Thesis for the Degree of Master of Business Administration

A Study on Economic Relationship between Port and City in China

- Based on Panel Data Model -

by

Yang Chao

Department of International Commerce and Logistics

The Graduate School

Pukyong National University

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Advisor: Professor Ha Myung Shin (Ph. D.)

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Approved as to style and content by:

_____이병근 교수

_____장병기 교수

_____하명신 교수

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Abstract

Within the last decades, there is a rapid economic growth in China, and China's ports are making a remarkable development in both quantity and scale. Since the well understanding the economic relationship between ports and port-cities is essential and is strategic meaning for the layout of ports and port-cities, and furthermore it might offer theoretical basis for the development of ports and port-cities, an increasing amount of interest has been devoted to the investigation on economic relationship between ports and port-cities.

We have collected the cargo throughput (CTP) data of the 30 top coastal ports and economic and social data, including GDP, fixed asset investment (FAI), foreign direct investment (FDI) and population, of the port-cities in mainland China in the past 15 years. It is expected that there is a positive reciprocal interaction between the ports and the port-cities. By using a panel data regression, the economic impact of the ports on the city's economy, and the impact of the city's economy on the port growth have been analyzed.

Keywords: Panel data model; Economic relationship; Port; City

Chapter 1 Introduction

1.1 Research background

Since 1980s the world's manufacturing centre has shifted to Asia. Asia annual growth rates in port CTP are more than 10%. Within Asia, China is making remarkable growth of its throughput volume and share. China's port CTP in 2010 reached 80 billion tons and ranked the first in the world. With the rapid development of Chinese ports, China's port cities are also experiencing a rapid growth.

As joints of water and land, ports play an important role in the transportation network and the city economy. Ports economy has become an important part of city economy or zone economy and ports are interactional with city economy. The development of domestic and international economic circles shows that the rise of its economic zone is relying on different functions in the formation of a port or port cluster. The success of free trade zone with convenient port conditions verifies that the cargo gathers in port and port makes city prosperity. The rises of China's Pearl River Delta, Yangtze River Delta, and the Bohai region are becoming the significant factors for China's booming economy, and also

demonstrating the important strategic roles played by port and port economy in regional economic development. It should be stressed that it is the local system (but not the hinterland) that furnishes the port with its inputs-labour, land and capital-and pays the costs of port activities in terms of pollution, congestion, and opportunity costs for land use (Hoyle and Hilling, 1984). A well recognizing of the port-city economy relationship correctly is of essential and strategic meaning for the layout of ports and the cities.

1.2 Methodology and purpose

Considering port and port-city economic relationship in China, most research is qualitative research and quantitative research is usually for a pair of port-city regression analysis. In this study, the economic data of more than thirty ports and port cities in China within the past 15 years are collected. By building a panel data model, the study aims to explore the economic function of port-cities by considering the impact of port-city's economic factors to the port CTP and the contribution of the port to the GDP of the port-city in China.

1.3 Structure

This paper is divided into six chapters. The first chapter describes the

background, purpose and method of the research. Chapter 2 is about the basic theoretical explanation of the economic relationship of the relationship between port and port-city. Chapter 3 is about the related literature review. In chapter 4, the panel data regression method is introduced. The data analysis is showed in chapter 5. In chapter 6, the implication and conclusion of the study are stated.

Chapter 2 Theoretical Background

2.1 Definition and functions of ports and port-cities

A port (or seaport) is a place at which the transfer of cargo and passengers to and from waterways and shores occurs. The transfers are made to and from vessels. The port may be a cargo port (handling only the transfer of cargo), a passenger port (handling only the transfer of passengers), or a combination cargo/passenger port (handling the transfer of both cargo and passengers).(Wayne K. Talley, 2009) A port is an economic unit, on one hand, which provides a transfer service as opposed to producing a product as for a manufacturing firm. The amount of this transfer service is often referred to as the port's throughput, i.e., the number of containers (or tons of cargo) and passengers moved through the port. Port plays an important role in stimulating economic development. On the other hand, a port is a transport infrastructure. It links a trading nation outwardly with its trading partners; and inside a nation it is the focal point for motorways and railway systems.

Intuitively, port-cities are cities with a port as an appendage. While their economic functions as nodes of sea-based trading networks need to

prominently, which are significantly different from those inland cities.(Tai-Yong Tan, 2007) Their economic character is essentially maritime in nature.(P. ReevesF. Broeze and K. Mcpherson, 1989) Privileged by their propitious positions at critical points in regional and global commercial connections, port cities are not normally constrained by political boundaries but are sustained by the flows of peoples, goods, cultures and ideas across the regions connected by water and the dynamics of trade.(R. Murphey, 1989)

Port cities' functions not only are for better life of people who living in, education, commercial activities, manufacturing, and political reasons, but also are nodal centers for the transport of goods, labor and capital, and for the reception and transmission of culture, knowledge and information.

2.2 Interaction between ports and their host cities

Ports and their host cities are closely related. They interact with each other in economy and culture. In some aspects they propel each other and co-develop, in others they conflict. The relationship between ports and the cities of which they are a part is very complex one and involves multidirectional influence in spatial, cultural, environmental and economic terms.(Tai-Yong Tan, 2007, 张萍, 2006, 陈航, 2009, 陈芸芸, 2007, 唐秀敏, 2005, 陈航栾维新 and 王跃伟, 2007, Fred V. CarstensenWilliam

F. LottStan Mcmillen and Hemanta Shrestha, 2001)

2.2.1 Impact of port industry on the local economy

As a sector of local economy, port industry plays an important role in stimulating economic development. Through the impact on other industries, it also makes an indirect contribution to the local economy at the same time. According to literature, the impacts of a port on the city economy are generally classified into four different types: direct impact, the employment and income generated by the direct construction and operation of the port; indirect impact, the employment and income generated by the chain of supplies of goods and services; induced impact, the employment and income generated by the spending of incomes by employees created by the direct and indirect effects; and finally catalytic impact, the employment and income generated by the role of the port as a driver of productivity growth and then as an attractor of new firms. (H. C. Davis, 1983) To put it specifically, the impacts act from following aspects.

Port industry contributes directly to the regional economic development. The port service industry includes such activities as port daily maintenance, cargo handling, pilotage, port construction and communications. Companies included in the scope of port service industry are directly related to port transportation services, such as port service

authority and cargo terminal. Port service industry creates industrial output value through the port production activities. Port industry is the fundamental industry of the nation. Therefore, the investment in port industry will not only trigger the development of the port itself, but also will bring large amounts of demand for production factors, result in the growth of related industrial output and social consumption and consequently lead to a new round of output growth.(Fred V. CarstensenWilliam F. LottStan Mcmillen and Hemanta Shrestha, 2001, 杨凤华 and 姚建云, 2010, 孙峻岩单敏贾大山 and 宁涛, 2004, 谢萍, 2008) The impact will have a ripple effect, that is, the multiplier impact of investment, which will bring the prosperity to the regional economy.

Port development promotes the development of relevant industries. On one hand, port development brings along the development of industries which utilize port resources.(杨凤华 and 姚建云, 2010, 李增军, 2002, 谢卫奇, 2010, 朱文涛, 2010, 何娴, 2010) The first is the industries utilizing coastline resources, such as shipyards and thermal power plants. The second is the industries utilizing the waterfront transportation conditions, such as steel and petrochemical industries depend on import iron ores and crude oil. The third is the industries providing serves for port and waterfront transportation, such as repair shipyards, crane building plants and fishing equipment manufacturers. The fourth is the

export-oriented industries utilizing inland or imported raw materials and spare parts to further process in the special export processing zones within or around the port region. On the other hand, as a distribution center for goods, port is characterized as informative, which makes it apt to form tangible market on the periphery of the port. The emerging functions of modern port not only involve serving as a trading and logistic centre based on transportation function, but also prosperous business activities due to the frequent labor exchange in the port region. Meantime, the development of manufacturing and trade further promotes financial institutes and other service industries.

Port development promotes regional industrial upgrading. As the costal region gradually develops into the power engine of the region, the costal city will realize the industrial upgrading either passively or actively in order to acquire more returns on investment and retain the inflow of capital, technology and talented people. Dominant industries attracted by the port are mainly high-tech industries and high value-added industries, the introduction of which could have significant impact on the upgrading of the regional industrial structure. It can thus be concluded that port also plays a crucial role in promoting the regional industrial.

Port development fosters clustering in port industries. In the

development of regional economy, costal city has comparative advantage of being closer to the transport nodes and having lower transport cost, which attract industries relied on substantial import raw materials or export tariffs gathering around the port. On the other hand, port serving as the hub connecting both inside and outside regions, assembles domestic and foreign advanced technologies, capital and talents in this region because of the well-developed natural and social environment. Industry cluster has brought regional economy much broader market opportunities and a higher level of development. According to the principles of external economy, the formation of scale advantages after industry cluster will contribute significantly to further industry clustering in this region, and this is the reason why many costal cities can still remain as the center of the region after losing the initial cost advantage, which is defined in the spatial economics as the "lock-in effect." The economic impact of port industry cluster will gradually spread to the entire region, and when the costal city's industry cluster level reaches a certain extent, it will trigger the onset of diseconomy over the lifecycle of the cluster, such as the rise of production cost, shortage of raw materials and increase in the sales expenses. The diseconomy appeared in the costal city will consequently result in expanding of the cluster. Thus the outsourcing for more optimum production factors starts among the industries, which will first take place

in the surrounding cities located near the arterial roads, then all of the cities within the region.

2.2.2 Supports of city to port industry

As the most essential function of ports, transport integration does not take place in isolation. A port node within a multimodal transport system is frequently associated with the development of an urban center and the hinterland. It should be stressed that it is the city which furnishes the port with its inputs, including labor, land and capital, and which pays the costs of port activities in terms of pollution, congestion, and opportunity costs for land use.

Cities are host of ports, which provide development space and infrastructure base for port. A port is a node within a multimodal transport system, the development of which must be restricted by other transport segment and the infrastructure, such as urban transport system, communication facilities. With the acceleration of globalization, comprehensive logistic is coming with the inflow of capital, technology and talented people. This requires the city providing space for port activity and connectivity to inland transport.

Cities provide relative service for ports. The development of ports not

only demands banking, informative and communication services, but also requires certain technological and assistant department. Without these supports, the port industrial would not supply high quality and efficient service, which eventually would limit the port's development.

Host cities and hinterland are the major region correlated with ports. The import and export of merchandise within the region are accomplished through ports. Therefore the overall economic level, industrial structure and foreign trade condition play an essential role on the port throughput. Furthermore, the structure of regional economy, especially the merchandise species might decide the port type, for example, a bulk cargo terminal or a container terminal.

2.2.3 Conflict between ports and cities

Competition for Resources: The port development will require the spatial expansion, acquisition of new land for operation and large amounts of venture capital. Meanwhile, the development of the port will absorb a lot of talent, technology and other basic production factors which are also fundamental to other industries. If the total amount of the resource is constant, then there will be an inevitable competition between the port and other enterprises which have the same demand for land and capital.

Environmental Issues: From the city's point of view, the contamination, noise and traffic congestion caused by port activities are the most frequently mentioned sensitive issues, not to mention security problems of the port operation. Port authorities are eager to obtain more land for operation, which will either lead to deterioration to the city or huge spending on the sea. Due to environmental concerns, the costal cities generally oppose the expansion of the port and emphasize that the port should rationally utilize existing facilities. Under such controversial situation, the port is still concerned about how to re-enter the coastal areas and take over living and recreational areas along with those abandoned waterfront areas that are no longer adapted to modern handling technologies, which can be transformed into logistic parks or multimodal transport centers.

