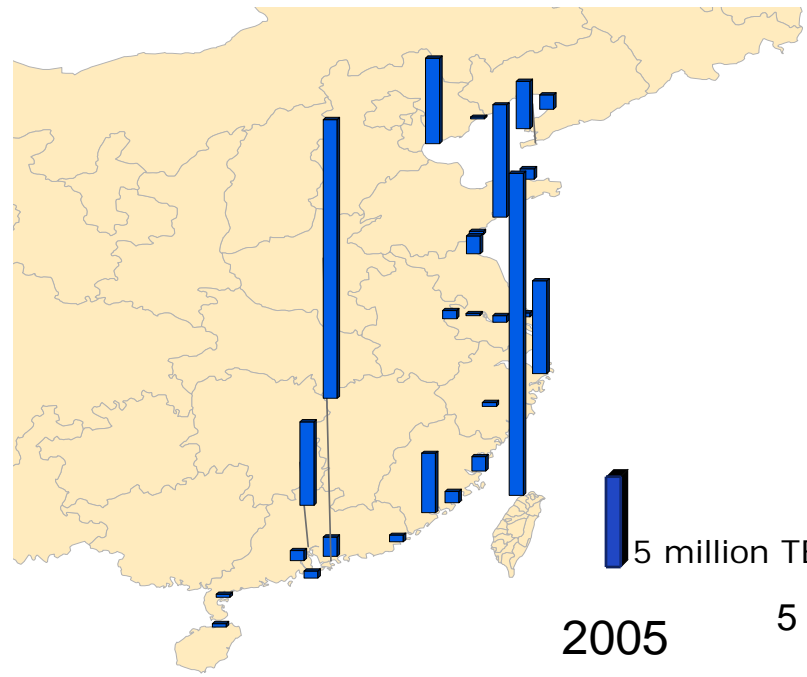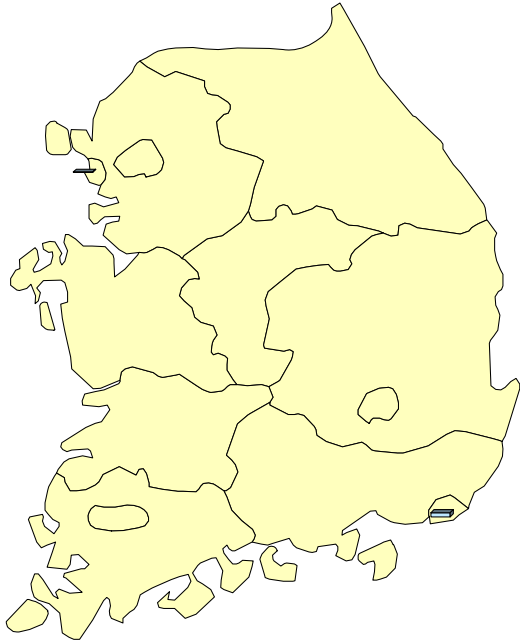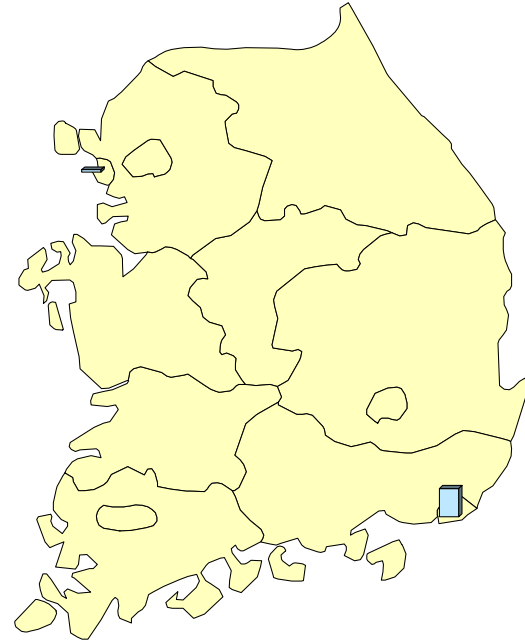
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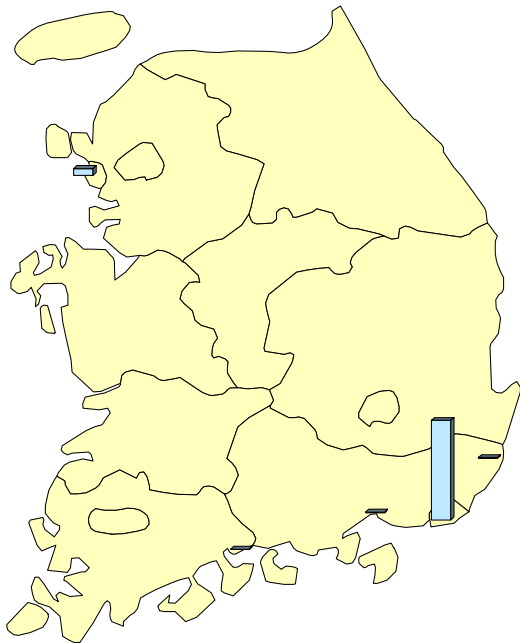1980 Container Port Evolution in China 1985

1995

2005 5

5 million TEU

1975

1985

1995   Container Port Evolution in Korea   2005

5 million TEU
6
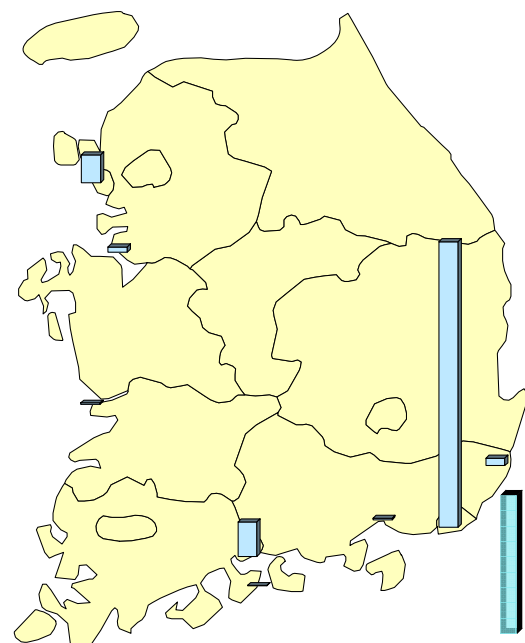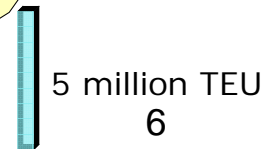
Mission

How to describe the port evolution process?

What are the evolution features of these three countries and how different?

Why they have such differences?

Port System Evolution

☐ How to interpreter port evolution ?

■ Concentration trend

☐ Big ports become bigger, while medium and sized ports have moderate growth

■ De-concentration trend

☐ The development of big with the emerge of new development of medium ports

- Economical of scale
- Carrier driven port development
  - o Growing vessel size.
  - o Strategic alliance of carries
- International competitiveness

- Shipper
  Direct calls, frequent services, land transportation cost;
- Constrains for further dev.
- Regionalization of trade
- Local ports
  Ambitions to become hub ports
  Vitalize local economy

Concentration Index

☐ Case I: Only market share of each port is considered

☐ Existing index

  ■ CR4-index

    ☐ The sum of the market share of the four largest ports

  ■ Herfindahl-Hirschman index (HHI)

$$HHI = \sum_{i=1}^{n} S_i^2$$

S_i indicates the market share of each port

CR analysis
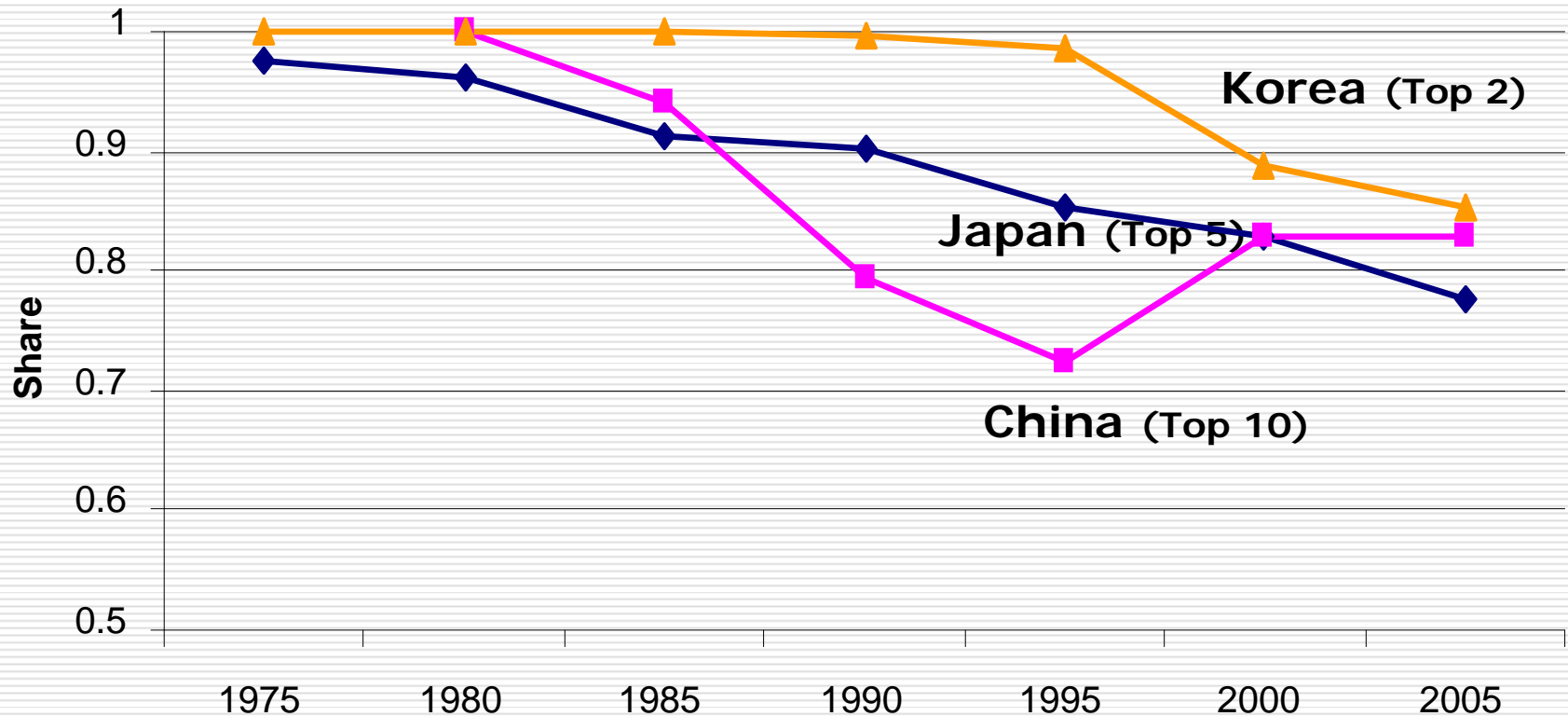
CR analysis of Japan, China and Korea

