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## Urban Competitiveness of Chinese Cities in FDI and Domestic Investment Networks

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## Summary

Over the last decade, Chinese urbanization rate is booming from 17.92% in 1978 to 52.57% in 2012. It is no doubt that city is the engine driving economic development. During urban development, Investment has huge impact on economy and contributes a lot to city's prosperity and dynamics. Among investment types, Foreign Direct Investment (FDI) and Domestic Investment (DI) are two key players that stimulate the economy on a large scale. Consequently, cities compete with each other to strive for FDI and DI. Therefore, how to build cities' competitive advantages is a significant subject research.

The research is aimed at city competitiveness to attract FDI and DI. Although it is still argument that which factor dominates capital allocation: relationship or attribute. Regardless of their priority, the research combines the two dimensions together that are network analysis and location factor analysis in the research. Therefore, FDI and DI, related with firms, governments and factor conditions, are analyzed in dimensions of relationship and attribute respectively in the research. Firstly, on the basis of network analysis, the research defines the positions of every city in the network. The network analysis includes general analysis, sector analysis, centrality analysis and core-periphery analysis in FDI network and DI network respectively. Secondly, the research focuses on finding main competitors for major cities. In the next part, the research concentrates on the location factors analysis by means of linear regression model. The location factor analysis comprises of general analysis, category analysis, coastal cities analysis and inland cities analysis for FDI and DI respectively. In the last part, the research explores the relationship between FDI and DI.

In terms of findings, the research identifies 7 clear results. Primarily, international investors are retreating, to some extent, from Chinese market. DI is upgrading from heavy industry and manufacturing to technology and service sectors. In addition, the research finds that *Number of Employed Persons in Urban Private Enterprises and Self-employed Individuals* and *Average Wage of Staff and Workers* are the most important indicators to attract FDI and DI respectively. Then the location factor analysis is operated by categories. As results, *Expenditure for Science Administration* is most important to attract both FDI and DI in Humanities Factors. *Park, Garden and Green Area* and *Number of Public Transportation Vehicles* contribute most to attract FDI and DI respectively in Environment Factors. *Number of Employed Persons in Urban Private Enterprises and Self-Employed Individuals* and *Average Wage of Staff and Workers* contribute most to attract FDI and DI respectively in Economy Factors. In the last part, the research confirms that FDI and DI influence each other positively.

In terms of recommendations, the research proposes that if China intends to keep competitive in attracting FDI, it has to expand its value chain. For cities in periphery block, they should consolidate their linkages with core cities; on the other side, they should cooperate with each other so as to become more independent. In addition, cities should make policies to encourage entrepreneurship and open some economic sectors for private capital so as to improve market openness, such as liberalizing interest rates and taking steps to reduce its dependency on exports. In order to attract talents, local governments should reform Household Registration System (HRS) and offer social services to outsiders equally. At the same time, it is a better way to develop local education which offers steady and qualified human resources. Regarding education, academic liberty is essential so there is a need to decentralize more authority to academic institutions rather than central administration. Based

on their contexts, local governments should increase financial support to scientific institutions and offer preferential policies to attract high-tech industries. Green area and underground system in urban planning should be paid more attention. Furthermore, market openness and employee welfare are the most important factors to attract FDI and DI respectively. Lastly, since DI has more power to attract FDI, cities can lay particular emphasis on DI so that cities would be more efficient to attract both FDI and DI. Aforementioned results are derived from general database analysis while some specific cities maybe deviate to some degree because of heterogeneity.

**Keywords:** competitiveness, FDI, DI, network, location factors.

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## Abbreviations

CCP	Chinese Communist Party
DI	Domestic Investment
FDI	Foreign Direct Investment
HRS	Household Registration System
IHS	Institute for Housing and Urban Development
IMET	Industrial Machinery Equipment & Tools
GDP	Gross Domestic Product
GIS	Geographic Information System
GMS	Gower Metric Scaling
MDS	Metric Multidimensional Scaling
MNC	Multinational Corporation
NYC	New York City
PRC	People's Republic of China
VIF	Variance Inflation Factor

## Glossary

**Cluster:** A cluster is a small group or bunch of something. In the research, cluster is business cluster in economics. A business cluster is a geographic concentration of interconnected businesses, suppliers, and associated institutions in a particular field. Clusters are considered to increase the productivity with which companies can compete, nationally and globally. In urban studies, the term agglomeration is used. Clusters are also very important aspects of strategic management.