Chapter 3 Literature Review

3.1 Investigation on the port-city economic relationship

In 1953, Delaware River Port Authority published The Value of a Ton of Cargo to the Area Economy,(Philadelphia Port Area, 1955) which is considered as the starting of the investigation on the port economic contribution to the region economy. After that, the economic relationship between some other ports and their host cities was studied, such as New York Port and Tacoma Port. Since then, the investigation on the economic relationship between port and city has been extensively performed in the world wide. The major qualitative studies were focused on the seaport economic impact on the city by measuring the direct and indirect impact of port on patterns of jobs, incomes, and tax revenues in the regional economy. Since one of the major challenges in port impact studies is to identify the port-related industries and find out the degree of port dependency of these industries. The majority of existing port impact studies begin with the definition of port impact. The impacts on the local and regional economies are the primary or direct, and secondary or indirect and induced impact. The primary or direct impact consists of the

initial round of spending and employment generated by port activities such as, port industry services associated with moving cargo through the port system, and capital spending on new port construction, expansion or rehabilitation projects.

Among the existed studies, different definitions of impacts were adapted. In 1964, Pearson studied the economic impact of the Virginia port on the Hampton area. In his study, the economic impact of the port was measured by first determining a list of companies who would cease to exist or relocate if the port was not available. The study accounted for businesses whose commerce only partially depended on port availability. Finally, using employment, income, and tax data obtained form state agencies, the researchers determined how each component of impact changed. Some other studies, on the other side, attempt to estimate the primary impact by surveying the factors of community income directly generated by services to vessels and by port operations. For this purpose, Brockel lists sixty-four factors directly generated by port operations and aggregates these factors into five categories, similarly, Kaufmann set out five broad categories of economic activities necessary for port operations. There are also some other definitions of port impacts and evaluation on the economic impact of port.

One of the drawback of the earlier studies is that they differ from each other in methodology and their definition of the economic impact of a port. While some studies measure this impact by using traditional methods that primarily measure only the direct impact by surveying a limited number of port-dependent industries, others propose new and improved methodologies to measure the total economic impact of a port.

3.2 Theoretical model

3.2.1 Value-added model

Economic Value Added or EVA is an estimate of a firm's economic profit – being the value created in excess of the required return of the company's investors (being shareholders and debt holders). EVA is the profit earned by the firm less than the cost of financing the firm's capital. The idea is that value is created when the return on the firm's economic capital employed is greater than the cost of that capital. Based on the added value aggregation to estimate direct, indirect and induced economic impact of different groups of economic agents, the economic impacts of a port to the region economy can be evaluated. By using this method, US Maritime Administration (MARAD) has attempted to provide guidelines to measure a port's economic impact on a local economy by publishing the

Port Economic Impact Kit and building a computer model in 1979. In 1986, an amendment was made to the Port Kit Model: an evaluation of the port significant to the city was added which increases the reliability and comparability of the result. Despite there are some critics to the Model, the approach described by MARAD has been widely used to measure the economic impact of a port.

3.2.2 Gravity model

Gravity models begin with Newton's Law for the gravitational force (GF) between two objects i and j. In equation form, this is expressed as:

$$GF_{ij} = \frac{M_i M_j}{D_{ij}} \qquad 3.1$$

In this equation, the gravitational force is directly proportional to the masses of the objects (Mi and Mj) and indirectly proportional to the distance between them (Dij). Gravity models are estimated in terms of natural logarithms, denoted "ln" In this form, what is multiplied in Equation 1 becomes added, and what is divided becomes subtracted, translating Equation 1 into a linear equation:

$$\ln GF_{ij} = \ln M_i + \ln M_j - \ln D_{ij} \qquad 3.2$$

Gravity models utilize the gravitational force concept as an analogy to explain the volume of trade, capital flows, and migration due to existence

of the port among the region. For example, gravity models establish a baseline for cargo throughput volumes as determined by gross domestic product (GDP), population, and distance. The effect of the port on the region economy can then be analyzed. In many instances, gravity models have significant explanatory power,

3.2.3 Input-output model

An input-output model is a quantitative economic technique that represents the interdependencies between different branches of national economy or between branches of different economies. Wassily Leontief (1905-1999) developed this type of analysis and took the Nobel Memorial Prize in Economic Sciences for his development of this model. Input-output analysis makes various departments of national economy and economic activities into a structured organic whole through input-output table. It fully describes the complex links among the various components of the national economy and the internal dependencies among industrial sectors.(Lu YinXie Weiqi and Jiang Miaomiao, 2011) Based on the analysis of the dependence of economic activities on different levels and whether it is an essential activity, the port's contribution to economic development and port mechanism of economic activity can be studied. In the data requirements, input-output methods need to recommend the port

input-output table.

3.2.4 Port-city growth model

In this model, port-city is considered as an organization, the port production as the output of the organization and the city factors as factors of production. Alternatively, the port factors, such as cargo throughput, turnover or total trade value, are treated as the port productivity which is the combined result of city factors of production. Following Cobb-Douglas production function, the relationship can be formulated into

$$Y = AL^{\alpha}K^{\beta}D^{\gamma} \qquad 3.3$$

in which, Y is the total port production, L is the labour input, K is the capital input, D is the land input, A is a constant, $\alpha, \beta, and\ \gamma$ are constant output elasticities of labour, capital and land, respectively.

3.3 Investigation on the economic relationship of mainland China port

The development of mainland China port is much later than those developed nations. While in recent decades, China's Open-Door Policy in 1978 and China joining into the World Trade Organization (WTO) in 2000, China economy and trade grow rapidly. The world economy is also changed, and the manufacture center is transferred to Asia. At the same

period of time, the development of mainland China ports is enormous. In 1978, there were 20 coastal ports in China mainland with a total throughput capacity of 0.1 billion ton; till 2010, there are 150 coastal ports with a total throughput capacity of 5.51 billion ton. 7 ports ranked world top ten, and 16 ports have the cargo throughput over 0.1 billion ton. Under this circumstance, the relationship between port and their host city, especially the economic impact attracted an increasing amount of interest. According to the studies, the port-city relationship at current stage is: the port and city are inter-related and interdependence. A port facilitates the growth of its host city and regional economy, on the other side, the growth of the city pushes the development and evolution of its port.

There are also some quantitative studies on the port economic contribution to the city. Chenyilong studied the port's economic contribution to regional and national economy by using value-added method, he suggested that the direct and indirect economic contribution of a port can be evaluated from a set of economy indicators. By setting the input-output model on the transport industrial, Zhangqi studied the relationship between port cargo throughput and growth of other industrial. Shanghai International Transport Information Investigation Center designed an indicator system of transport industrial and other industrial. By evaluation the factors, the economic impact of Shanghai transport

industrial and other industrial on Shanghai's economy can be analyzed. In addition, a lot of studies on the port development and city economy were performed from the viewpoint of regional economy.(Li WeiLiu Bin and Liu Xiaoyu, 2010) According to the literature, it can be revealed that a majority of the investigation focused on the issue:

1. Impact of port development on city economy;

while the following issues are seldom reported:

2. Impact of city economy on port development;

3. Reversal relationship between port development and city economy.

The representative studies are reported by Jizhongyiin, and Wangyuping. Jizhongyin studied the reversible impact between transport industrial and national economy. While Wangyueping analysed the interaction between industrial structure variation and transport industrial. Although there is certain amount of studies on single port-city pair, a systematical investigation on the reversal economic impact between port and city economy within the national wide has not been performed.

3.4 Research questions

In this study, we focused our attention on the reversal economic impact between port and city economy within the national wide. The top 30 cargo throughput coastal port and their city's economic factors within

the past 15 years will be studied. The reversal impacts will be evaluated. And the following questions will be studied:

Can the port growth be quantified by the port-city's activities?

What extent does the port production affect the port-city's GDP?

Which city economic factors are the most remarkable factor to the port production?.

Chapter 4 Estimation Methods

4.1 Definition and advantages of panel data model

Panel (or longitudinal) data sets contain observations on multiple cross-sectional samples over multiple time periods. For example, we observed GDP data of 30 cities over 15 years or CTP data of 30 ports over 15 years. Both these sets are panel data sets. Since panel data have both cross-sectional and time series dimensions, the application of regression models to fit econometric models are more complex than those for simple cross-sectional data sets or simple time series. Due to their heightened capacity for capturing the complexity of human behavior as compared to cross-sectional or time-series data models, panel data models have become increasingly popular among applied researchers. As a consequence, more and richer panel data sets also have become increasingly available.

There are several reasons for the increasing interest in panel data sets. First, panel data usually give the researcher a large number of data points, increasing the degrees of freedom and reducing the collinearity among explanatory variables – hence improving the efficiency of econometric estimates. If there are N units of observation and if the survey is

undertaken in T time periods, there are potentially NT observations consisting of N parallel units over T time series. More importantly, longitudinal data allow a researcher to analyze a number of important economic questions that cannot be addressed using cross-sectional or time-series data sets. An important one is that their use may offer a solution to the problem of bias caused by unobserved heterogeneity.(Josef Brüderl,, 2005), which is a common problem in the fitting of models with cross-sectional data sets.

4.2 Several regression methods for panel data

4.2.1 Pooled ordinary least squares (OLS) model

Pooled OLS model is the most restrictive one. The model underlies the usual assumptions for cross section analysis. There is assumed to be no unobserved individual heterogeneity, so the model reduces to:

$$y_{it} = \alpha + \beta x_{it} + u_{it} \ (i = 1,...,N; t = 1,...,T) \qquad 4.1$$

If the model is set up correctly, the explanatory variables and the error term is not relevant, that is $Cov(x_{it}, u_{it}) = 0$.

4.2.2 Fixed effect versus random effect models.

Panel data models examine fixed or random effects of entity

individual. The core difference between fixed and random effect models lies in the role of dummy variables. If dummies are considered as a part of the intercept, this is a fixed effect model. In a random effect model, the dummies act as an error term. A fixed group effect model examines group differences in intercepts, assuming the same slopes and constant variance across entities or subjects. Since a group (individual specific) effect is time invariant and considered a part of the intercept, *iu* is allowed to be correlated to other regressor. Fixed effect models use least squares dummy variable (LSDV) and within effect estimation methods. OLS regressions with dummies, in fact, are fixed effect models.

A random effect model, by contrast, estimates variance components for groups (or times) and error, assuming the same intercept and slopes. *iu* is a part of the errors and thus should not be correlated to any regressor; otherwise, a core OLS assumption is violated. The difference among groups (or time periods) lies in their variance of the error term, not in their intercepts. A random effect model is estimated by generalized least squares (GLS) when the Ω matrix, a variance structure among groups, is known. The feasible generalized least squares (FGLS) method is used to estimate the variance structure when Ω is not known. Fixed effects are tested by the (incremental) F test, while random effects are examined by the Lagrange Multiplier (LM) test (Breusch and Pagan 1980). If the null hypothesis is

not rejected, the pooled OLS regression is favored. The Hausman specification test (Hausman 1978) compares fixed effect and random effect models. If the null hypothesis that the individual effects are uncorrelated with the other regressors in the model is not rejected, a random effect model is better than its fixed counterpart.

4.2.3 GLS

We may estimate GLS specifications that account for various patterns of correlation between the residuals. There are four basic variance structures that we may specify: cross-section specific heteroskedasticity, period specific heteroskedasticity, contemporaneous covariances, and between period covariances.

Note that all of the GLS specifications may be estimated in one-step form. When we estimate coefficients, compute a GLS weighting transformation, and then reestimate on the weighted data, or in iterative form, where to repeat this process until the coefficients and weights converge.