Japan: Tokyo, Yokohama, Kobe, Osaka, Nagoya
China: Shanghai, Shenzhen, Qingdao, Ningbo, Tianjin, Guangzhou, Xiamen, Dalian, Zhongshan, Fuzhou
Korea: Busan, Incheon

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Herfindahl-Hirschman index (HHI)
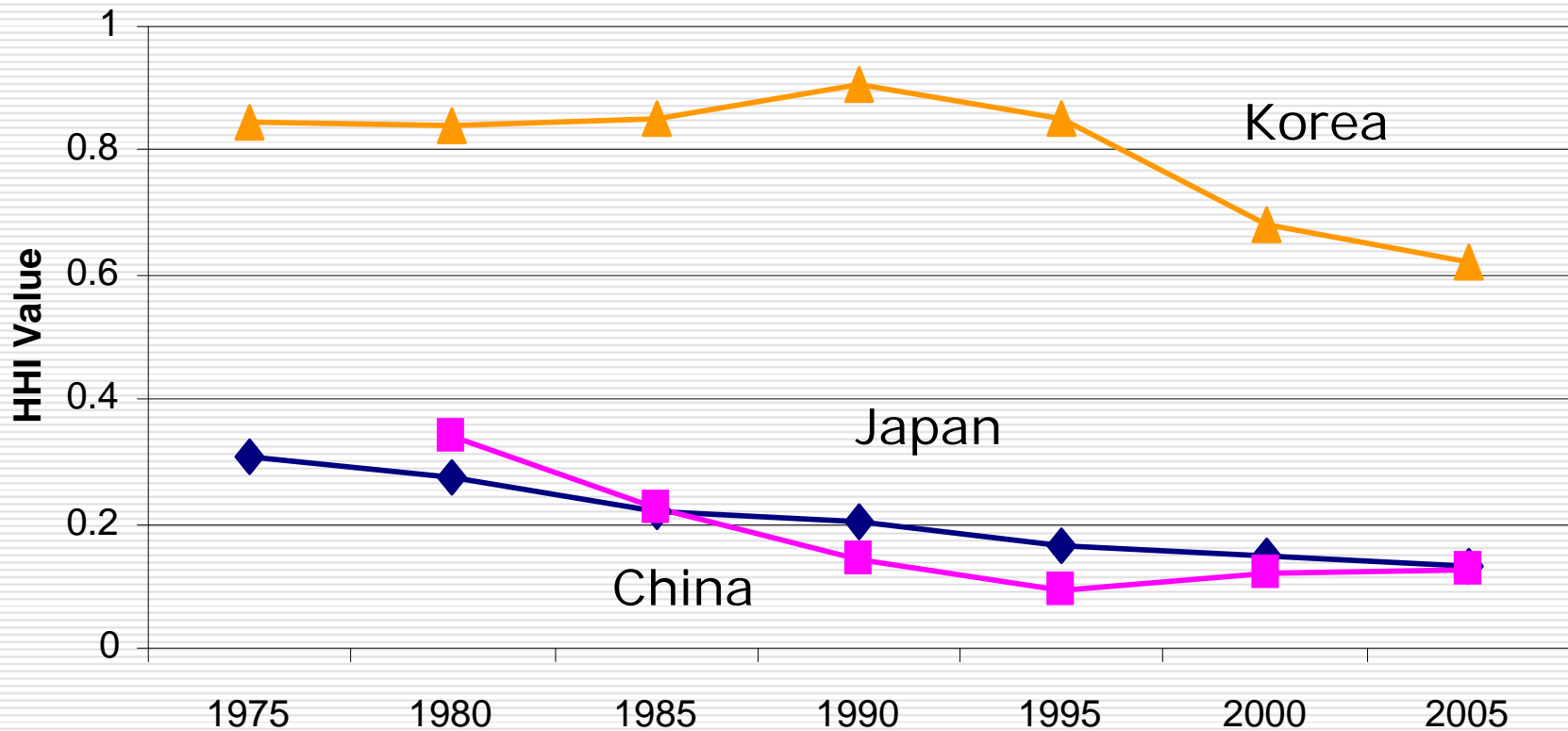
Comparison of HHI value of Japan, China and Korea

HHI value of China by Region
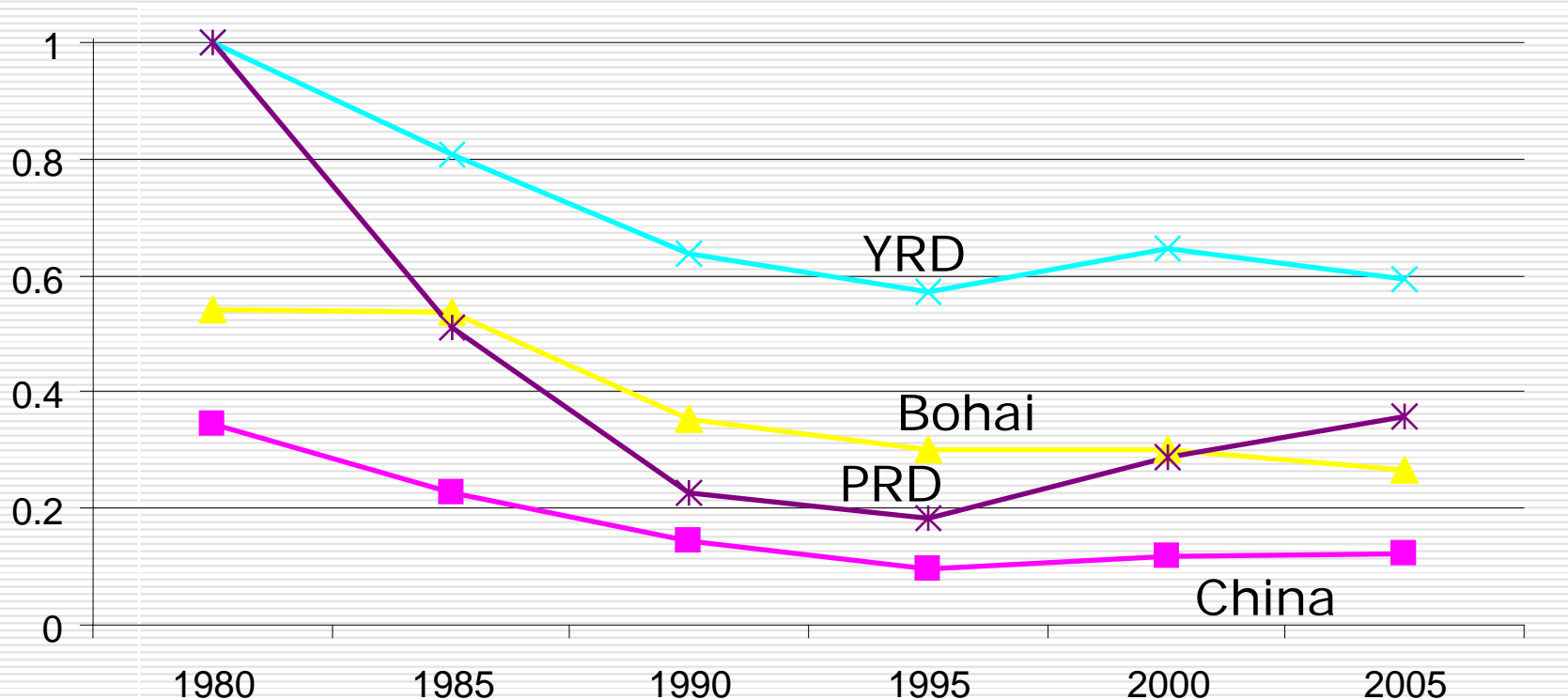
Comparison of HHI value of China by region