**Fordism:** Fordism, named after Henry Ford, is a notion of a modern economic and social system based on an industrialized and standardized form of mass production. The concept is used in various social theories and management studies about production and related socio-economic phenomena. It is also related to the idea of mass consumption and changes of working condition of workers over time. Nowadays different theoretical positions assume that Fordism has either been replaced or continues to exist in various forms.

**Matrix:** in mathematics, a matrix (plural matrices) is a rectangular array of numbers, symbols, or expressions, arranged in rows and columns. The individual items in a matrix are called its elements or entries.

**Hub-and-Spoke Pattern:** the hub-and-spoke distribution paradigm (or model or network) is a system of connections arranged like a chariot wheel, in which all traffic moves along spokes connected to the hub at the center. The model is commonly used in industry, in particular in transport, telecommunications and freight, as well as in distributed computing.

**Residual:** the residual of an observed value is the difference between the observed value and the estimated function value.

**Megalopolis:** A megalopolis is typically defined as a chain of roughly adjacent metropolitan areas. The term was used by Oswald Spengler in his 1918 book, *The Decline of the West*, and Lewis Mumford in his 1938 book, *The Culture of Cities*, which described it as the first stage in urban overdevelopment and social decline. Later, it was used by Jean Gottmann in 1957, to describe the huge metropolitan area along the eastern seaboard of the U.S. extending from Boston, Massachusetts through New York City, Philadelphia, Baltimore and ending in Washington, D.C.

**Hot money:** Hot money is a term that is most commonly used in financial markets to refer to the flow of funds (or capital) from one country to another in order to earn a short-term profit on interest rate differences and/or anticipated exchange rate shifts. These speculative capital flows are called "hot money" because they can move very quickly in and out of markets, potentially leading to market instability.

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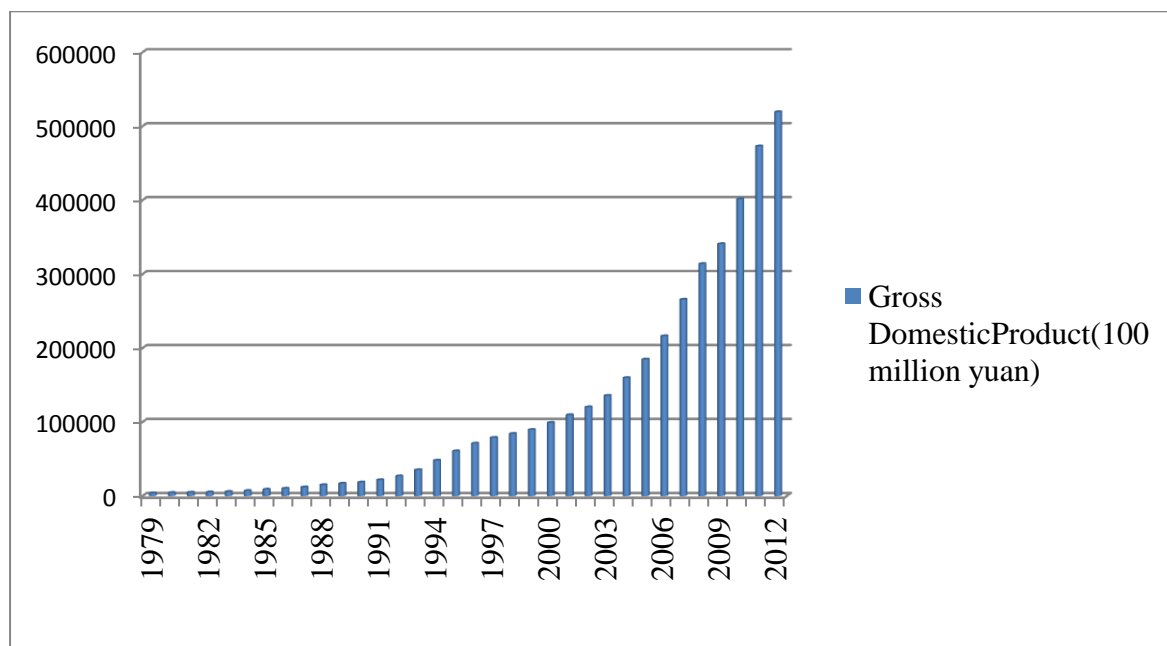
# Chapter 1: Introduction