4.2.4 Full-modified ordinary least square (FMOLS)

If variables are cointegrated, we may estimate cointegrating coefficients in order to investigate the long-run relationship between the

variables. Since the asymptotic distribution of the OLS estimator is based on unit root distribution, which is nonstandard, any inferences drawn on β using t-tests in the OLS regression will be invalid. Therefore, two types of panel estimators are proposed: the within-dimension estimator that pools the data along the within-dimension and the group mean estimator that pools the data along the between-dimension. While the former indicates large distortions in small samples, the latter indicates only small ones. Pedroni (2000) emphasized the (between-dimension) pools the data along the between-dimension. While the former indicates large distortions in small samples, the latter indicates only small ones. Pedroni (2000) emphasized the (between dimension) pools the data along the between-dimension. While the former indicates large distortions in small samples, the latter indicates only small ones. Pedroni (2000) emphasized the (between-dimension) pools the data along the between dimension. While the former indicates large distortions in small samples, the latter indicate.

The between-dimension estimators have several advantages. The most important advantage is that the form in which the data is pooled permits greater flexibility in the presence of the heterogeneity of cointegrating vectors. In particular, whereas test statistics constructed from the within-dimension estimators are designed to test the null hypothesis

H0: $\beta_i=\beta_0$ for all i against the alternative hypothesis H1: $\beta_i=\beta_A\neq\beta_0$ where the value β_A is the same for all i, test statistics conducted from the between-dimension estimators are designed to test the null hypothesis H0: $\beta_i=\beta_0$ for all i against the alternative hypothesis H1: $\beta_i\neq\beta_0$, so that the values for β_i are not constrained to be the same under the alternative hypothesis. It is evident that this is an important advantage for applications, such as the present one, because there is no reason to believe that they necessarily take on some other arbitrary common value. Second, the point estimates of the between-dimension have a more useful interpretation in which the true cointegrating vectors are heterogeneous. In particular, point estimates for the between-dimension estimator can be interpreted as the mean value for the cointegrating vectors while this is not true for the within-dimension. Finally, the test statistics created from the between dimension estimators appear to have another advantage, even under the null hypothesis, in which the cointegrating vector is homogeneous. In particular, they appear to suffer from much lower small-sample distortion than the within-dimension estimators.

Basically, FMOLS is OLS with some kind of bias correction. In the FMOLS estimation, based on the estimated long-run covariance matrix, a data transformation is conducted on the dependent variable before running the OLS.

4.3 Tests of panel data

4.3.1 Panel unit root tests

If a random variable X is indexed to time, usually denoted by t, the observations $\{X_t, t \in T\}$ is called a time series, where T is a time index set. Time series data are very common in empirical economic studies. There is something special of time series data compared to cross sectional data, such as time series data are very likely to display some degree of dependence over time, namely non-stationary. Estimates from non-stationary variable may generate a spurious regression. In statistics, unit root test is used to test whether a time series variable is non-stationary. The presence or absence of unit roots, to put it simply, helps to identify some features of the underlying data-generating process of a series. If a series has no unit roots, it is characterized as stationary, and therefore exhibits mean reversion in that it fluctuates around a constant long run mean. Also, the absence of unit roots implies that the series has a finite variance which does not depend on time, and that the effects of shocks dissipate over time. Alternatively, if the series feature a unit root, they are better characterized as non-stationary processes that have no tendency to return to a long-run deterministic path. In sum, the existence (or lack thereof) of unit roots in macroeconomic time series brings about important

implications, and much effort has therefore been devoted to devising unit-root tests to determine whether any given data should be treated as integrated or not in the last three decades.

Consider a following autoregression process for panel data:

$$y_{it} = \rho_i y_{it-1} + X_{it}\delta_i + e_{it} \qquad 4.2$$

where i =1, 2, . . . , N cross-section units or series, that are observed over periods t = 1, 2, . . . , T_i. The X_{it} represent the exogenous variables in the model, including any fixed effects or individual trends, ρ_i are the autoregressive coefficients, errors e_{it} are assumed to be mutually independent idiosyncratic disturbance. If $|\rho_i| < 1$, y_i is said to be weakly stationary, on the other hand, if $|\rho_i| = 1$ then y_i contains a unit root, namely non-stationary. On the basis of whether there are restrictions on the autoregressive process across cross-sections or series, unit root tests can be classified into two groups. Levin, Lin, and Chu (2002, hereafter LLC) assume that there is a common unit root process so that ρ_i is identical across cross-sections ($|\rho_i| < 1$ for all i). All individuals in the panel have identical first-order partial autocorrelation coefficients, but other parameters such as the degree of persistence in individual regression error, the intercept and trend coefficients are allowed to vary freely across individuals. Their test procedures are designed to assess the null hypothesis, that each individual in the panel has non-stationary time series,

versus the alternative hypothesis, that all individuals' time series are stationary. LLC consider the following basic specification:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-j} + X_{it}^{'} + e_{it} \qquad 4.3$$

where it is assumed that a common $\alpha = \rho - 1$, but allow the lag order for the difference terms p_i to vary across cross-sections. The null and alternative hypotheses for the tests are respectively correlated to there is a unit root and there is no unit root:

$$\begin{aligned} H_0 &: \alpha = 0 \\ H_1 &: \alpha < 0 \end{aligned} \qquad 4.4$$

Im, Pesaran, and Shin (2003, hereafter IPS), on the other hand, allow the first order autoregressive coefficient ρ_i to differ across cross-sections. Consider a separate regression for each cross-section:

$$\Delta y_{it} = \alpha_i y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-j} + X_{it}^{'} \delta + e_{it}. \qquad 4.5$$

The null hypothesis and the alternative hypothesis are given by

$$\begin{aligned} H_0 &: \alpha_i = 0, \textit{for all } i; \\ H_1 &: \begin{cases} \alpha_i = 0, i = 1, 2, ..., N_1 \\ \alpha_i < 0, i = N_1 + 1, N_1 + 2, ..., N \end{cases} . \end{aligned} \qquad 4.6$$

Both tests are supported in EViews, and will be used to test the integration of the data.

4.3.2 Panel cointegration tests

Cointegration is a statistical property of time series variables. If two series, Yt and Xt, are individually integrated, there exist a $\beta \neq 0$, so that the linear combination Zt of Yt and Xt, $Z_t = Y_t - \beta X_t$, is stationary, we say that Yt and Xt cointegrate with cointegration vector β.

Consider a regression model for Yt and Xt, given by

$$Y_t = \mu + \beta_c X_t + u_t . \qquad 4.7$$

The term ut is interpretable as the deviation from the relation. If Yt and Xt cointegrate, then the deviation

$$u_t = Y_t - \mu - \beta_c X_t \qquad 4.8$$

is a stationary process with mean zero. Shocks to Yt and Xt have permanent effects. Equation (4.3.7) defines an equilibrium between Yt and Xt. while if Yt and Xt do not cointegrate, there is no natural interpretation of equation (4.3.7) as an equilibrium relation, which may also be called a spurious regression. This is why cointegration is as important as unit roots.

The extensive interest in and the availability of panel data has led to an emphasis on extending various cointegration tests to panel data. The Engle-Granger (1987) cointegration test is based on an examination of the residuals of a spurious regression performed using integrated of order one variables, which will be referred to I(1). If the variables are cointegrated

then the residuals should be integrated of order zero, viz., I(0). On the other hand if the variables are not cointegrated then the residuals will be I(1). Pedroni (1999, 2004) extend the Engle-Granger framework to tests involving panel data. Pedroni proposes several tests for cointegration that allow for heterogeneous intercepts and trend coefficients across cross-sections. Consider the following regression

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1it} + \beta_{2i} x_{2it} + ... + \beta_{Mi} x_{Mit} + \varepsilon_{it} \qquad 4.9$$

for t = 1, … , T; i = 1, … , N; m = 1, … , M; where y and x are assumed to be I(1). The parameters $\alpha_i \; and \; \delta_i$ are individual and trend effects which may be set to zero if desired. Under the null hypothesis of no cointegration, the residuals e_{it} will be I(1). The general approach is to obtain residuals from Equation (4.9) and then to test whether residuals are I(1) by running the auxiliary regression,

$$e_{it} = \rho_i e_{it-1} + u_{it} \qquad 4.10$$

or

$$e_{it} = \rho_i e_{it-1} + \sum_{j=1}^{pi} \psi_{ij} \Delta_{it-j} + v_{it} \qquad 4.11$$

for each cross-section. Pedroni describes various methods of constructing statistics for testing for null hypothesis of no cointegration ($\rho_i = 1$). There are two alternative hypotheses: the homogenous alternative, $(\rho_i = \rho) < 1$ for all *i* (which Pedroni terms the within-dimension test or panel statistics

test), and the heterogeneous alternative, $\rho_i < 1$ for all i (also referred to as the between-dimension or group statistics test).

Chapter 5 Data and Analysis

5.1 Data description:

In this study, the economic relationship between 30 ports and cities are considered. The GDP, FAI, FDI and population were selected as the indicators of the port-city economy. The port CTP was selected as the factor quantifying the port production. Since the CTP data before 1995 is not available for most ports, the time span of the data is over 1995-2009. The city's GDP, FDI, FAI and population data and consumer price index (CPI) are from CHINA CITY STATISTICAL YEARBOOK (1996-2010) and CHINA STATISTICAL YEARBOOK (2010), respectively. In order to remove the effect of inflation, CPI was taken into consideration when anglicizing GDP variation. The CTP data is from CHINA PORT YEARBOOK (2003-2010)..

5.2 Variable selection

5.2.1 Port CTP

Port CTP is an important indicator reflecting the port operation, the scale of production, the port development and other economic statuses.

Therefore, port CTP can be used as an indicator to determine the port's productivity and scale, on which basis, the analysis of port economy and regional economy relationship can be conducted. The CTP data of 30 ports are pool plotted and plotted as a function of time series in Figure 5-1.

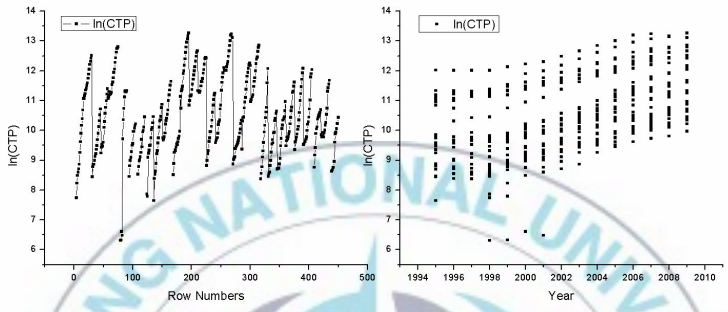

Figure 5-1. Plots of CTP as a function of year series.

5.2.2 Port city's GDP

Port city's GDP is a composite index reflecting the urban economy and represents the total amount of social production, while port is the transport department for social service. Assuming the social production determines the port's source of goods, and therefore the summary of a port throughput should be equal to the social total production. On this basis, some correlation should emerge between port throughput and GDP. The GDP data of 30 cities are pool plotted and plotted as a function of time series in Figure 5-2.

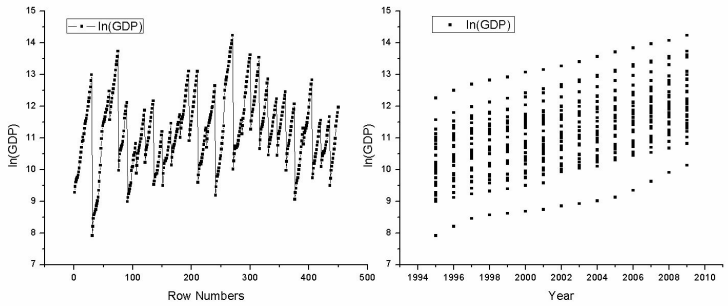

Figure 5-2 Plot of GDP as a function of year series.