Dynamic positioning of individual ports
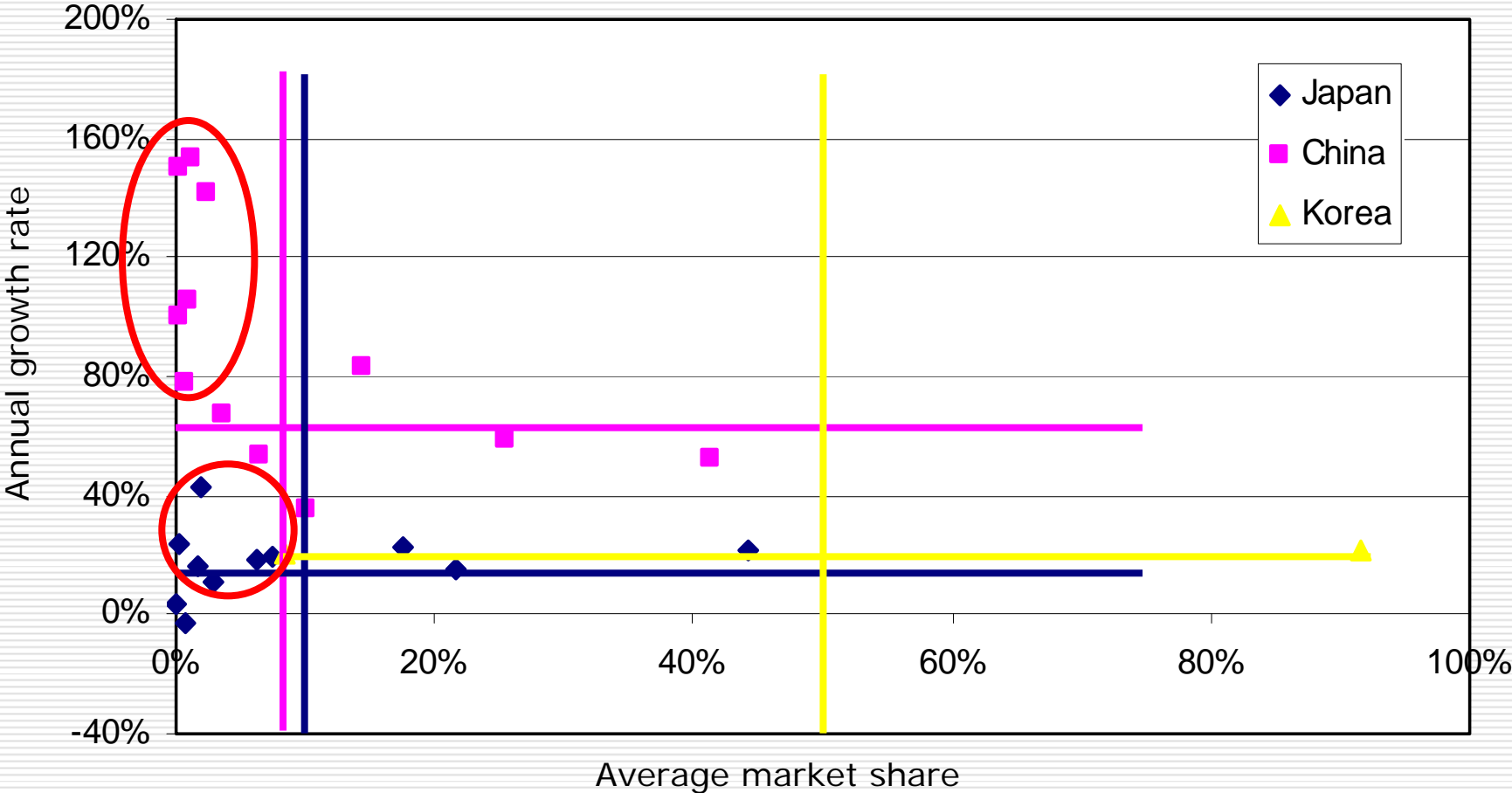
Dynamic positioning of ports from 1975 to 1985

Dynamic positioning of individual ports
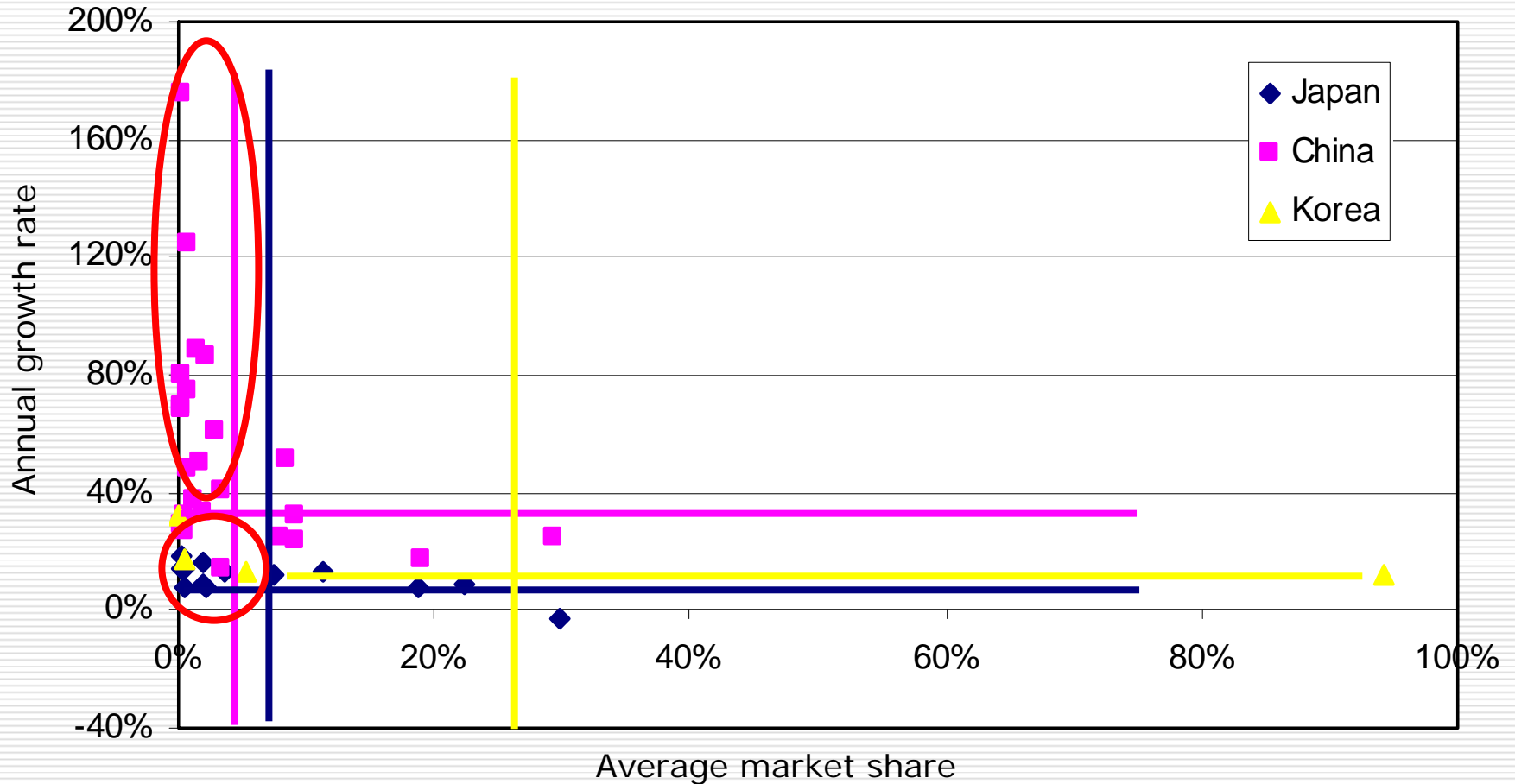
Dynamic positioning of ports from 1985 to 1995

Dynamic positioning of individual ports
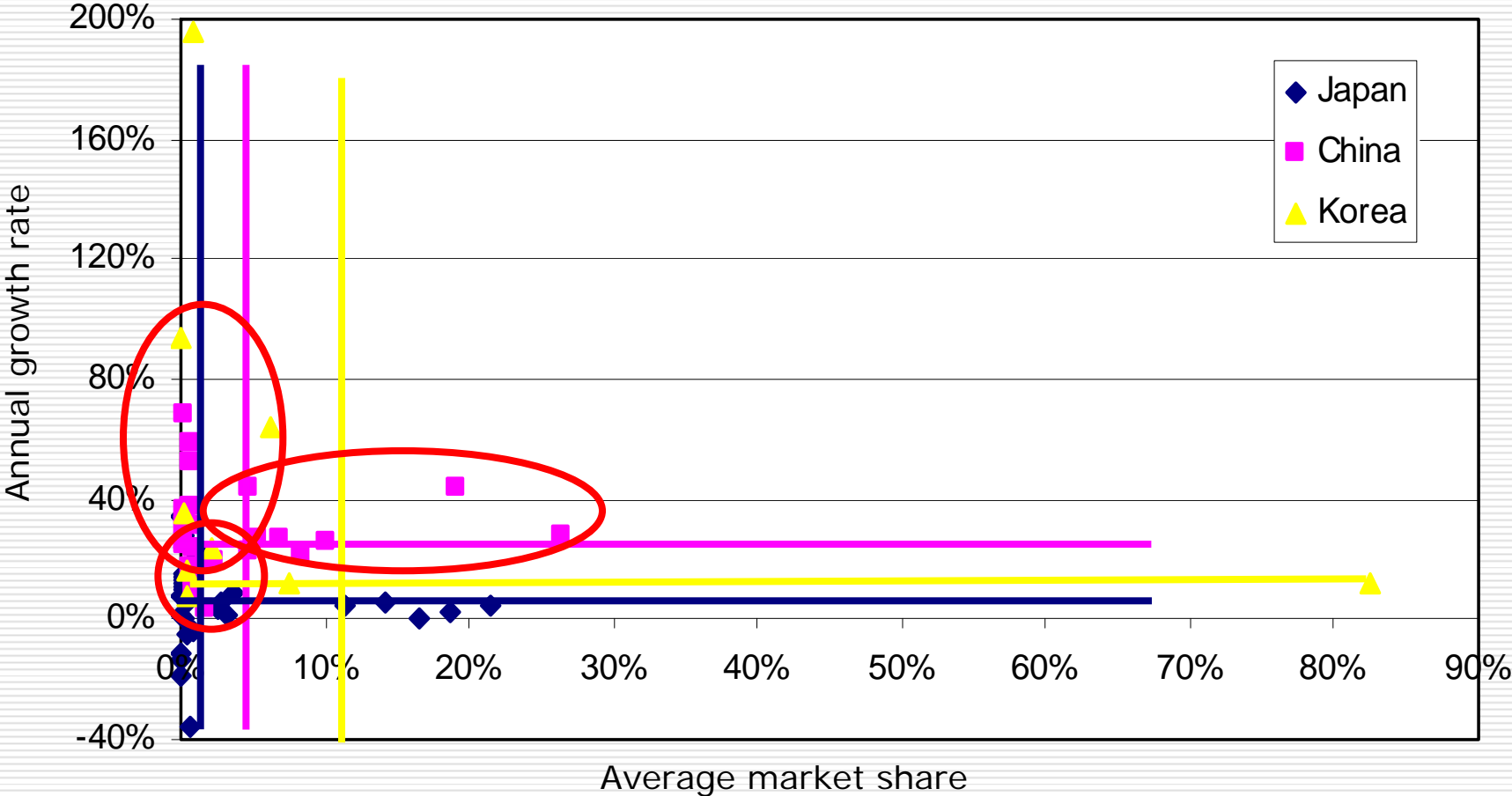
Dynamic positioning of ports from 1995 to 2005

Average annual growth rate by port size

Country	Port size*	Average annual growth rate		
		1975-1985	1985-1995	1995-2005
Japan	Large	22%	8%	4%
	Medium	19%	17%	5%
	Small	1%	24%	8%
China	Large	56%	20%	39%
	Medium	31%	33%	22%
	Small	/	41%	31%
Korea	Large	21%	13%	11%
	Medium	21%	11%	33%
	Small	/	/	23%

*The size of the port is classified by the market share of the port.
 Ports with market size larger than 10% are classified into large size; between 1% to 10% are classified into medium size; less than 1% are classified into small size.