## 1.1 Background

In 1978, Chinese communist party (CCP) opened the Third Plenary Session of the 11th Central Committee, which is regarded as a milestone for the coming rapid economic development. It mentioned the goal of CCP is to make China to fulfill modernization. For the sake of economic reform, central government decided to open the door and attract foreign investment. With huge capital flow into China, Chinese firms and governments absorb and digest advanced management modes, high-end technology, efficient devices and even capital market pattern. Especially in coastal part of China, they have evolved to comprehensive industrial system and take major account of Chinese export so far. Other regions are also going through transformation period from labor-intensive or resource-intensive mode to capital-intensive or technology-driven mode.

The Figure 1 shows the statistics of Chinese GDP development since 1978 including consideration of RMB depreciation. The gradient is clear evidence that China has achieved a huge progress in large scales.

**Figure 1: Gross National Product of China (Based on China Data Online)**



With rapid economic development, over the last decade, Chinese urbanization rate is booming from 17.92% in 1978 to 52.57% in 2012. With rapid urbanization in China, city competitiveness is introduced into governmental projects and academic circle. City competitiveness is used to evaluate city's comprehensive performance through a huge project and gradual process in the long run. It is not simple imitation of successful sample but a forward-looking strategy based on certain circumstances. It calls for a set of requirements and indicators for city manager no matter in vision, knowledge, capability and so forth. What city competitiveness stresses is how to improve city energy, dynamics, capability and charm etc. to obtain sustainable development.

There is no doubt that 21st century is a significant period for all Chinese cities to improve their competitiveness. Meanwhile, it also gives rise to fierce competition in resources allocation, promotion of living standard and attraction of investment etc. Among all the

factors which are aimed at improving competitiveness, the performance of attracting FDI and DI plays a vital role to express city competitiveness.

DI is about investment from domestic government, domestic enterprises, individuals and so forth within border. As for FDI, it is dominated by multinational corporations (MNCs) or international banks. These organizations utilize their monetary capital and industrial capital via transnational mobility so as to achieve increment of value in the end. In sum, FDI and DI are key indicators to evaluate city competitiveness. Moreover, these two factors are not independent.

## **1.2 Problem Statement**

FDI is regarded as important icon of Chinese open policy. Since China opened the door, it has been 30 years and China has achieved huge progress in attracting FDI. FDI inflows are equipped with advanced technique and managerial expertise that can be used to fill the technique gap and managerial gap existing in developing countries. In addition, it stimulates domestic enterprises to get involved in global market and improve managerial methods and strategic marketing. However, the amount of FDI in China shows the declining trend at the first time in recent years. With industrial transformation and regional coordination, there is a problem coming up that is how to keep competitive in attracting FDI and stimulate both FDI and DI?

## **1.3 Research Objective**

Firstly, the research is aimed at identification of general situation of FDI and DI. Then the research defines cities' positions in the network. Thirdly, definition of competitors' structure is another objective. In the next step, the research analyzes location factors' contribution to drawing FDI and DI. Moreover, the research also explores the relationship between FDI and DI. In the end, the research is aimed at recommendations for urban policies for the sake of improving city competitiveness in attracting FDI and DI.

## **1.4 Provisional Research Question**

Main question: how to define cities' position in network and improve local configuration to attract FDI and DI into Chinese cities. And what effects do FDI and DI have on each other.

Sub-questions:

How is the current investment climate in China?

Which sectors are powerful to absorb FDI and DI?

How are the cities' position and hierarchy structure in investment network?