5.2.3 Port-city's population (CPN)

The population here refers to the labor force of a port-city. In general, the growth of GDP will bring the expansion of the demand for labor, there is a consistency between employment growth and economic growth. As to the development of a port, labor is a basic factor of production. The CPN data of 30 cities are pool plotted and plotted as a function of time series in Figure 5-3.

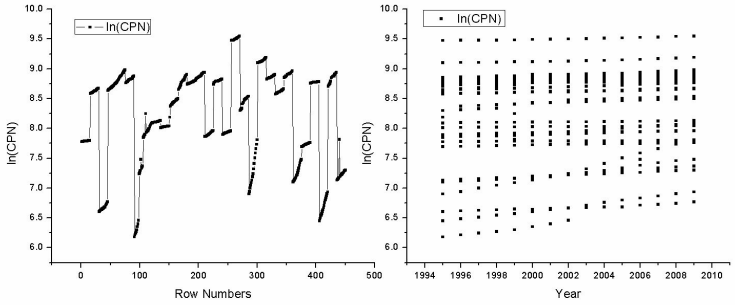

Figure 5-3 Plot of CPN as a function of year series.

5.2.4 Port-city's FDI

Foreign direct investment is the investment that involves the injection of foreign funds into an enterprise that operates in a different country of origin from the investor. An important factor for the investor choosing the location is close to a port to reduce the transportation costs of raw material imports and exports. Obviously, foreign direct investment will affect the port CTP. The FDI data of 30 cities are pool plotted and plotted as a function of time series in Figure 5-4.

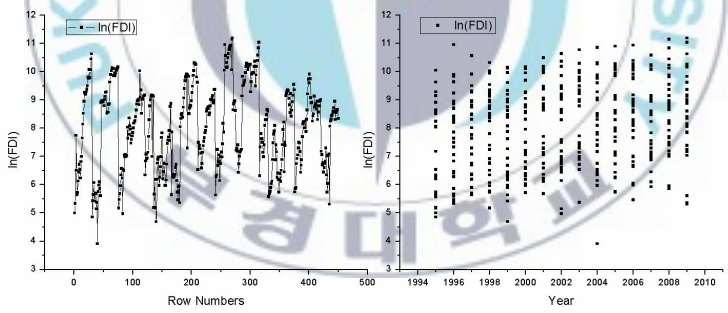

Figure 5-4 Plot of FDI as a function of year series.

5.2.5 Port-city's FAI

As well-known, the economic growth depends on the investment. Investment on fixed assets such as superstructure in port and infrastructure

of the city provides a solid material foundation for the development of the port and the port-city. The FAI data of 30 cities are pool plotted and plotted as a function of time series in Figure 5-5.

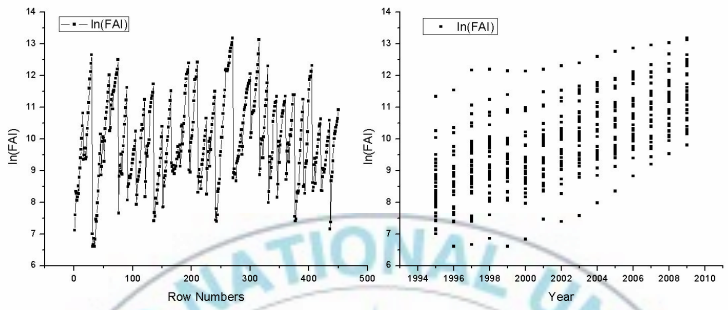

Figure 5-5 Plot of FAI as a function of year series.

5.2.6 Scatter plots

In Figures 5-6, 5-7, 5-8 and 5-9, lnCTP were scatter plotted versus lnGDP, lnFAI, lnFDI and lnCPN, respectively. In Figures 5-10, 5-11, 5-12 and 5-13, lnGDP were scatter plotted versus lnGDP, lnFAI, lnFDI and lnCPN, respectively.

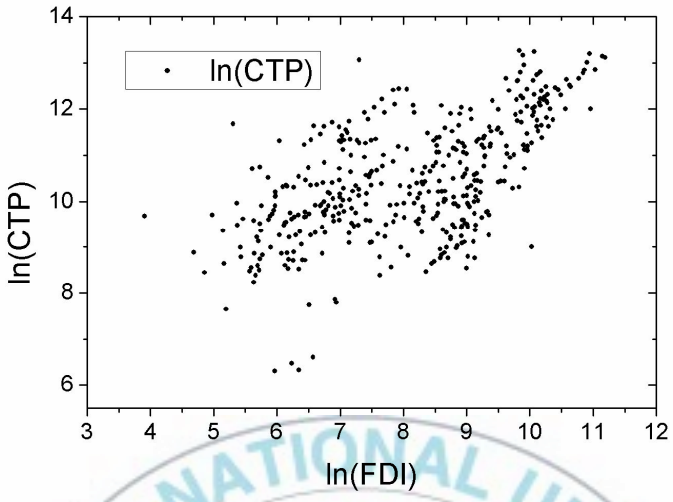

Figure 5-6 Plot of ln(CTP) versus ln(FDI)

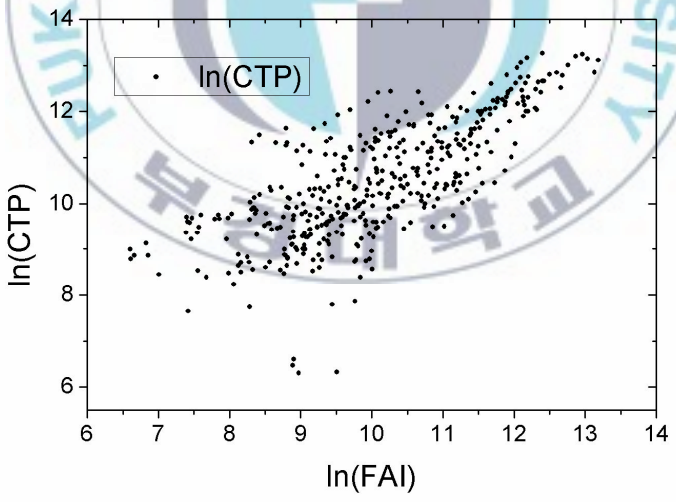

Figure 5-7 Plot of ln(CTP) versus ln(FAI)

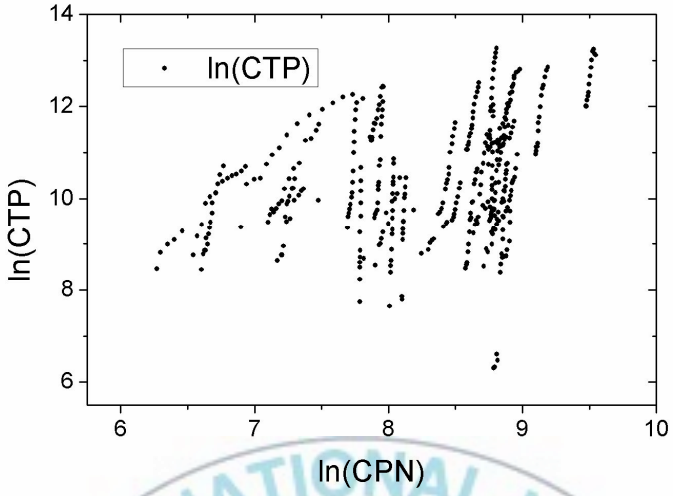

Figure 5-8 Plot of ln(CTP) versus ln(CPN)

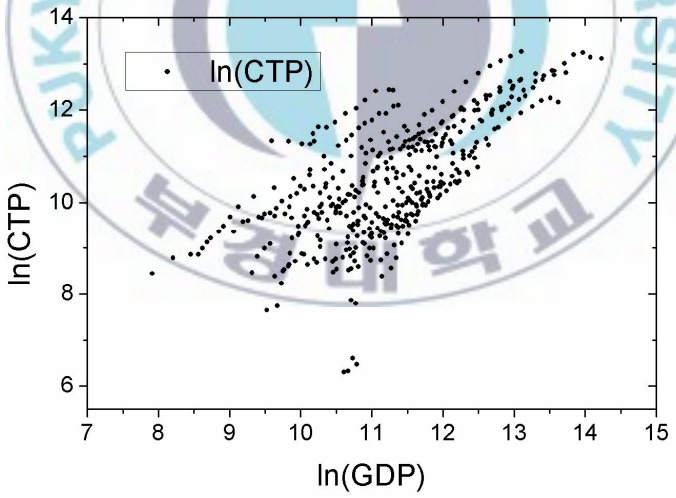

Figure 5-9 Plot of ln(CTP) versus ln(GDP)

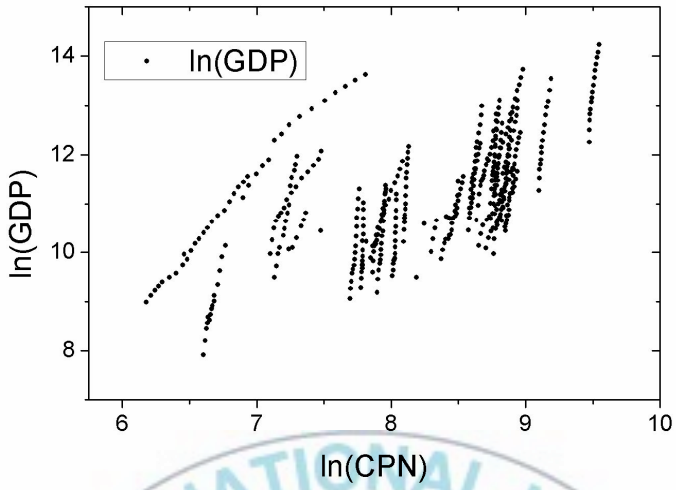

Figure 5-10 Plot of ln(GDP) versus ln(CPN)

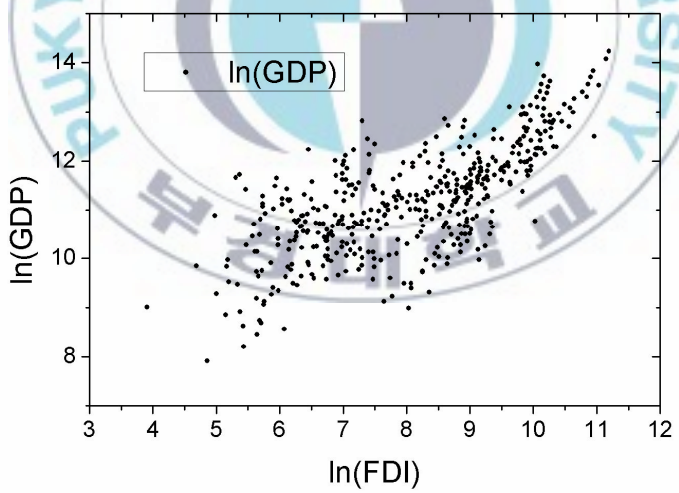

Figure 5-11 Plot of ln(GDP) versus ln(FDI)