Summary (1)
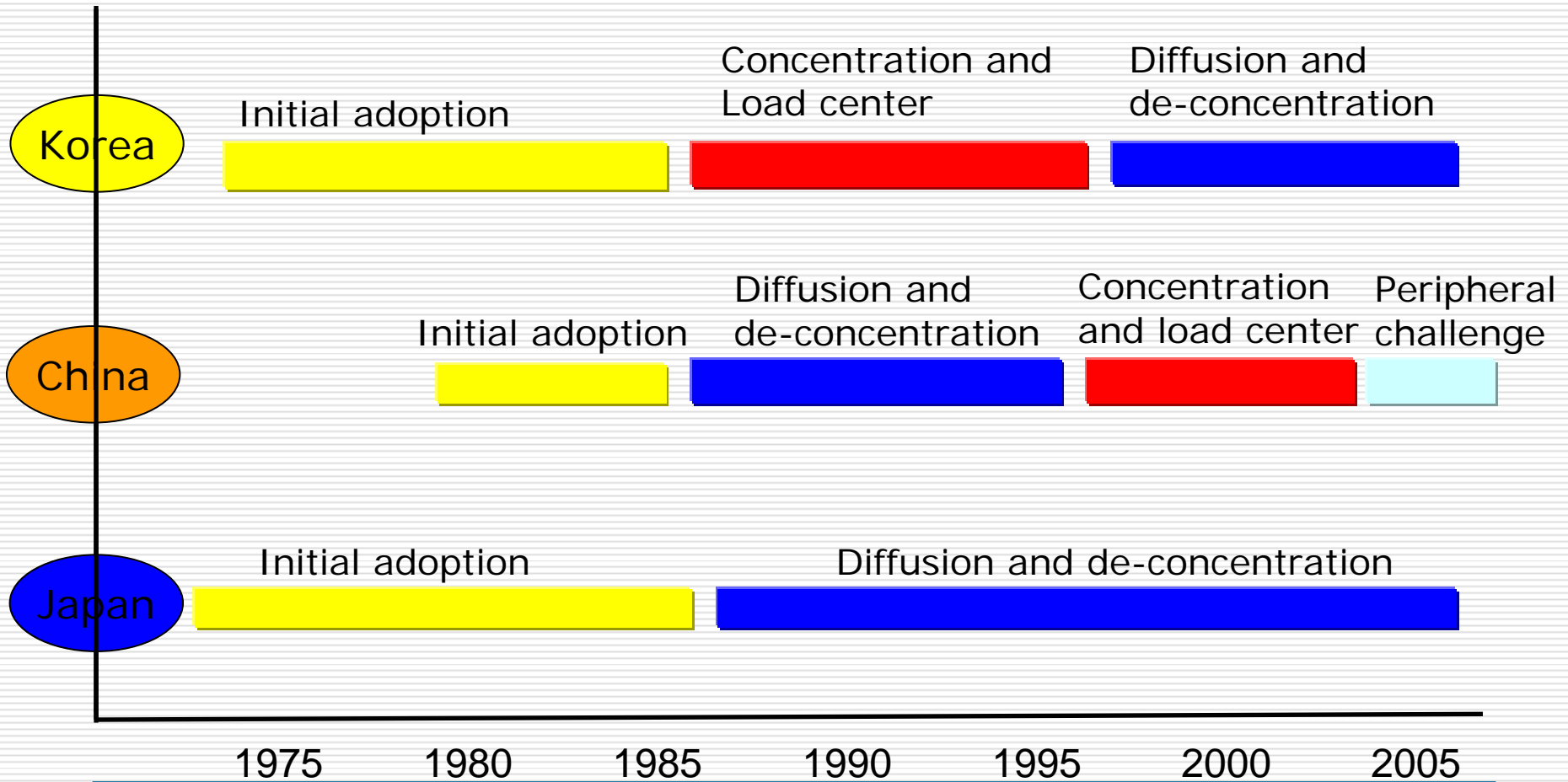
*According to Hayut's Five-phrase Theory proposed in "Containerization and the load center concept", 1982. Conventional port system, initial adoption system, diffusion and concentration system, load center system, peripheral challenge system.

Comparison of concentration

☐ How to compare the concentration rate of different countries?

☐ Case II: Both market share and geography location are considered

- ■ Hypothesis 1: Ports are all competed with each other, the closer location, the lower concentration rate

- ■ Hypothesis 2: Ports are all cooperate with each other, the closer location, the higher concentration rate

Definition of Concentration

Concentration

De-concentration

Concentration

De-concentration

Concentration

Small overlapping market

Large overlapping market

Competitive ports
Hypothesis 1

Complementary ports
Hypothesis 2
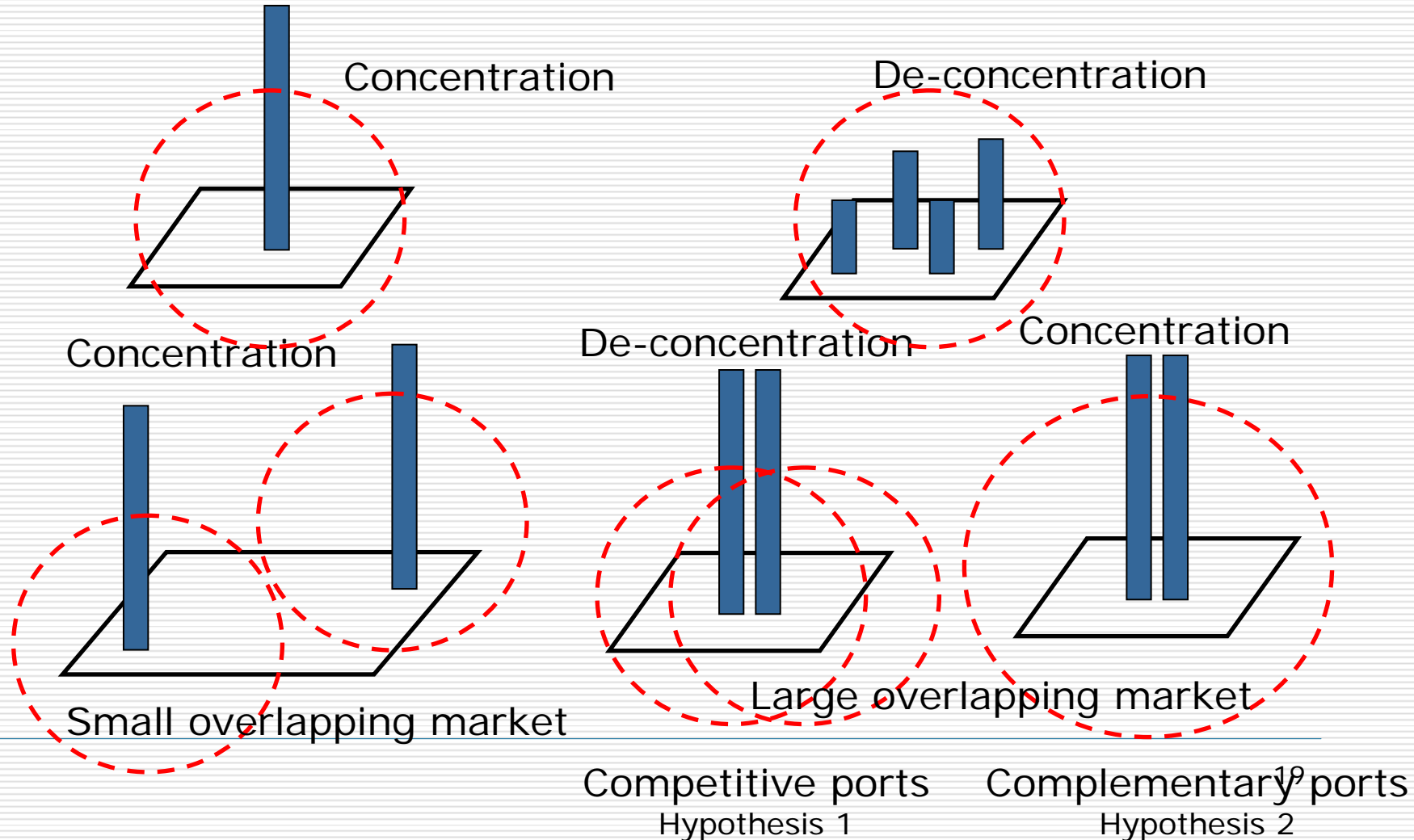
Structure