What are the most attractive location factors for FDI and DI?

How is the relationship between DI and FDI?

What recommendations can be used to improve city competitiveness in attracting FDI and DI?

## **1.5 Significance of the Study**

There is no doubt that China is going to be one of pillars of global economy. It has been more involved in global market and connected with other economic entities closely. In the post reform of China, especially after gradual decentralization, Chinese cities have attempted to get more autonomous power to develop their economies and attract investments. This is a

critical period for each city to take advantage of investment to improve competitiveness. Therefore, sober cognition and perspective strategies are essential for urban policies.

## **1.6 Scope and Limitation**

Regarding complicated sector division and great deal of data, this research cannot cover all the sectors and cities. As a consequence, the research selects some typical cities as sample based on economic level. In DI network, because of missing value and time validation (only 2012 year available), the research just utilizes the data which have complete information to form a network. And in the database, besides prefecture-level cities, it contains some provincial-level cities, vice-provincial cities and some county-level cities. Actually, in China's administrative structure, cities from different levels have different autonomous power to develop economy. In addition, for the sake of coordination, the research picks concrete indicators which are closely associated with FDI and DI so there will be some unstable and incomprehensive factors. In addition, location factor analysis is not comprehensive enough and there are still some dimensions can be further explored. Lastly, the scope of this research is also attributed to Chinese rapid changes and complicated regional context.

## Chapter 2: Literature Review

### 2.1 Competitiveness Theories

#### 2.1.1 Regional Competitiveness or National Competitiveness

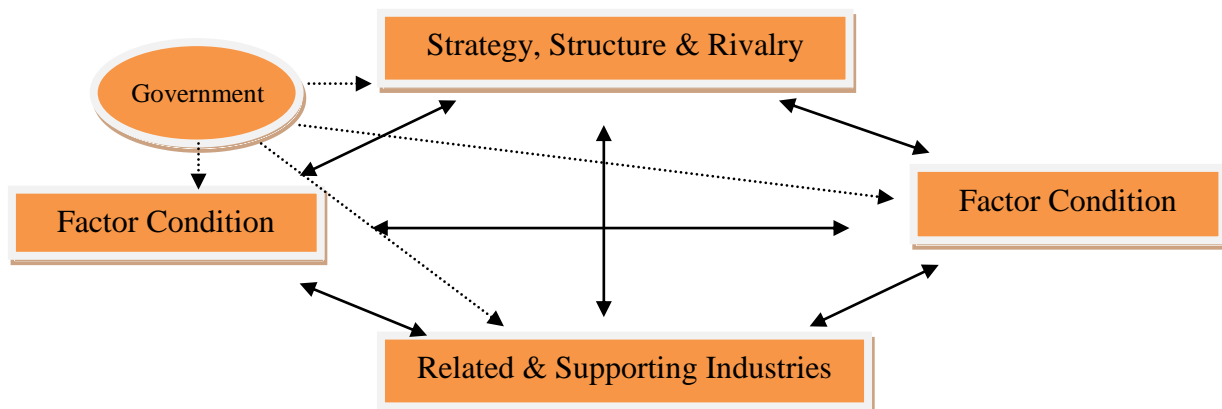
Regional competitiveness or national competitiveness is the capability to obtain resources and market share when economic entities compete with rivals within the region. The term “competitive advantage” is the ability gained through attributes and resources to perform at a higher level than others in the same industry or market (Christensen and Fahey 1984). Since urban areas are playing more and more essential role in economy, competitiveness theory has introduced in urban studies and induced much attention.