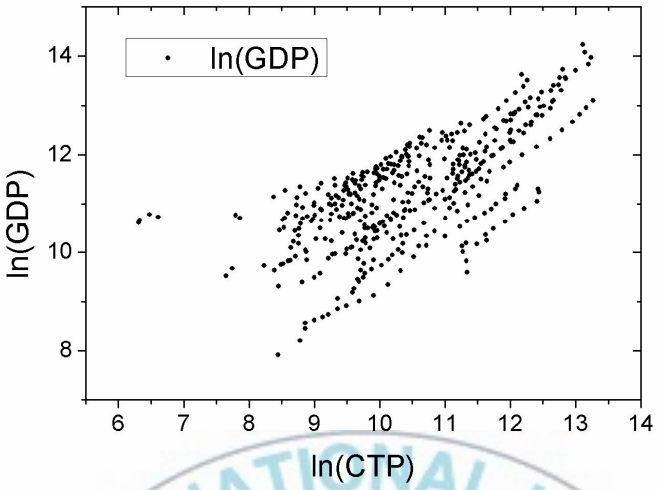

Figure 5-12 Plot of ln(GDP) versus ln(CTP)

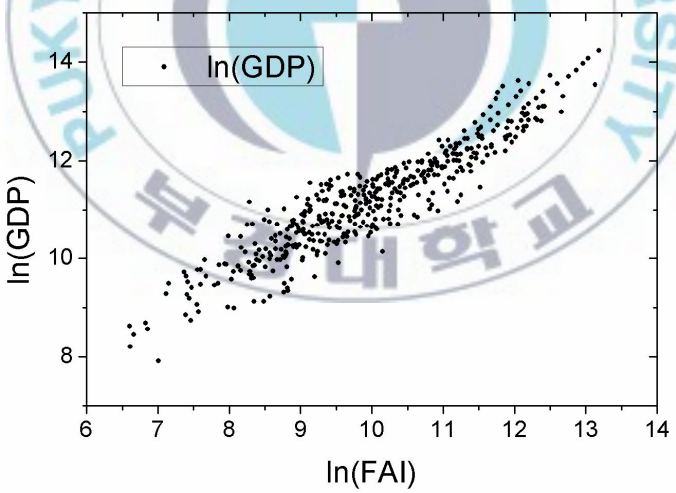

Figure 5-13 Plot of ln(GDP) versus ln(FAI)

5.3 Panel data model estimation

5.3.1 Fixed effects and GLS estimation

For our data, the cross section number (30) is greater than period section number (15). In order to make sure the statistic of the data, and therefore the effective of the regression, the one order difference of the natural logarithm values of the data are used as the variables for our productivity functions, namely Δln(GDP), Δln(CTP), Δln(FDI), Δln(FAI), Δln(CPN), in which Δln(Xit) Xit= GDP, CTP, FDI, FAI, CPN are defined as

$$\Delta \ln(X_{it}) = \ln(X_{it}) - \ln(X_{i(t-1)}). \quad 5.1$$

On the basis of Cobb-Douglas production function, the port-city is considered as an organization, the port production as the output of the organization and the city factors as factors of production. Given:

$$\Delta \ln(CTP)_{it} = C + \alpha_i \Delta \ln(GDP)_{it} + \beta_i \Delta \ln(FAI)_{it} + \gamma_i \Delta \ln(CPN)_{it} + \lambda_i \Delta \ln(FDI)_{it} + u_{it} \ (i = 1, \ldots, N, t = 1, \ldots, T) \quad 5.2$$

in which $\alpha_i, \beta_i, \gamma_i, \lambda_i$ are $1 \times K$ vectors of constants that vary across i and t, and uit is the error term. We have conducted the cross section fixed effects (CSFE) model, cross period effects (CPE) model and GLS period SUR model to do the regression analysis. The results are listed in Table

5-1. It indicates that GDP has no significant impact on CTP when CSFE and CPE models are used. This might because that there are period heteroskedasticity and general correlation of observations within a given cross-section. Since the SUR model can correct both factors, the SUR model is finally used to conduct the estimation.

Table 5-1 Regression analysis results

Dependent Variable	Explanatory Variable	Coefficient	Model
△lnCTP	C	0.078*	CSFE
	△lnGDP	0.190	
	△lnFAI	0.175**	
	△lnFDI	-0.062**	
	△lnCPN	0.085	
△lnCTP	C	0.114***	CPE
	△lnGDP	0.314	
	△lnFAI	0.257***	
	△lnFDI	-0.065**	
	△lnCPN	-0.046	
△lnCTP	C	0.096***	SUR
	△lnGDP	0.453***	
	△lnFAI	0.099***	
	△lnFDI	-0.029**	
	△lnCPN	-0.006	

***,**and * denotes statistical significance at 1% ,5% and 10%level

On the basis of Cobb-Douglas production function, the port-city's GDP can be presented as the productivity function:

$$\Delta \ln(GDP)_{it} = C + \alpha_i \Delta \ln(CPT)_{it} + \beta_i \Delta \ln(FAI)_{it} + \gamma_i \Delta \ln(CPN)_{it} + \lambda_i \Delta \ln(FDI)_{it} + u_{it} \ (i = 1, \ldots, N, t = 1, \ldots, T) \quad 5.3$$

in which $\alpha_i, \beta_i, \gamma_i, \lambda_i$ are $1 \times K$ vectors of constants that vary across i and t, and u_{it} is the error term. We have also conducted the CSFE model, CPE model and SUR model to do the regression analysis. The results are listed in Table 5-2. It also indicates that there are period heteroskedasticity and general correlation of observations within a given cross-section, and the SUR model should be used to do the estimation again.

Table 5-2 Regression analysis results

Dependent Variable	Explanatory Variable	Coefficient	Model
△lnGDP	C	0.139***	CSFE
	△lnCTP	0.009	
	△lnFAI	0.005	
	△lnFDI	0.007	
	△lnCPN	-0.025	
△lnGDP	C	0.128***	CPE
	△lnCTP	0.013	
	△lnFAI	0.045***	
	△lnFDI	0.008	
	△lnCPN	0.005	
△lnGDP	C	0.132***	SUR
	△lnCTP	0.024**	
	△lnFAI	0.014*	
	△lnFDI	0.006**	
	△lnCPN	-0.034	

***,**and * denotes statistical significance at 1% ,5% and 10%level.

5.3.2 Panel Long-Run Estimators

In order to explore the impact of CTP on GDP of the cities of different economic development level, we choose 3 groups of the cities and conduct the panel long-run estimation within each group respectively. The grouping of cities is showed in Table 5-3.

Prior to testing for cointegration among lnGDP, lnCTP, lnFAI, lnFDI and lnCPN, it must be ensured that the variables are integrated of the same order. Table5-4 presents the results of panel unit root tests, including five test statistics calculated for each variable. In general, all variables are non-stationary. Then, the differenced data is stationary, thereby suggesting that all series in our analysis are integrated of order one. Thus, the evidence implies that the application of OLS (GLS) to the productivity function will result in biased and inconsistent estimates. For this reason, panel cointegration techniques must be utilized in order to determine whether a long-run equilibrium relationship exists among the non-stationary variables in level form.

The results of the panel cointegration tests proposed by Podroni (1999, 2004) are shown in Table 5-5. As is evidenced, the chi-square test statistics indicate that there exists a cointegrating vector in the panel

system.

Table 5-3 Grouping of cities

Big Cities	Middle Cities	Small Cities
SH	QZ	QH
GZ	WZ	YK
SZ	TZ	ZH
TJ	FZ	FC

Table 5-4 Panel unit root test

	Method	lnGDP	lnFDI	lnFAI	lnCTP	lnCPN
Big Cities	Levin, Lin & Chu t*	1.544	0.199	-7.952***	1.216	-2.154**
	Breitung t-stat	-2.954***	-1.128	0.315	1.342	1.060
	ADF - Fisher Chi-square	10.236	4.646	37.673***	6.545	8.246
	PP - Fisher Chi-square	26.781***	13.623*	26.765***	10.599	8.070
	Hadri Z-stat	3.961***	2.495***	3.409***	3.483***	4.420***
Middle Cities	Levin, Lin & Chu t*	1.743	-1.186	-4.693***	0.109	1.515
	Breitung t-stat	-0.971	-2.007**	-1.257	-2.387***	-0.828
	ADF - Fisher Chi-square	13.059	8.649	20.402***	7.385	5.567
	PP - Fisher Chi-square	32.121***	5.423	21.363***	7.960	18.156**
	Hadri Z-stat	2.393***	1.690**	1.280	1.542*	2.067**
Small Cities	Levin, Lin & Chu t*	0.074	-0.392	-1.205	-2.312**	-1.190
	Breitung t-stat	-1.154	-2.591***	1.491	0.654	1.962
	ADF - Fisher Chi-square	5.827	8.424	4.175	9.810	6.327
	PP - Fisher Chi-square	1.432	6.993	7.169	19.023**	6.945
	Hadri Z-stat	3.226***	1.411**	4.474***	3.835***	3.999***
One-order	difference					

Big Cities	Levin, Lin & Chu t*	-3.29012***	0.01797	-8.8916***	0.30575	-3.577***
	Breitung t-stat	-3.18644***	-1.95618***	-6.10262***	-1.03007	-2.942***
	ADF - Fisher Chi-square	25.1499***	16.6905***	44.0497***	10.8463	15.633**
	PP - Fisher Chi-square	49.2607***	52.3238***	25.8138***	27.3825***	12.580
	Hadri Z-stat	1.84958**	0.95211	0.69078	2.43452***	1.292*
Middle Cities	Levin, Lin & Chu t*	-1.82196**	-3.41429***	-7.27537***	-0.33425	0.27286
	Breitung t-stat	-2.52085***	-2.35194***	-5.14794***	-1.06707	-1.66255**
	ADF - Fisher Chi-square	20.4275***	19.5221**	37.9202***	11.2802	14.8856*
	PP - Fisher Chi-square	42.9189***	37.0289***	47.2104***	28.4718***	38.685***
	Hadri Z-stat	0.85717	0.22406	1.30871*	-0.32564	0.90419
Small Cities	Levin, Lin & Chu t*	-0.45407	-0.44496	-3.38626***	-1.14915	-0.5883
	Breitung t-stat	-0.4379	-1.68995**	-2.72682***	-2.13564**	-0.50417
	ADF - Fisher Chi-square	8.80537	15.4142*	21.7844***	18.311**	7.85896
	PP - Fisher Chi-square	9.15048	38.7242***	30.1792***	37.6847***	19.6655***
	Hadri Z-stat	0.59965	-0.43336	3.52541***	2.14087**	2.78858***

LLC refers to Levin et al. (2002). IPS indicates Im et al. (2003). Fisher-ADF and Fisher-PP represent the Maddala and Wu (1999) and Choi (2001) panel unit root tests, respectively. ***,**and * denotes statistical significance at 1% ,5% and 10%level;

Table 5-5 Panel cointegration test

Group	Test method	Statistic (With Trend)	Statistic (Without Trend)
Big Cities	Panel v-Statistic[a]	5.624***	-0.431535
	Panel rho-Statistic[a]	0.899	0.932922
	Panel PP-Statistic[a]	-6.946***	-1.056805
	Panel ADF-Statistic[a]	-1.389***	1.749605
	Group rho-Statistic[b]	1.648	1.529557
	Group PP-Statistic[b]	-6.931***	-1.833806**
	Group ADF-Statistic[b]	-1.052***	2.347344
Middle Cities	Panel v-Statistic[a]	0.272	0.147114
	Panel rho-Statistic[a]	1.544	0.885947
	Panel PP-Statistic[a]	-2.056***	-1.540609*
	Panel ADF-Statistic[a]	2.357***	0.4813
	Group rho-Statistic[b]	1.721	1.239137
	Group PP-Statistic[b]	-5.963***	-3.990783***
	Group ADF-Statistic[b]	0.878***	-0.417862
Small Cities	Panel v-Statistic[a]	-0.940	-0.587879
	Panel rho-Statistic[a]	1.319	1.272313
	Panel PP-Statistic[a]	-1.901***	0.435383
	Panel ADF-Statistic[a]	-0.395***	0.987194
	Group rho-Statistic[b]	2.432	2.299966
	Group PP-Statistic[b]	-1.662***	1.032588
	Group ADF-Statistic[b]	-0.358*	1.137422

Pedroni statistics test the following hypothesis; H_0: All of the individuals of the panel are not cointegrated. H_1: A significant portion of the individuals are cointegrated. ***,**and * denotes statistical significance at 1% ,5% and 10%level; [a]within-dimension; [b]between-dimension.