☐ Elements for evaluating port concentration

Conceptual Model

Overlapping market — High / Low

Share disparity — Low / High

COI

CMI

Conceptual Model of Concentration Measuring

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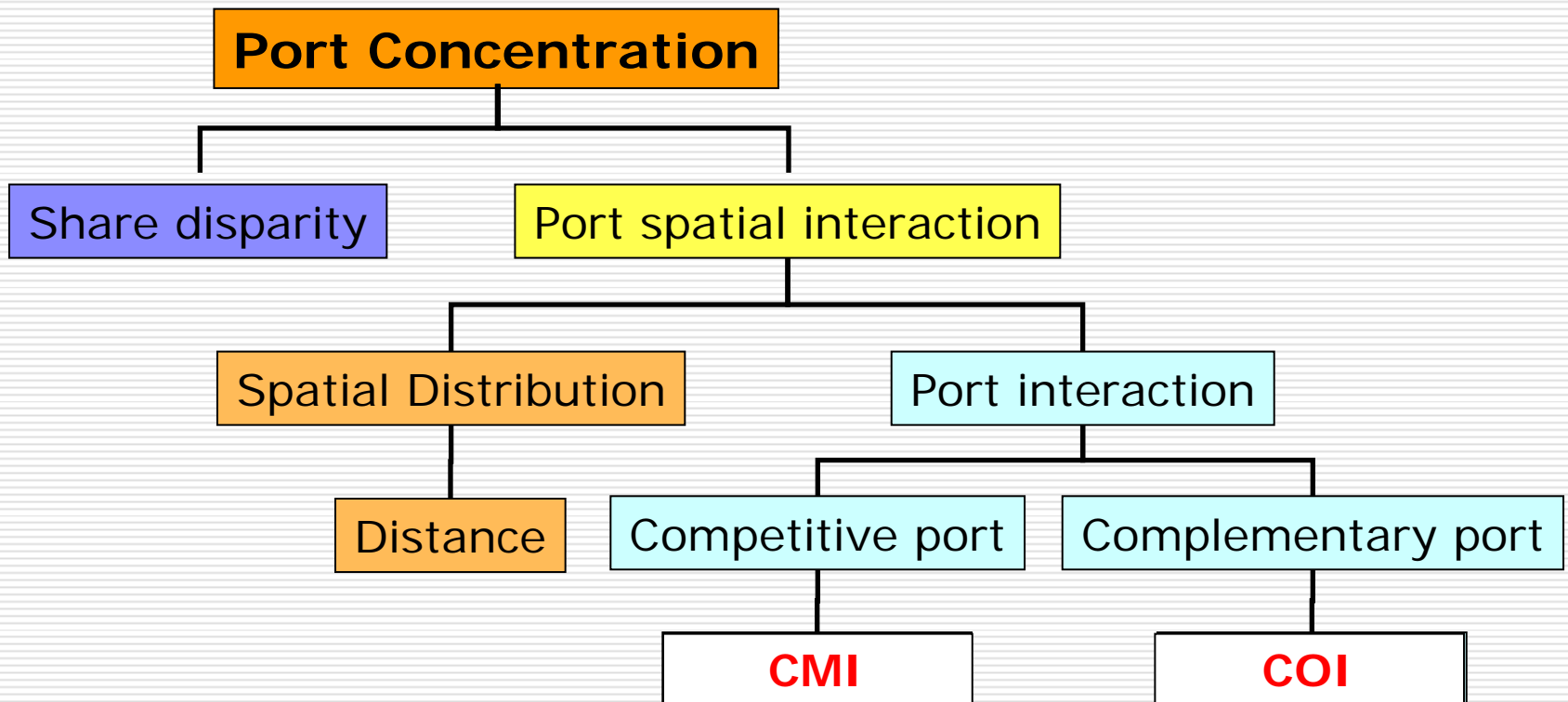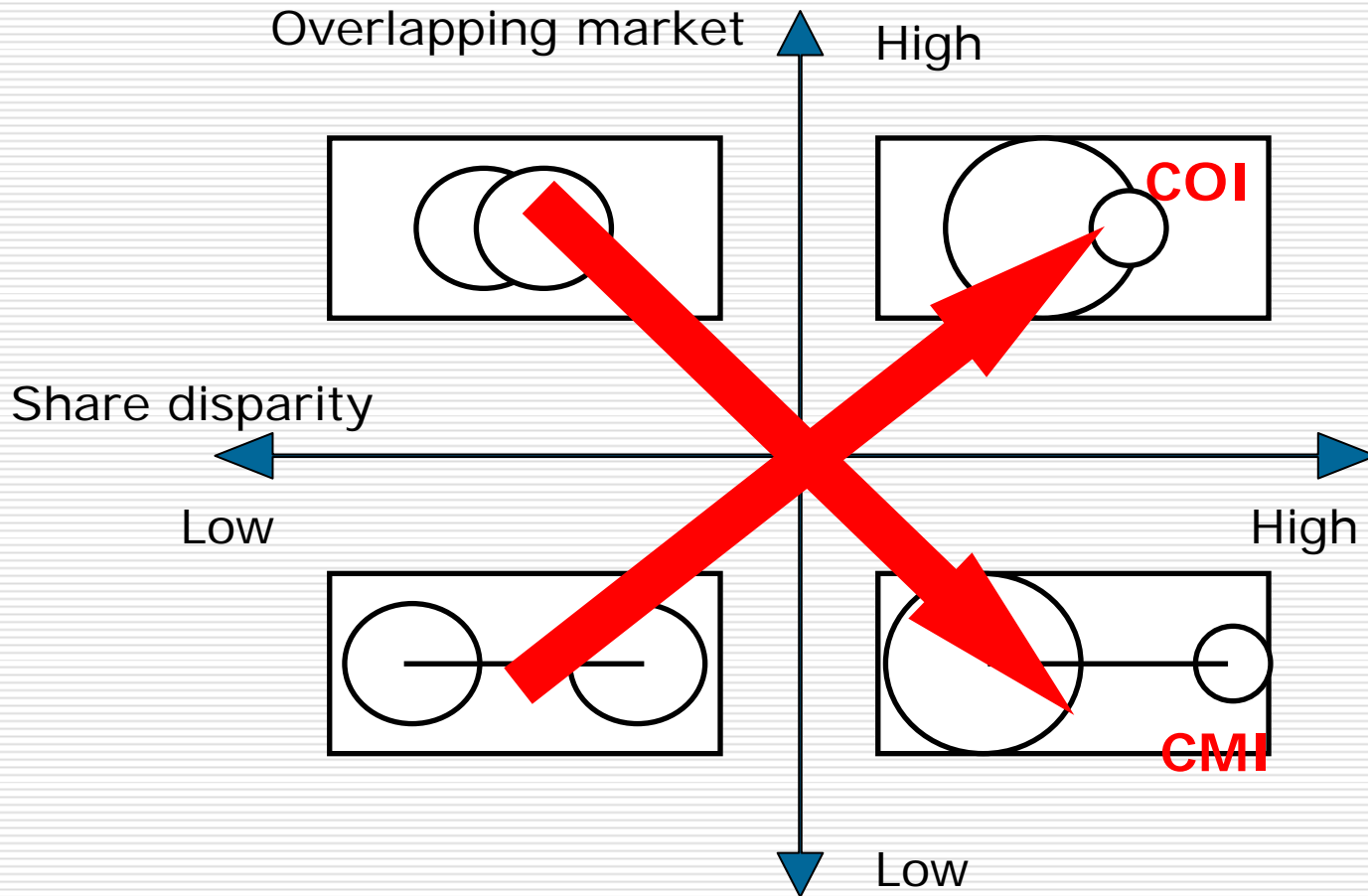
Formulation

Distance decay function

$$\alpha = e^{-kr_{ij}} \quad \text{and} \quad K = aC + bT$$

Port Spatial Interaction $= S_i S_j \alpha$

Cooperative Concentration Index

$$\text{COI} = \sum S_i^2 + \sum \sum S_i S_j \alpha (i, j = 1, \cdots n, \forall i \neq j)$$

Competitive Concentration Index

$$\text{CMI} = \sum S_i^2 + \sum \sum S_i S_j (1 - \alpha)(i = 1, \cdots, n, \forall i \neq j)$$

Parameter Determination

Accumulated Cargo Distribution Probability by distance (2003)
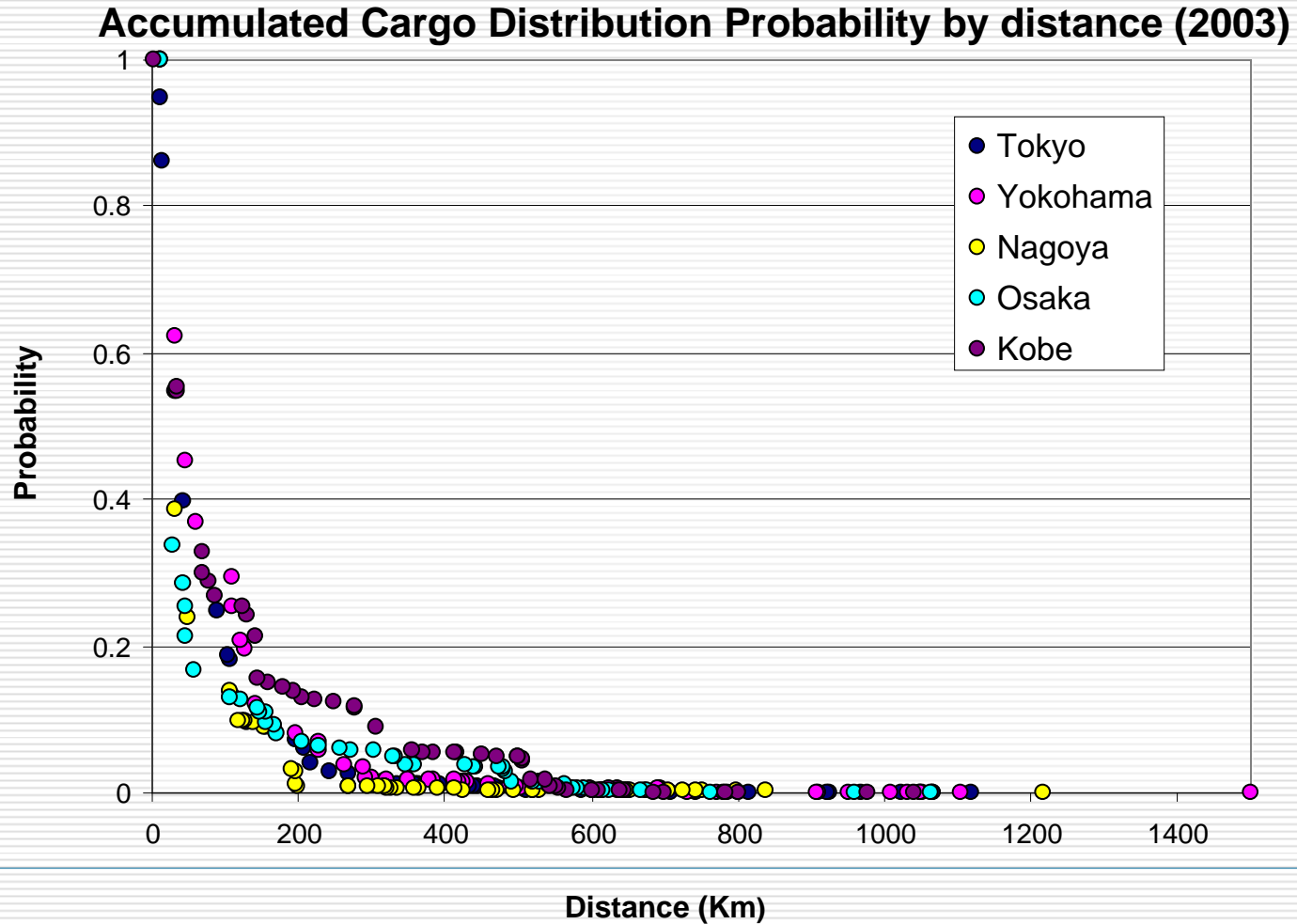
Parameter Determination