#### 2.1.2 Michael Porter Competitive Theory

Michael Porter is a leading scholar in this field. He has proposed various theories including Competitive Strategy, Competitive Advantage, Competitive Advantage of Nations and the Value Chain. Competitive advantage theory suggests that states and businesses should pursue policies that create high-quality goods to sell at high prices in the market. Porter emphasizes productivity growth as the focus of national strategies. He put forward three general competitive strategies that are Cost Leadership Strategy, Differentiation Strategy, and Innovation Strategy. The traded advantage is not simply determined by national resources, labor, interest rate and exchange rate but influenced by national industrial innovation and upgrading capability. Porter established 5 Forces’ Mode which determines the changes of profitable potential and corporate strategy: *the threat of substitute products or services, the threat of established rivals, the threat of new entrants, the bargaining power of suppliers and the bargaining power of customers.*

Another significant model put forward by Michael Porter is Diamond Model. In this model, he proposes 4 factors that determine competitive level of national industry: *factor conditions, demand condition, firm strategy, structure and rivalry, supportive and related industries.* Porter supposes that these 4 factors are bidirectional and dependent. Besides 4 factors, there are two more variables: government and chance. Chance is out of control and accidentally. Nevertheless, effects of government policy cannot be neglected.

Figure 2: Diamond model



As for regional competitiveness, some scholars are trying to analyze inter-regional competition on the ground of different contexts. It has been stated that regions compete each

other on conditions of strong economic specialization in similar markets and variety leads knowledge creation and learning extended from organizational to territorial level (Ron Boschma, 2004). He suggested that knowledge externalities are geographically bounded because of the access to *information flows, knowledge transfer and interactive learning and variety*.

### **2.1.3 Criticism**

Krugman (1994) argued that, in the context of countries, productivity is what matters and "the world's leading nations are not, to any important degree, in economic competition with each other." Krugman warned that thinking in terms of competitiveness could lead to wasteful spending, protectionism, trade wars and bad policies.

## **2.2 Globalization Theories**

### **2.2.1 The Theory of Global City**

Among cities' competition, global cities are leaders who possess overwhelming power to affect network. Allen Scott has referred that formation of global city and network today is relative to Post-fordism to a large extent. In contrast with mass production of Fordism, Post-fordism emphasizes the flexible specialization, lean production, Neo-Schumpeterianism and regulation school.

This kind of cities has some mutual characteristics like many headquarters of MNCs, financial center, contribution to national GDP and so on. Global cities are sites both for instrumental and expressive forms of corporate power (William Carroll, 2007). William highlighted that global city is playing role embedded in a networked hierarchy and hub-and-spoke patterns. Most leading corporate elites participate in transnational network directly or linked to its centrality.

### **2.2.2 The Theory of Value Chain**

Value Chain theory is a prominent argument which is put forward by Michael Porter (1985) in his book *<<Competitive Advantage: Creating and Sustaining Superior Performance>>*. The value chain is a chain of activities that a firm operates in a specific industry so as to deliver a valuable product or service for the market. In Porter's value chains, activities are categories into two levels: primary activities (*inbound logistics, operations, outbound logistics, marketing and sales and service*) and secondary activities (*procurement, human resource management, technological development and infrastructure*). Nowadays, one firm cannot handle all the activities any more while firms start to stress specialization and lean productivity. In industry, firms build up collaboration with firms specialized in another activity to finish the whole chain.

### **2.2.3 FDI Analysis**

With development of globalization, FDI is regarded a typical good to deliver to every place via value chain. Borensztein, De Gregorio and Lee (1998) found that FDI is an important tool for the transfer of technology. However, FDI contributes to economic growth only when a sufficient absorptive capability of the advanced technologies is available in the host economy. And there is another topic coming up about crowd-in or crowd-out effect of FDI especially in developing countries. A great deal of academic voices is in favor of FDI's positive effects on domestic market. But Manuel Agosin and Roberto Machado (2007) claimed that the effects of FDI on DI are by no means always favorable and simplistic policies towards FDI are

unlikely to be optimal. They also suggest that more attention needs to be paid to foster the domestic market.

## **2.3 Economic Geography**

### **2.3.1 Innovation and Core-periphery Theory**

Under mainstream economy as pillar, Paul Krugman claims that some blind points like intangible factors need geographic analysis in middle-aged economic geography.