Given the evidence that GDP, CTP, FAI, FDI and CPN may be cointegrated, we estimate cointegrating coefficients in order to investigate the long-run relationship among them. We apply the between-dimension methods to do the estimations. Table 5-6 provides the results of the panel FMOLS Tests.

Table 5-6 Panel estimates: between-dimension FMOLS

Group	Variables	Coefficient
Big Cities	CTP	0.278***
	FAI	0.253***
	FDI	0.070*
	CPN	6.548***
Middle Cities	CTP	0.110***
	FAI	0.010*
	FDI	0.093***
	CPN	14.926***
Small Cities	CTP	0.177***
	FAI	0.105**
	FDI	0.079***
	CPN	1.390***

***,**and * denotes statistical significance at 1% ,5% and 10%level.

Chapter 6 Conclusion and Implication

In order to explore the economic relationship between the ports and the port-cities in China, we have collected the economic and social data of 30 ports and port-cities during the past 15 years. By using a panel data regression analysis, we have studied three issues: first, the estimation of the long run relationship between the ports and port-cities has also been conducted; second, the impact of port-cities' GDP, FAI, FDI and population on the port CTP; and last, the impact of port CTP, port-cities' FAI, FDI and population on the port-cities' GDP.

The regression analyses indicate that neither the fixed effect model nor the random effect model is appropriate for our analysis because there are period heteroskedasticity and general correlation within a given cross-section. By using the Period SUR, the two factors can be corrected and the reasonable results can be obtained.

All the regression analyses were conducted on the basis of the model for port-city growth. The economic and social factors were connected by the Cobb-Douglas production function with a general formulation of Eq.3.3. The results suggest: First, there is a long run relationship between

the ports and the port-cities in China. Second, FDI, FAI and GDP do have an impact on the port CTP at a significance level of 0.05. GDP is the most remarkable factor that have effects on the CTP, followed by FAI and FDI. The city population, which refers to the labor force of the port-city, has no significant effect on the throughput of the port. Third, CTP and FDI pose an effect on GDP at a significance level of 0.05, and FAI at a significance level of 0.1. The most remarkable factor, which has effect on GDP growth, is CTP, followed by FAI and FDI.

In this work, the growth of port is qualified by port-city's activities. Two models for economic production are developed to study the economic relationship between port-cities. It's identified that the city economy is the most significant contributor to the port production growth. Port-cities are the direct economic hinterland of ports, the economic growth of port-cities will provide more supply for the port cargo and increase the throughput, and also providing a solid material foundation for the development of the port.

The contribution of the labor force to port production and port-city's GDP is not significant in short-term. The empirical results are consistent with the actual situation in China's economy. China is a country with large population, a relative surplus manpower, the capital is relatively scarcity.

Among the impact factors on the city's GDP, CTP is the most remarkable one, followed by FAI and FDI. This might because that China economy is a type of investment driven, therefore port production has a significant impact on GDP. Our study offers a theoretical support to the massive investment in the development of port industry in China.

Although it is evidenced from our study that the port economy and city economy promote each other, while there might be some problems in the process of port development in China currently. For some port-cities, the well development of the port is simply considered to a continuous growth of CTP. The competition among the ports is simplified into a fighting on the source of goods by reducing the price. The economic and social impacts of the ports on the port-cities are ignored. In fact, ports are economic units, which provide a transfer service. The continuing expansion of CTP at the cost of a reducing of benefic to the economic development will finally bring more and more negative impacts on the society and environment.

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Appendix

Table A-1 Port name, city name and their code.

	Port name	City name	Code
1	SHANGHAI	SHANGHAI	SH
2	NINGBO	NINGBO	NB
3	GUANGZHOU	GUANGZHOU	GZ
4	TIANJIN	TIANJIN	TJ
5	QINGDAO	QINGDAO	QD
6	DALIAN	DALIAN	DL
7	QINHAUNGDAO	QINHAUNGDAO	QH
8	SHENZHEN	SHENZHEN	SZ
9	RIZHAO	RIZHAO	RZ
10	YINGKOU	YINGKOU	YK
11	FUZHOU	FUZHOU	FZ
12	LIANYUNGANG	LIANYUNGANG	LY
13	XIAMEN	XIAMEN	XM
14	ZHANJIANG	ZHANJIANG	ZJ
15	YANTAI	YANTAI	YT
16	ZHUHAI	ZHUHAI	ZH
17	WENZHOU	WENZHOU	WZ
18	HAIKOU	HAIKOU	HK
19	FANGCHENGGANG	FANGCHENGGANG	FC
20	SHANTOU	SHANTOU	ST
21	DANDONG	DANDONG	DD
22	JINZHOU	JINZHOU	JZ
23	TANGSHAN	TANGSHAN	TS
24	HUANGHUA	CANGZHOU	HH
25	JIAXING	JIAXING	JX
26	TAIZHOU	TAIZHOU	TZ

27	HUIZHOU	HUIZHOU	HZ
28	ZHONGSHAN	ZHONGSHAN	ZS
29	MAOMING	MAOMING	MM
30	QUANZHOU	QUANZHOU	QZ

Table A-2 The data after taking natural logarithms

City-Year	ln(CTP)	ln(GDP)	ln(FAI)	ln(CPN)	ln(FDI)
DD-1995		9.282	7.116	7.775	5.004
DD-1996		9.469	7.597	7.780	5.335
DD-1997		9.601	8.342	7.781	7.742
DD-1998	7.745	9.675	8.285	7.785	6.509
DD-1999	8.230	9.732	8.063	7.785	5.632
DD-2000	8.489	9.754	8.163	7.787	5.720
DD-2001	8.598	9.827	8.509	7.787	6.126
DD-2002	8.710	9.925	8.274	7.789	6.446
DD-2003	8.865	10.044	8.787	7.788	6.717
DD-2004	9.262	10.239	9.078	7.787	6.535
DD-2005	9.620	10.375	9.400	7.793	6.234
DD-2006	9.907	10.544	9.670	7.794	6.814
DD-2007	10.170	10.698	10.012	7.795	6.999
DD-2008	10.392	10.883	10.412	7.794	7.655
DD-2009	10.681	11.022	10.811	7.794	8.144
DL-1995	11.069	10.917	9.349	8.584	8.525
DL-1996	11.071	11.123	9.488	8.589	8.950
DL-1997	11.163	11.298	9.709	8.595	9.271
DL-1998	11.227	11.444	9.698	8.600	9.243
DL-1999	11.351	11.530	9.365	8.604	9.196
DL-2000	11.417	11.614	9.424	8.615	9.284
DL-2001	11.518	11.718	10.132	8.621	9.389
DL-2002	11.595	11.862	10.332	8.627	9.501
DL-2003	11.744	11.991	10.822	8.631	9.803
DL-2004	11.886	12.149	11.141	8.633	9.773
DL-2005	12.049	12.261	11.600	8.640	10.078
DL-2006	12.208	12.442	11.883	8.652	9.790
DL-2007	12.314	12.607	12.124	8.663	10.068
DL-2008	12.413	12.806	12.377	8.671	10.450

DL-2009	12.514	12.990	12.656	8.674	10.629
FC-1995	8.443	7.915	7.006	6.603	4.855
FC-1996	8.780	8.207	6.610	6.617	5.430
FC-1997	8.864	8.454	6.662	6.627	5.642
FC-1998	8.864	8.564	6.857	6.634	6.075
FC-1999	8.997	8.620	6.606	6.648	5.420
FC-2000	9.130	8.684	6.829	6.637	5.710
FC-2001	9.213	8.736	7.462	6.656	5.684
FC-2002	9.361	8.851	7.388	6.663	5.144
FC-2003	9.488	8.919	7.574	6.670	5.375
FC-2004	9.685	9.009	7.981	6.683	3.908
FC-2005	9.907	9.123	8.348	6.682	5.753
FC-2006	10.129	9.341	8.824	6.712	5.979
FC-2007	10.320	9.628	9.198	6.725	6.093
FC-2008	10.519	9.905	9.532	6.742	5.862
FC-2009	10.714	10.138	10.150	6.768	5.609
FZ-1995	9.242	10.664	8.856	8.635	8.917
FZ-1996	9.431	10.971	9.130	8.648	8.920
FZ-1997	9.526	11.201	9.921	8.657	8.972
FZ-1998	9.463	11.375	10.064	8.665	8.928
FZ-1999	9.603	11.469	10.021	8.671	8.931
FZ-2000	10.097	11.512	9.290	8.681	8.795
FZ-2001	10.296	11.578	9.935	8.690	9.016
FZ-2002	10.573	11.670	10.322	8.695	9.123
FZ-2003	10.769	11.799	10.647	8.708	9.273
FZ-2004	10.992	11.912	10.833	8.715	9.291
FZ-2005	11.216	11.885	10.990	8.724	8.532
FZ-2006	11.391	12.007	11.187	8.737	8.567
FZ-2007	11.072	12.146	11.468	8.749	8.560
FZ-2008	11.117	12.282	11.678	8.758	8.840
FZ-2009	11.300	12.477	12.019	8.761	8.868

GZ-1995	11.198	11.573	10.252	8.775	9.631
GZ-1996	11.219	11.801	10.352	8.789	9.900
GZ-1997	11.228	11.984	11.065	8.805	9.902
GZ-1998	11.273	12.132	11.245	8.816	10.029
GZ-1999	11.529	12.248	11.397	8.832	10.130
GZ-2000	11.620	12.422	10.944	8.855	10.112
GZ-2001	11.762	12.550	11.484	8.871	10.113
GZ-2002	11.940	12.685	11.530	8.883	9.855
GZ-2003	12.055	12.825	11.662	8.889	9.957
GZ-2004	12.279	12.968	11.774	8.906	9.859
GZ-2005	12.431	13.135	11.913	8.923	9.952
GZ-2006	12.621	13.302	12.027	8.937	10.054
GZ-2007	12.741	13.419	12.088	8.954	10.106
GZ-2008	12.756	13.562	12.200	8.967	10.126
GZ-2009	12.805	13.732	12.498	8.980	10.165
HH-1995		9.973	7.659	8.763	5.177
HH-1996		10.282	8.823	8.767	5.472
HH-1997		10.490	9.160	8.777	5.684
HH-1998	6.310	10.612	8.972	8.785	5.966
HH-1999	6.328	10.666	9.511	8.794	6.346
HH-2000	6.607	10.735	8.906	8.808	6.571
HH-2001	6.477	10.787	8.887	8.815	6.237
HH-2002	9.713	10.889	9.585	8.821	4.974
HH-2003	10.358	11.037	9.778	8.825	6.533
HH-2004	10.736	11.219	10.070	8.824	6.498
HH-2005	11.122	11.618	10.458	8.832	7.042
HH-2006	11.308	11.746	10.718	8.841	6.987
HH-2007	11.331	11.848	10.986	8.854	7.060
HH-2008	11.287	11.996	11.223	8.868	7.011
HH-2009	11.336	12.108	11.618	8.878	7.034
HK-1995		8.988	8.065	6.180	8.032