Accumulated Log-probability of Cargo Distribution by Distance (2003)
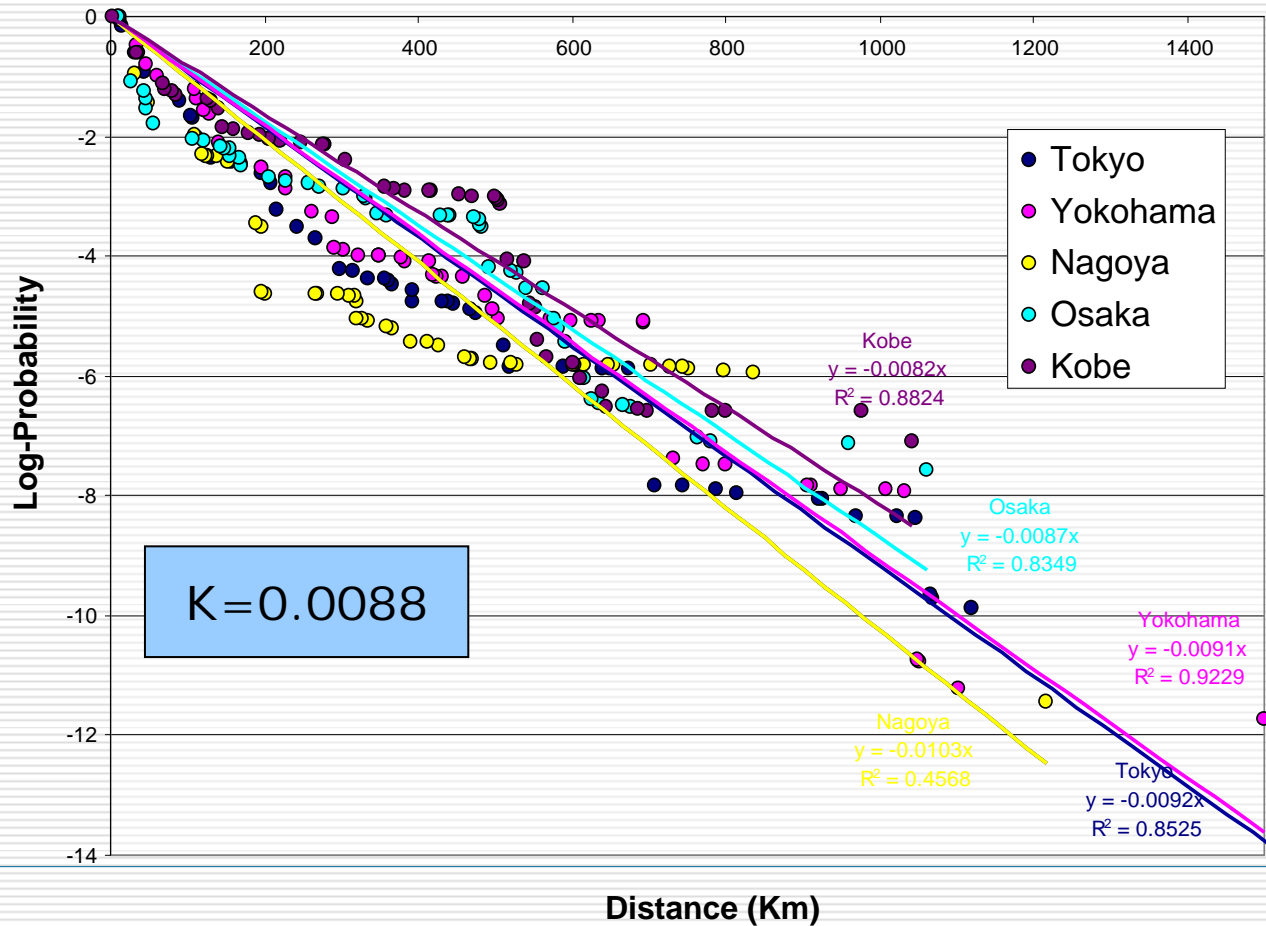
Competitive Concentration Index
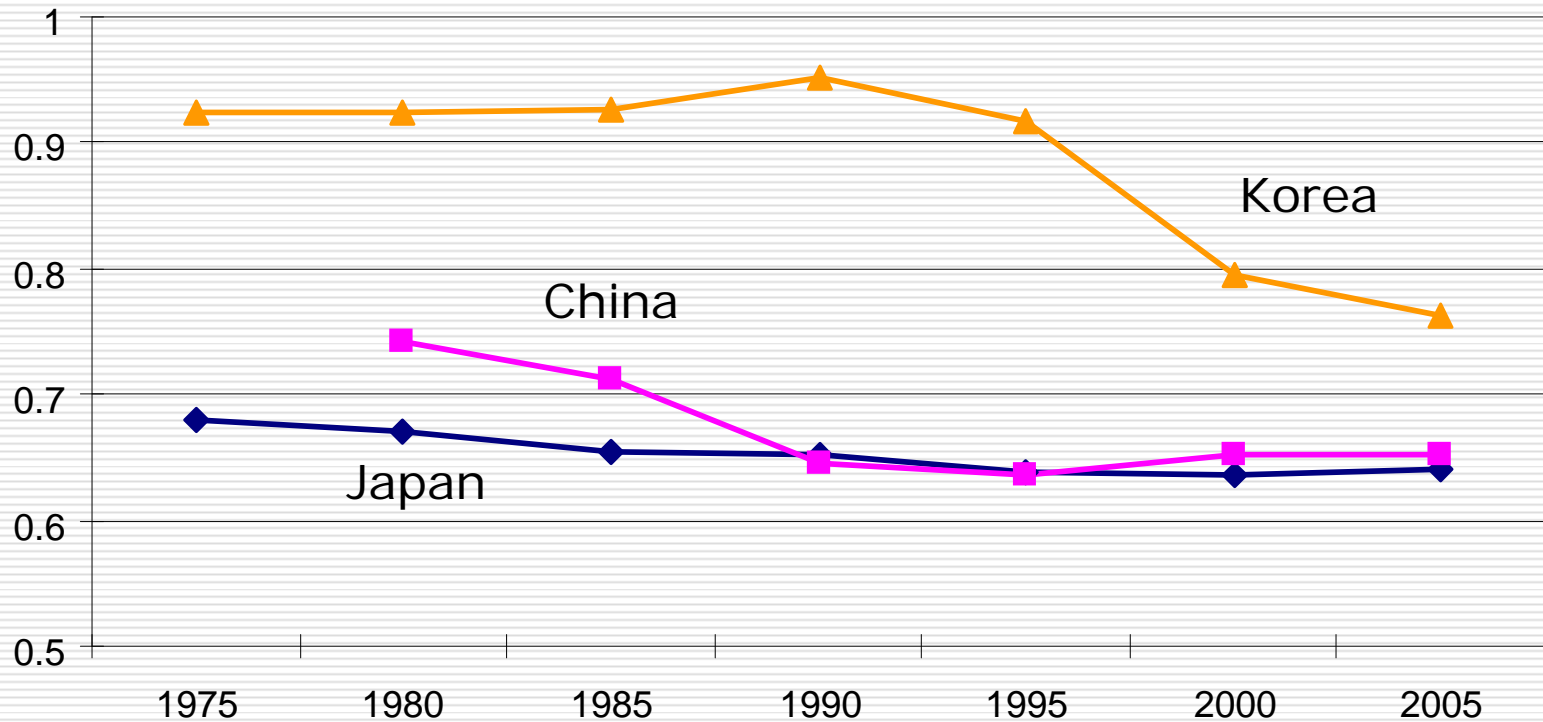
CMI comparison of Japan, China and Korea