In core-periphery theory, innovation is often spreading from metropolitan area to peripheral area. Core area is spatial social organization subsystem which is equipped with high level of innovation. Peripheral area is one spatial social organization subsystem which is dependent on core area. Core area plays a dominant role in this system. The main functions of core area comprise: 1. in order to organize its peripheral dependent area, core area takes advantage of its supply system, market system and administrative system and etc.; 2. Core area spreads its outcome of innovation to peripheral area; 3. the self-strengthening characteristic of core area is helpful to development of peripheral area; 4. with increment of information communication within system, innovation will cross the spatial scope. As a consequence, core area is expanding constantly and peripheral area is becoming strong, which gives rise of new core area forming in peripheral area. In the end, Paul Krugman predicts that extreme of core area expansion is only one core area in the world.

### **2.3.2 Other Theories of Network**

Burt has claimed that competition is a relationship issue other than competition of players themselves. Market is evolved from social network and market regulation is reflection of hints, trust and rules generated by mutual communication of producers' or marketers' network inside. In network system, brokerage, as one kind of social capital, is due to the fact that broker establishes relationship between two groups that exist heterogeneity and opportunity.

Transnational elite relations knit global cities (William Carroll, 2007). In other words, elite connection is an important factor to consolidate the global corporate network. It has been argued that local network yields positive effects on regional internal productivity (Rosella Nicolini, 2003). It is argued that shared information is happening inside a cluster and it will charge association fee to keep privilege in the local network.

## **2.4 Urban Studies and Regional Studies**

### **2.4.1 Urbanization and Migration**

Urbanization is the physical growth of urban areas as a result of rural migration and even suburban concentration into cities, particularly the very large ones. The United Nations predicts that 64.1% and 85.9% of the developing and developed world respectively will be urbanized by 2050. Urbanization is closely linked to modernization, industrialization and the sociological process of rationalization.

Migration is a typical phenomenon in urban development, which indicates human resource is the core engine driving the urbanization. Migration is also regarded as a significant indicator to express urban competitiveness. Jianfa Shen (2012) made use of multilevel Poisson migration model to analyze interregional migration in China in decomposition approach. Consequently, in the model, 62.28% of migration increment can be explained by explanatory variables like illiterate people rate, while 37.72% is due to model parameters like distance



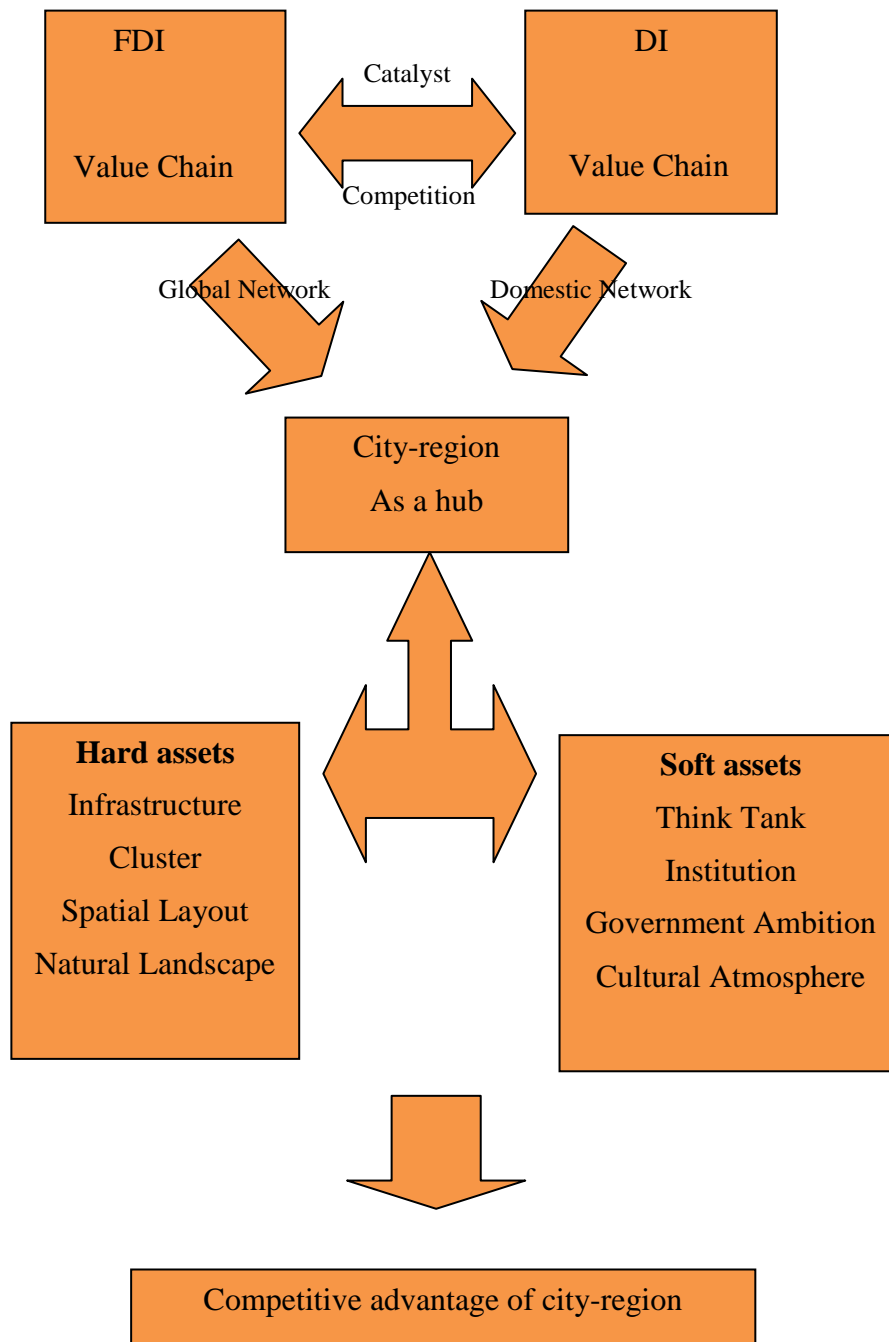
from 1985-1990 to 1995-2000. To some extent, migration between urban areas is signal indicator to evaluate urban competitiveness.