HK-1996		9.119	8.489	6.213	7.645
HK-1997		9.227	8.575	6.242	7.776
HK-1998	8.455	9.316	8.764	6.269	8.359
HK-1999	8.816	9.394	8.820	6.299	8.077
HK-2000	8.997	9.495	8.773	6.352	7.959
HK-2001	9.092	9.572	8.876	6.400	7.470
HK-2002	9.281	9.964	9.027	6.460	7.598
HK-2003	9.495	10.066	9.232	7.238	7.725
HK-2004	9.558	10.100	9.348	7.266	7.844
HK-2005	9.961	10.296	9.509	7.295	8.008
HK-2006	9.965	10.448	9.654	7.477	8.175
HK-2007	10.074	10.541	9.761	7.333	8.230
HK-2008	10.171	10.673	9.937	7.351	8.259
HK-2009	10.215	10.817	10.236	7.367	8.403
HZ-1995		9.887	7.935	7.847	8.643
HZ-1996		10.131	8.228	7.864	8.850
HZ-1997		10.355	8.652	7.888	8.962
HZ-1998	8.533	10.505	8.714	7.901	8.999
HZ-1999	8.790	10.592	8.818	8.246	9.019
HZ-2000	8.976	10.689	8.950	7.930	8.835
HZ-2001	9.007	10.773	9.034	7.939	10.031
HZ-2002	9.116	10.877	9.265	7.948	9.108
HZ-2003	9.263	10.975	10.025	7.960	9.351
HZ-2004	9.692	11.097	10.263	7.984	8.525
HZ-2005	9.450	11.276	10.452	7.998	9.019
HZ-2006	9.944	11.431	10.323	8.028	9.025
HZ-2007	9.995	11.566	10.746	8.048	9.122
HZ-2008	10.110	11.711	10.926	8.067	9.141
HZ-2009	10.451	11.867	11.244	8.084	9.170
JX-1995		10.220	8.171	8.091	6.345
JX-1996		10.470	8.647	8.096	6.837

JX-1997		10.617	9.549	8.100	7.082
JX-1998	7.863	10.711	9.765	8.101	6.920
JX-1999	7.796	10.776	9.445	8.102	6.940
JX-2000	9.094	10.895	9.792	8.105	7.141
JX-2001	9.229	11.002	9.857	8.108	7.707
JX-2002	9.333	11.173	9.973	8.109	8.296
JX-2003	9.494	11.348	10.858	8.111	8.783
JX-2004	9.510	11.524	11.019	8.114	9.005
JX-2005	9.743	11.643	11.143	8.115	9.124
JX-2006	10.020	11.796	11.275	8.118	9.181
JX-2007	10.093	11.927	11.361	8.122	6.999
JX-2008	10.252	12.052	11.462	8.126	9.146
JX-2009	10.459	12.171	11.730	8.130	9.125
JZ-1995	7.650	9.526	7.416	8.009	5.194
JZ-1996	8.385	9.637	7.675	8.015	5.663
JZ-1997	8.525	9.769	7.555	8.018	6.177
JZ-1998	8.632	9.842	8.127	8.020	5.167
JZ-1999	8.886	9.849	8.125	8.024	4.687
JZ-2000	9.216	9.879	7.960	8.028	6.194
JZ-2001	9.315	9.976	8.384	8.030	6.760
JZ-2002	9.576	10.106	8.568	8.030	6.902
JZ-2003	9.745	10.234	8.903	8.031	6.979
JZ-2004	10.109	10.405	8.844	8.032	5.973
JZ-2005	10.310	10.533	9.123	8.034	6.267
JZ-2006	10.360	10.722	9.392	8.037	6.633
JZ-2007	10.467	10.870	9.680	8.037	6.986
JZ-2008	10.763	11.085	10.064	8.040	7.671
JZ-2009	10.870	11.202	10.393	8.040	7.837
LY-1995	9.750	9.492	7.842	8.188	6.207
LY-1996	9.670	9.874	7.857	8.373	6.457
LY-1997	9.712	10.052	8.760	8.383	6.751

LY-1998	9.785	10.192	8.515	8.397	6.757
LY-1999	9.912	10.272	8.832	8.408	5.971
LY-2000	10.207	10.275	8.981	8.424	5.975
LY-2001	10.328	10.353	9.274	8.433	6.164
LY-2002	10.409	10.357	9.528	8.443	6.728
LY-2003	10.533	10.454	9.952	8.451	7.460
LY-2004	10.681	10.599	10.074	8.453	7.583
LY-2005	11.005	10.710	10.367	8.460	7.686
LY-2006	11.189	10.858	10.640	8.475	7.919
LY-2007	11.352	10.985	10.929	8.481	7.562
LY-2008	11.519	11.168	11.204	8.493	8.772
LY-2009	11.642	11.459	11.520	8.498	8.876
MM-1995		10.141	9.242	8.651	5.640
MM-1996		10.385	9.130	8.668	7.861
MM-1997		10.559	8.982	8.683	6.371
MM-1998	8.511	10.671	9.169	8.711	6.345
MM-1999	8.893	10.744	9.042	8.730	6.264
MM-2000	9.263	10.798	8.903	8.772	6.303
MM-2001	9.340	10.890	9.053	8.787	6.363
MM-2002	9.317	10.998	9.140	8.797	6.609
MM-2003	9.443	11.081	9.136	8.807	6.717
MM-2004	9.553	11.187	9.357	8.811	6.147
MM-2005	9.518	11.282	9.571	8.824	5.731
MM-2006	9.623	11.418	9.757	8.856	5.463
MM-2007	9.727	11.490	9.431	8.877	5.922
MM-2008	9.810	11.653	9.530	8.890	5.950
MM-2009	9.965	11.728	9.805	8.903	5.365
NB-1995	11.135	11.014	9.132	8.740	8.054
NB-1996	10.745	11.304	9.614	8.746	8.342
NB-1997	11.317	11.472	10.391	8.751	8.482
NB-1998	11.375	11.586	10.445	8.754	8.526

NB-1999	11.478	11.661	9.837	8.759	8.383
NB-2000	11.901	11.745	10.212	8.763	8.745
NB-2001	11.991	11.852	10.480	8.766	9.067
NB-2002	12.179	11.998	10.704	8.770	9.409
NB-2003	12.399	12.162	11.434	8.774	9.673
NB-2004	12.610	12.325	11.676	8.779	9.801
NB-2005	12.792	12.499	11.899	8.785	9.849
NB-2006	12.953	12.664	12.041	8.790	9.910
NB-2007	13.064	12.812	12.096	8.797	7.300
NB-2008	13.162	12.950	12.182	8.802	9.889
NB-2009	13.267	13.102	12.398	8.807	9.834
QD-1995	10.845	10.912	9.018	8.832	8.516
QD-1996	11.003	11.091	9.607	8.840	8.719
QD-1997	11.144	11.259	8.948	8.847	8.815
QD-1998	11.159	11.403	9.883	8.853	8.785
QD-1999	11.192	11.520	10.016	8.858	8.963
QD-2000	11.366	11.684	10.093	8.863	9.266
QD-2001	11.552	11.820	10.280	8.869	9.483
QD-2002	11.713	11.981	10.522	8.876	9.867
QD-2003	11.856	12.127	11.199	8.883	10.044
QD-2004	11.999	12.295	11.500	8.897	10.318
QD-2005	12.138	12.487	11.871	8.911	10.275
QD-2006	12.320	12.663	11.894	8.922	10.278
QD-2007	12.488	12.798	11.958	8.933	10.253
QD-2008	12.613	12.945	12.158	8.938	9.811
QD-2009	12.662	13.100	12.420	8.940	9.620
QH-1995	11.336	9.596	8.314	7.863	6.538
QH-1996	11.328	9.829	8.811	7.868	7.494
QH-1997	11.272	10.019	9.032	7.870	7.300
QH-1998	11.263	10.133	8.795	7.875	7.400
QH-1999	11.322	10.191	8.651	7.880	7.268

QH-2000	11.487	10.174	8.421	7.887	7.113
QH-2001	11.635	10.250	8.798	7.894	6.585
QH-2002	11.623	10.363	9.187	7.903	6.747
QH-2003	11.741	10.484	9.340	7.913	7.141
QH-2004	11.921	10.631	9.522	7.922	7.382
QH-2005	12.038	10.784	9.693	7.933	7.538
QH-2006	12.215	10.904	9.946	7.939	7.658
QH-2007	12.412	11.058	10.089	7.949	7.838
QH-2008	12.438	11.244	10.264	7.958	7.926
QH-2009	12.427	11.303	10.655	7.963	8.054
QZ-1995	8.825	10.699	8.251	8.742	8.600
QZ-1996	8.992	10.970	9.062	8.772	8.684
QZ-1997	9.216	11.193	9.326	8.780	8.748
QZ-1998	9.316	11.375	9.590	8.786	8.684
QZ-1999	9.630	11.478	9.913	8.792	8.472
QZ-2000	9.748	11.553	9.137	8.787	8.545
QZ-2001	9.953	11.624	10.011	8.790	8.793
QZ-2002	9.963	11.722	9.661	8.793	9.013
QZ-2003	10.131	11.823	10.223	8.799	9.003
QZ-2004	10.340	11.947	10.450	8.803	9.072
QZ-2005	10.608	11.981	10.649	8.806	9.161
QZ-2006	10.846	12.140	10.794	8.810	8.898
QZ-2007	11.037	12.292	11.102	8.816	8.998
QZ-2008	11.188	12.451	11.303	8.821	9.370
QZ-2009	11.247	12.642	11.496	8.826	9.379
RZ-1995	9.583	9.188	7.438	7.895	5.637
RZ-1996	9.665	9.455	7.797	7.901	6.275
RZ-1997	9.711	9.635	7.394	7.907	6.342
RZ-1998	9.755	9.778	7.596	7.915	7.244
RZ-1999	9.905	9.843	8.335	7.921	6.683
RZ-2000	10.194	9.946	8.423	7.923	6.807

RZ-2001	10.286	10.055	8.589	7.926	7.051
RZ-2002	10.353	10.179	8.733	7.929	6.144
RZ-2003	10.716	10.335	9.470	7.932	6.990
RZ-2004	10.841	10.431	9.597	7.939	6.750
RZ-2005	11.341	10.643	10.049	7.944	7.156
RZ-2006	11.609	10.817	10.050	7.946	6.983
RZ-2007	11.780	11.003	10.375	7.949	7.445
RZ-2008	11.926	11.198	10.799	7.954	8.171
RZ-2009	12.108	11.375	11.061	7.958	7.860
SH-1995	12.018	12.256	11.337	9.474	10.047
SH-1996	12.008	12.499	11.542	9.476	10.960
SH-1997	12.007	12.697	12.167	9.477	10.564
SH-1998	12.007	12.826	12.196	9.478	10.321
SH-1999	12.136	12.922	12.146	9.483	10.150
SH-2000	12.228	13.072	12.135	9.489	10.168
SH-2001	12.306	13.157	12.197	9.493	10.494
SH-2002	12.483	13.269	12.304	9.499	10.645
SH-2003	12.664	13.402	12.398	9.504	10.776
SH-2004	12.845	13.563	12.601	9.512	10.861
SH-2005	13.002	13.710	12.760	9.518	10.902
SH-2006	13.195	13.837	12.865	9.524	10.942
SH-2007	13.238	13.967	12.961	9.532	10.068
SH-2008	13.138	14.073	13.030	9.540	11.150
SH-2009	13.112	14.231	13.183	9.547	11.192
ST-1995	8.876		8.772	8.297	8.649
ST-1996	9.026		8.930	8.312	8.856
ST-1997	9.087		9.051	8.326	8.929
ST-1998	9.109		8.880	8.338	8.969
ST-1999	9.385		8.897	8.410	8.626
ST-2000	9.460		8.675	8.431	7.219
ST-2001	9.480	10.693	9.233	8.437	7.285