Cooperative Concentration Index
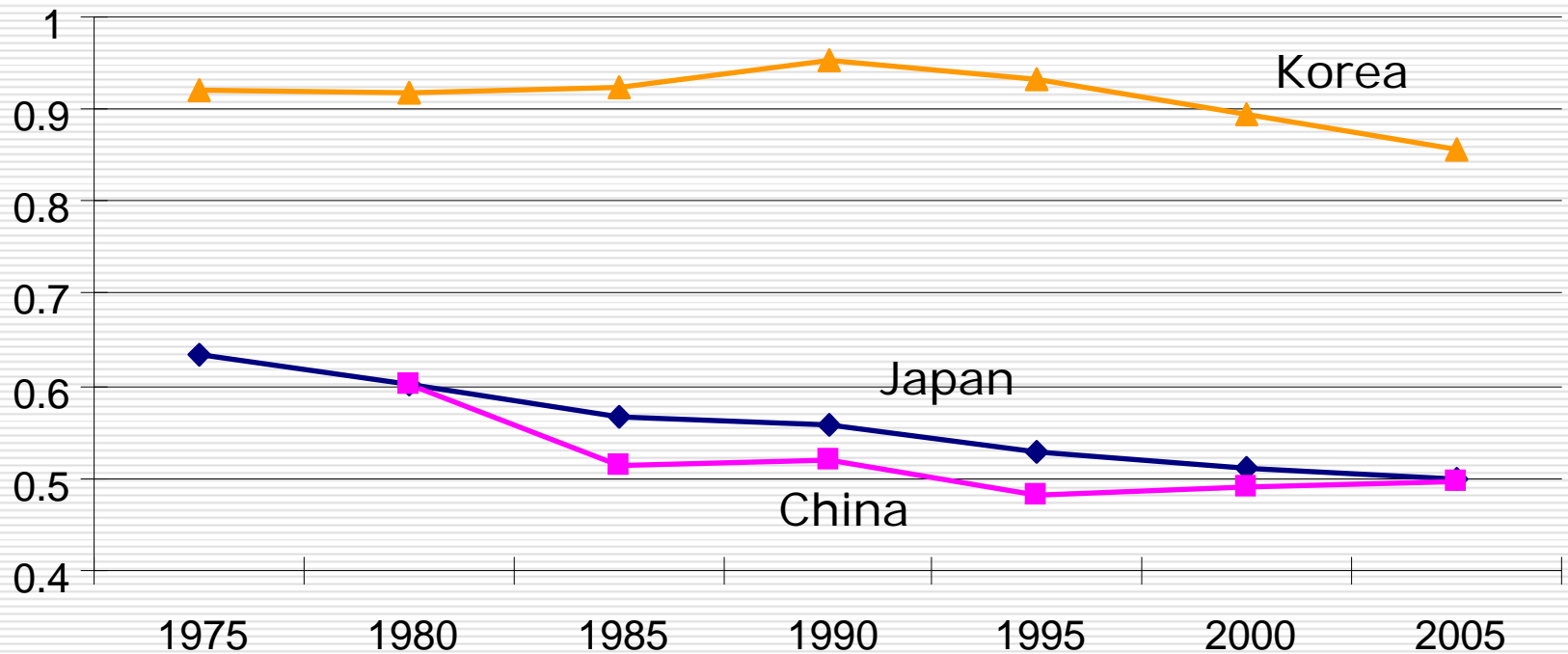
COI comparison of Japan, China and Korea

Summary (2)

- ☐ Korea's container port system is more concentrated than that of Japan and China
- ☐ Japan and China have similar concentrate rate at present though their evolution process are quite different
- ☐ There is no obvious concentration trend observed in Japan's port system evolution
- ☐ Japan has higher potential concentration rate if strategic cooperation can be reached in neighboring ports.

Port Dev. Strategy
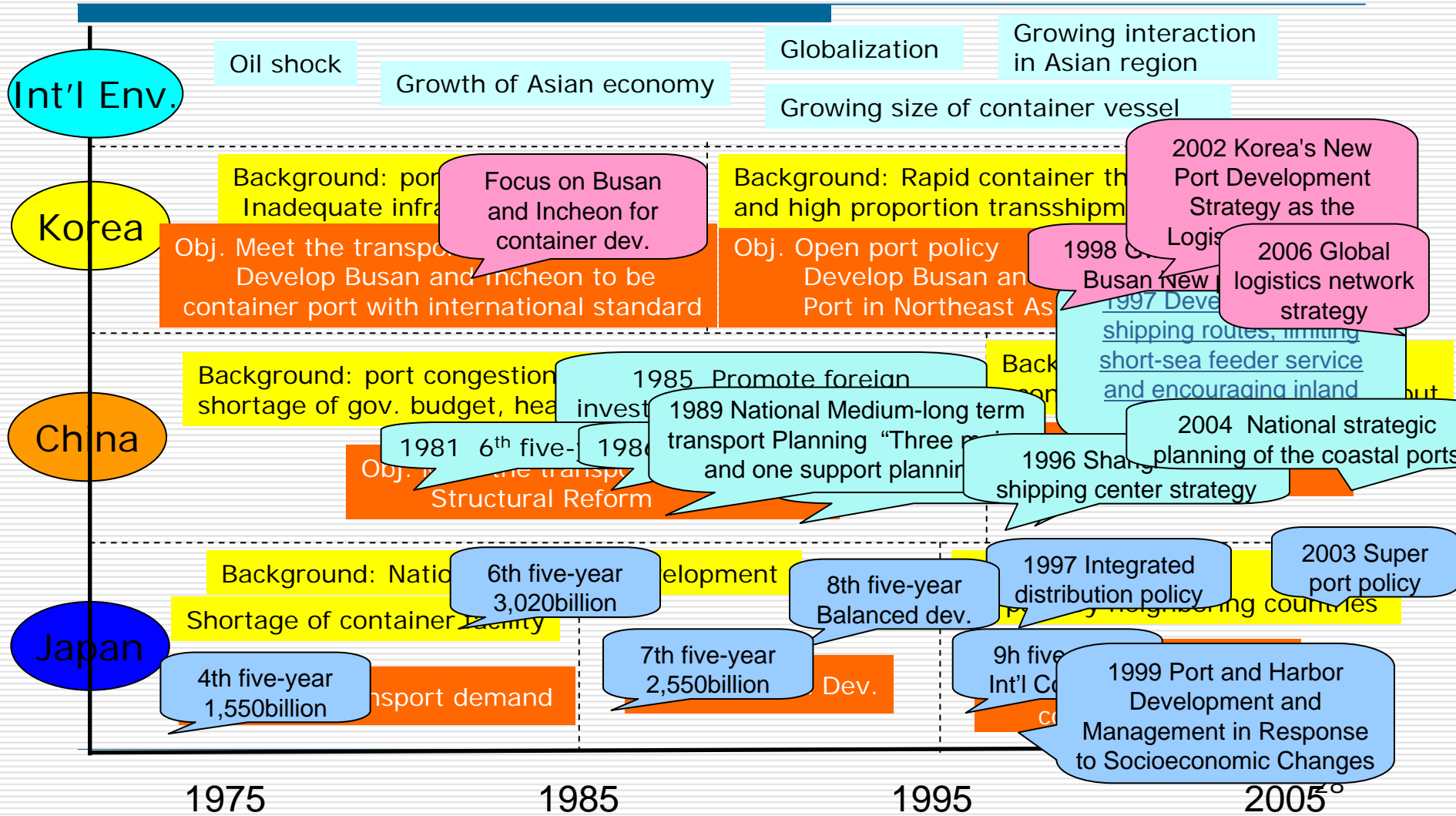
China's strategy

- ☐ Limitation on short-sea shipping routes policy (1997)
  - ■ Purpose: To develop the direct ocean shipping
  - ■ Background

    Most of the coastal ports in China were the feeder ports for other Asia ports.

    1995 Shanghai

    Total throughput 1.53 Mil.TEU

    Direct ocean shipping 0.17 Mil. TEU 11%

China's strategy

- **Action**
  - ☐ Limit the market access of short-sea route
  - ☐ Increase the port charges for vessels engaged in short-sea shipping service
- **Effect of the policy**

	1997	1998	Growth rate
Voyages for Ocean shipping line	223	279	25%
Voyages for Short-sea shipping line	2026	2253	11%
Overseas transshipment rate	62	56	-9.70%
Domestic transshipment rate	10	16	60%

Source: China shipping report (1999)

Port Legislation_Japan

Year	Name	Content
1950	Port and Harbor Law	Set regulation of port planning, construction, management and operation
1953	Enactment of the port construction promotion Law	Set regulation for port development planning and construction
1959	Law on Measures for the development of specially designated ports	Set regulation for port development planning and construction of specially designated ports
1961	Law on Emergency Measures for Port development	Set regulation for port development planning and construction
1999	Private Finance Initiative Law	To promote private sector participating in infrastructure *1986, Private Utilization Law, port construction was excluded

Source: Complied through various sources

Port Legislation_China

Year	Name	Content
1986	"Measures for the collection of port construction fees "	Port construction fees changed from appropriation to loan
1984	" Instruction for Tianjin port administration system experimental reform"	Start to change from central governance to joint administration by central and local government
1985	" Preferential Treatment to Sino-Foreign Joint Ventures on Harbour and Wharf Construction"	Promote the foreign investment in port construction Long contract period and extension of contract period is possibleTax exemption in the first five years
1988	" Provisions on management of port self-sufficient fund "	Local port authority can remain the port revenue for future development
1993	" Implementing rules about road and water transportation industry"	Regulate the foreign investment in port construction The establishment of port joint venture is subject to approval by the MOC
1997	" Catalogues for the Guidance of industries for foreign investment"	Construction and operation of port facilities for public wharves was classified as one of the industries for encouraging foreign investment
2001	" Provisions on promoting dual administration reform"	Port assets are all hand over to local authority Separate administration from operation Diversify the funding sources for port construction
2003	" Port Law of People's Republic of China"	Sets the regulation for port planning, construction, management and operation Clarify the responsibility of port administration body
2004	Rules on Port Operation and management	Implementing rules of port law

Source: Complied through various sources

Port Legislation_Korea

Year	Name	Content
1967	"Harbor Act"	Designation, development and management/operation of ports Port facility tariff Non-managing agency port works Management of port facility and equipment
1990	" Act on Korea container terminal Authority "	Establishment and operation of Korea Container Terminal Development and operation of container terminals Financing of development funds
1993	" New Port Construction Promotion Law "	Formulation of basic plan on new port construction Designation and management of the area determined for new port construction
1994	" Law of Private Participation in Infrastructure "	Formulation of basic plan on private investment facility project Conclusion of concession agreement and designation of concessionaire
2003	" Act on Busan Port Authority "	Management and development of container port, facilities and areas related to Busan port
2005	" Act on Incheon Port Authority "	Management and development of container port, facilities and areas related to Incheon port

Source: Port Governance in Korea, Dong-Wook song

MOC

Strategy formulation
National port planning
Local port planning
Infrastructure Investment
Owner of asset
Landlord
Regulator
Financial Autonomy

Local Government

Land Allocation
Urban and Regional Planning

Local Port Authority

Operational management

Local Port Administration Bure...

Regulator
Financial Autonomy

...Group Co Ltd

...re investment
...p of assets
... Function
...Autonomy
...Management

...t Authority

... Function
...ulator
...Autonomy
...Management

Terminals

Terminals

Infrastructure investment
Operation by private/public company
Financial Autonomy
Ownership of Assets

Subsidiaries

Joint ventures

Japan

Operational Management

Terminals

Infrastructure investment (1993-)
Operation by private/public company
Financial Autonomy
Ownership of Assets (certain period)

Terminals

Infrastructure investment
Operation by private company
Financial Autonomy
Ownership of Assets (certain period)

2005

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Summary of Port Governance

Category	Country	Feature
Administration		Centralized ➡ Localized Japan > China > Korea
Investment		Gov. Budget ➡ Various financial sources China > Korea > Japan
Operation		Public Authority ➡ Commercialization China > Korea > Japan

Conclusion
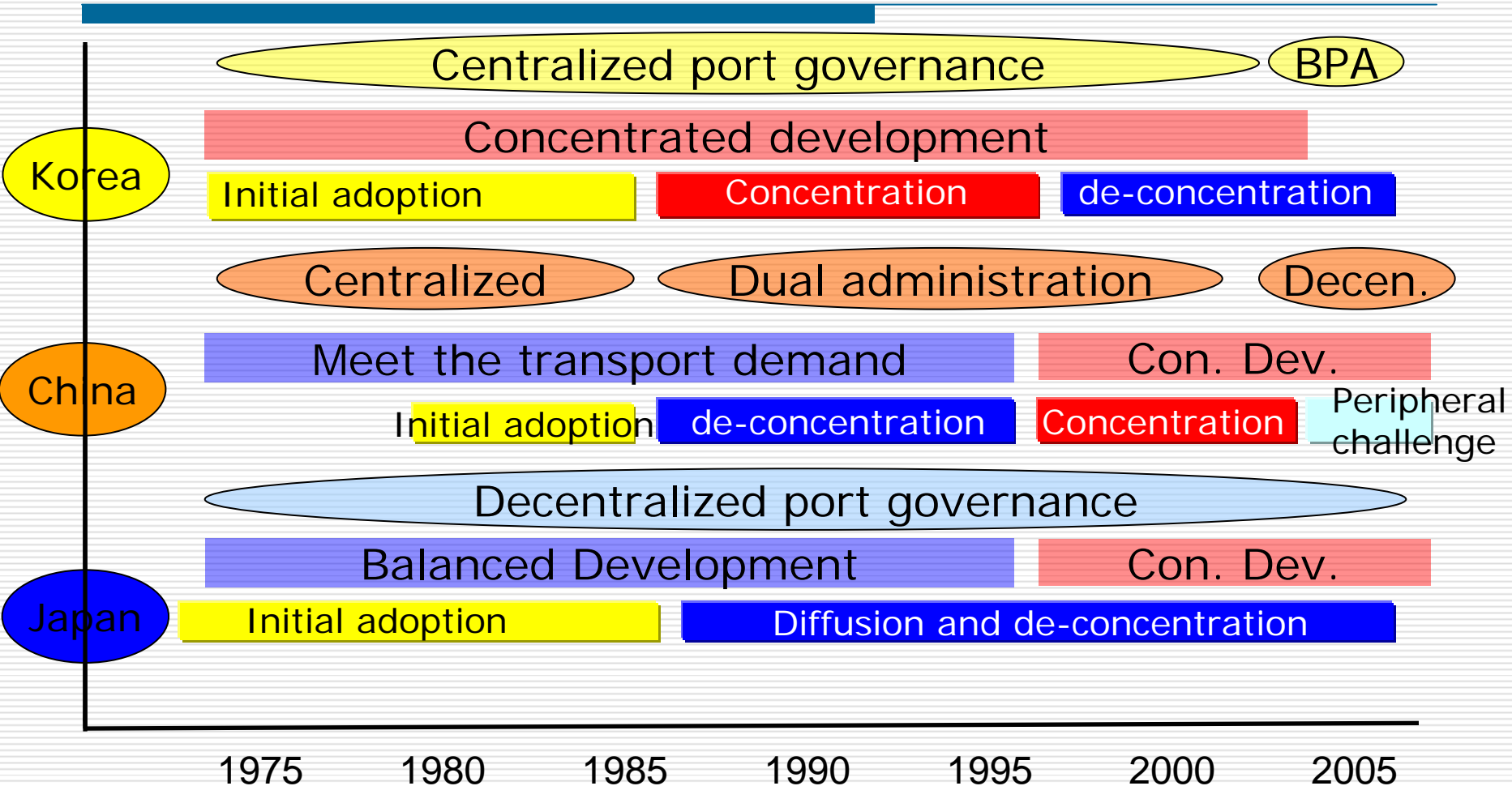
Centralized port governance — BPA

Concentrated development

Korea

Initial adoption | Concentration | de-concentration

Centralized | Dual administration | Decen.

China

Meet the transport demand | Con. Dev.

Initial adoption | de-concentration | Concentration | Peripheral challenge

Decentralized port governance

Japan

Balanced Development | Con. Dev.

Initial adoption | Diffusion and de-concentration
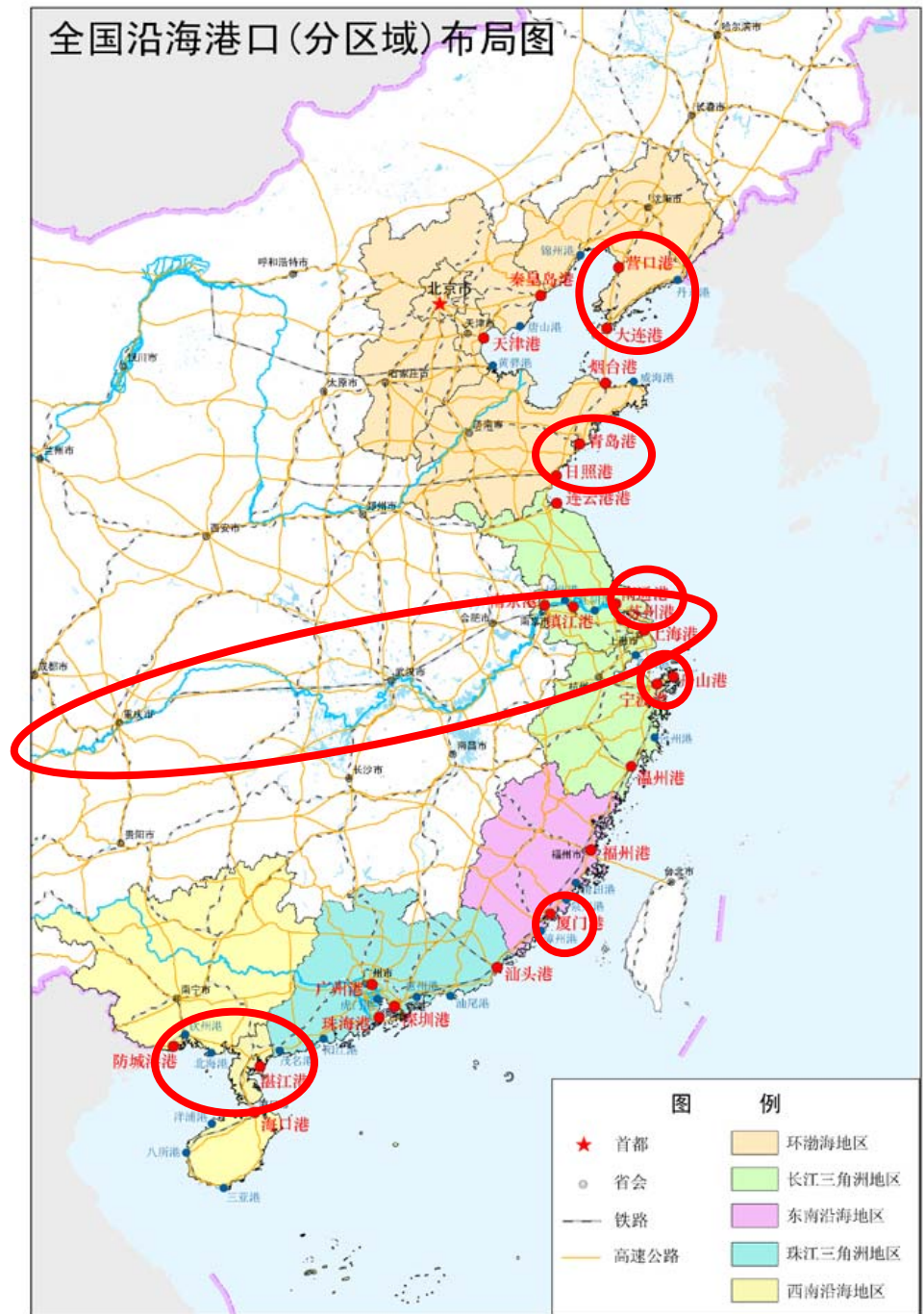
1975 1980 1985 1990 1995 2000 2005

*According to Hayut's Five-phrase Theory proposed in "Containerization and the load center concept" 1982. Conventional port system, initial adoption system, diffusion and concentration system, load center system, peripheral challenge system.

Trend in port de

□ Port Strategic A

■ Japan

□ Super port po

■ China

□ Port Resource
(2003)

■ Korea

□ Global logistic

全国沿海港口(分区域)布局图

Thanks for your Attention!