ST-2002	9.532	10.743	9.296	8.475	7.185
ST-2003	9.596	10.805	9.374	8.486	7.409
ST-2004	9.665	10.915	9.450	8.492	6.436
ST-2005	9.761	11.066	9.636	8.500	6.736
ST-2006	9.911	11.193	9.765	8.508	7.012
ST-2007	10.043	11.304	9.891	8.519	7.154
ST-2008	10.226	11.430	10.114	8.530	7.199
ST-2009	10.341	11.555	10.289	8.538	7.248
SZ-1995	9.371	11.127	9.508	6.899	9.138
SZ-1996	10.316	11.382	9.753	6.941	9.829
SZ-1997	10.421	11.608	10.503	6.998	9.501
SZ-1998	10.447	11.775	10.733	7.044	9.539
SZ-1999	10.750	11.889	10.920	7.089	9.611
SZ-2000	10.950	12.292	10.989	7.130	9.691
SZ-2001	11.104	12.415	11.070	7.186	9.966
SZ-2002	11.381	12.609	11.298	7.240	10.190
SZ-2003	11.628	12.778	11.449	7.319	10.297
SZ-2004	11.816	12.929	11.563	7.409	10.267
SZ-2005	11.942	13.095	11.662	7.506	10.066
SZ-2006	12.077	13.258	11.740	7.585	10.166
SZ-2007	12.202	13.383	11.762	7.661	10.214
SZ-2008	12.260	13.511	11.839	7.732	10.233
SZ-2009	12.174	13.624	12.056	7.808	10.262
TJ-1995	10.966	11.272	10.034	9.101	9.287
TJ-1996	11.033	11.531	10.193	9.103	9.640
TJ-1997	11.126	11.701	10.790	9.105	9.915
TJ-1998	11.130	11.811	10.835	9.111	9.953
TJ-1999	11.198	11.899	10.841	9.116	9.965
TJ-2000	11.469	12.041	10.884	9.118	9.957
TJ-2001	11.641	12.158	11.032	9.120	10.184
TJ-2002	11.768	12.287	11.185	9.126	10.366

TJ-2003	11.994	12.448	11.547	9.134	9.500
TJ-2004	12.237	12.610	11.705	9.141	9.888
TJ-2005	12.391	12.803	11.912	9.148	10.181
TJ-2006	12.459	12.970	12.113	9.158	10.400
TJ-2007	12.643	13.079	12.337	9.169	10.580
TJ-2008	12.783	13.305	12.681	9.179	10.843
TJ-2009	12.851	13.538	13.131	9.190	11.036
TS-1995		10.659	8.868	8.824	6.320
TS-1996		10.934	9.052	8.831	7.329
TS-1997	8.378	11.144	9.838	8.837	7.632
TS-1998	8.555	11.274	10.008	8.839	7.806
TS-1999	8.781	11.344	9.967	8.845	7.624
TS-2000	9.107	11.420	9.398	8.853	7.497
TS-2001	9.307	11.512	9.403	8.854	7.144
TS-2002	9.592	11.618	10.062	8.858	6.988
TS-2003	9.944	11.760	10.345	8.863	7.410
TS-2004	10.167	11.961	10.700	8.868	8.100
TS-2005	10.424	12.202	11.042	8.874	8.293
TS-2006	10.613	12.358	11.231	8.881	8.301
TS-2007	10.769	12.488	11.502	8.888	8.473
TS-2008	11.595	12.726	11.765	8.895	8.660
TS-2009	12.076	12.858	12.299	8.901	8.605
TZ-1995	8.466	10.459	7.989	8.575	5.571
TZ-1996	8.549	10.713	8.330	8.581	5.595
TZ-1997	8.594	10.810	9.265	8.587	5.696
TZ-1998	8.825	10.932	9.443	8.593	5.772
TZ-1999	8.998	11.025	8.771	8.600	5.900
TZ-2000	9.264	11.116	9.095	8.606	6.038
TZ-2001	9.545	11.215	9.366	8.610	6.126
TZ-2002	9.689	11.368	9.568	8.613	6.891
TZ-2003	9.587	11.496	10.549	8.617	7.476

TZ-2004	9.914	11.635	10.739	8.623	7.789
TZ-2005	9.936	11.720	10.875	8.630	7.893
TZ-2006	10.318	11.879	11.026	8.639	8.098
TZ-2007	10.408	12.009	11.148	8.647	6.877
TZ-2008	10.571	12.131	11.181	8.655	7.407
TZ-2009	10.640	12.233	11.339	8.663	7.166
WZ-1995	8.701	10.448	8.158	8.851	6.258
WZ-1996	8.718	10.760	8.566	8.860	6.405
WZ-1997	8.727	10.984	9.760	8.866	6.185
WZ-1998	8.734	11.131	9.918	8.879	5.733
WZ-1999	8.869	11.217	9.258	8.884	6.164
WZ-2000	9.058	11.317	9.807	8.904	6.387
WZ-2001	9.483	11.437	10.083	8.908	6.116
WZ-2002	9.727	11.575	10.233	8.908	6.506
WZ-2003	10.060	11.700	10.699	8.912	6.886
WZ-2004	10.177	11.813	10.796	8.918	7.418
WZ-2005	10.341	11.965	10.883	8.923	7.948
WZ-2006	10.397	12.105	11.060	8.931	8.210
WZ-2007	10.462	12.235	11.161	8.942	6.455
WZ-2008	10.654	12.341	11.179	8.952	7.499
WZ-2009	10.963	12.447	11.343	8.961	7.386
XM-1995	9.483	9.971	8.718	7.101	9.147
XM-1996	9.650	10.257	8.898	7.115	9.244
XM-1997	9.772	10.496	9.611	7.128	9.315
XM-1998	9.705	10.649	9.839	7.144	9.352
XM-1999	9.783	10.747	9.879	7.162	9.330
XM-2000	9.886	10.818	9.268	7.180	9.048
XM-2001	9.952	10.920	9.815	7.203	8.822
XM-2002	10.217	11.088	10.128	7.224	8.553
XM-2003	10.435	11.227	10.095	7.257	9.227
XM-2004	10.660	11.351	10.286	7.292	8.421

XM-2005	10.772	11.524	10.583	7.335	8.632
XM-2006	11.263	11.649	11.086	7.380	8.935
XM-2007	11.304	11.785	11.391	7.422	9.156
XM-2008	11.483	11.900	11.381	7.460	9.553
XM-2009	11.617	12.072	11.395	7.479	9.360
YK-1995	9.355	9.059	7.549	7.695	5.746
YK-1996	9.611	9.266	7.408	7.699	5.867
YK-1997	9.684	9.410	7.473	7.704	5.897
YK-1998	9.775	9.571	8.032	7.709	6.740
YK-1999	9.876	9.660	8.314	7.715	6.923
YK-2000	10.029	9.739	8.288	7.724	7.048
YK-2001	10.135	9.857	8.351	7.729	7.296
YK-2002	10.350	9.996	8.568	7.734	7.494
YK-2003	10.599	10.129	9.234	7.737	7.474
YK-2004	10.998	10.330	9.629	7.740	7.170
YK-2005	11.230	10.530	9.986	7.743	6.432
YK-2006	11.459	10.717	10.261	7.745	6.686
YK-2007	11.712	10.902	10.593	7.751	6.877
YK-2008	11.924	11.104	10.845	7.757	7.701
YK-2009	12.078	11.306	11.249	7.762	8.153
YT-1995	9.519	10.803	8.494	8.756	8.237
YT-1996	9.568	11.003	8.544	8.762	8.201
YT-1997	9.655	11.164	8.282	8.766	8.014
YT-1998	9.623	11.220	9.104	8.769	8.249
YT-1999	9.709	11.305	9.227	8.772	7.878
YT-2000	9.784	11.384	9.306	8.773	8.315
YT-2001	9.994	11.486	9.835	8.773	8.645
YT-2002	10.200	11.630	10.227	8.775	9.216
YT-2003	10.287	11.776	11.196	8.773	9.727
YT-2004	10.443	11.969	11.556	8.775	9.602
YT-2005	10.716	12.194	11.874	8.776	9.914

YT-2006	11.015	12.374	11.963	8.780	9.749
YT-2007	11.787	12.524	11.940	8.782	9.075
YT-2008	11.898	12.689	12.129	8.782	8.895
YT-2009	12.039	12.829	12.318	8.783	8.918
ZH-1995		9.741	8.617	6.450	8.251
ZH-1996		9.860	8.357	6.483	8.437
ZH-1997		10.038	8.471	6.512	8.510
ZH-1998	8.761	10.187	9.179	6.544	9.131
ZH-1999	9.169	10.277	9.381	6.571	8.750
ZH-2000	9.425	10.401	8.592	6.605	8.813
ZH-2001	9.894	10.504	9.251	6.632	8.869
ZH-2002	10.047	10.631	9.405	6.667	8.670
ZH-2003	10.115	10.760	9.542	6.710	8.949
ZH-2004	10.377	10.870	9.759	6.759	8.310
ZH-2005	10.444	11.040	9.974	6.798	8.572
ZH-2006	10.497	11.210	10.140	6.831	8.788
ZH-2007	10.534	11.346	10.402	6.864	8.945
ZH-2008	10.599	11.448	10.468	6.903	8.972
ZH-2009	10.697	11.558	10.630	6.934	9.003
ZJ-1995	9.850	10.092	8.374	8.706	7.182
ZJ-1996	9.781	10.298	8.362	8.726	7.061
ZJ-1997	9.928	10.431	8.804	8.744	6.702
ZJ-1998	9.822	10.497	9.072	8.759	6.775
ZJ-1999	9.771	10.559	9.022	8.791	6.447
ZJ-2000	9.922	10.525	8.943	8.846	6.605
ZJ-2001	10.001	10.591	9.039	8.855	6.742
ZJ-2002	10.176	10.667	9.173	8.864	6.834
ZJ-2003	10.263	10.775	9.331	8.873	7.295
ZJ-2004	10.540	10.880	9.579	8.876	6.343
ZJ-2005	10.747	11.077	9.783	8.879	5.733
ZJ-2006	11.311	11.237	9.922	8.905	6.041

ZJ-2007	11.426	11.352	10.051	8.916	7.029
ZJ-2008	11.553	11.503	10.236	8.928	7.089
ZJ-2009	11.682	11.666	10.587	8.940	5.305
ZS-1995		9.492	7.153	7.133	8.070
ZS-1996		9.725	7.372	7.146	8.252
ZS-1997		9.976	8.670	7.157	8.312
ZS-1998	8.638	10.100	8.807	7.171	8.446
ZS-1999	8.678	10.228	8.947	7.816	8.488
ZS-2000	8.756	10.347	9.301	7.199	8.586
ZS-2001	8.764	10.491	9.780	7.207	8.710
ZS-2002	8.955	10.643	10.002	7.216	8.581
ZS-2003	9.601	10.811	10.162	7.229	8.954
ZS-2004	9.883	10.981	10.241	7.240	8.309
ZS-2005	9.939	11.368	10.359	7.250	8.549
ZS-2006	10.055	11.534	10.440	7.260	8.651
ZS-2007	10.223	11.680	10.548	7.280	8.608
ZS-2008	10.224	11.798	10.646	7.289	8.657
ZS-2009	10.434	11.969	10.914	7.299	8.339