#### **2.4.1 Urban Assets and Layout**

Many urban scholars initiate the focus of urban assets such as specialized labor pool, institutional support, university alliance, high-tech cluster, Brain Park, urban lifestyle, cultural atmosphere and natural landscape (Florida, 2002). Actually, Scott (2001) conceived that “city-regions are coming to function as the basic motors of the global economy”. The focus of urban development has transferred from spatial policy to exploiting indigenous strengths (Ivan Turok, 2004). Some scholars suggest that urban size is also source of urban competitiveness. The concentration of population and urban economic activities indicate that urban areas have advantages to be economic location.

## 2.5 Conceptual Framework

Figure 3: Conceptual Framework



## **Chapter 3: Research Design and Methods**

### **3.1 Revised Research Question**

Main questions:

1. How to define cities' position in network and attract FDI and DI into Chinese cities on basis of location factor analysis.
2. What effects do FDI and DI have on each other?

Sub-questions:

How is the general investment situation in Chinese cities and which sectors are powerful to absorb FDI and DI?

How is geographic distribution of FDI network and DI network respectively?

Which cities are powerful hubs in investment network to attract FDI and DI?

Which cities are investment competitors for each other?

Which factors are the most attractive location factors for total FDI and DI?

Which factors are the most attractive location factors by categories?

Which factors are the most attractive location factors for coastal cities and inland cities respectively?

What effects do FDI and DI have on each other?

### **3.2 Research Type and Data collection**

The research focuses on position definition and location factors analysis which contribute to attracting FDI and DI. In addition, this research is also exploring mutual effects between FDI and DI. Therefore, this research is an exploratory research based on descriptive and explanatory analysis. All the analysis is derived from secondary data that are collected from FDI markets, ORBIS, China Data Online, Chinese Annual Report on Urban Competitiveness and China Trade and External Economics Statistical Yearbook.

### **3.3 Sample Size and Selection**

All the data in this research is extracted from FDI markets, ORBIS, China Data Online, China Trade, External Economic Statistical Yearbook and Chinese Annual Report on Urban Competitiveness. There are 12819 FDI investments from 2003 to 2012 and 18214 DI investments in 2012. Based on the data analysis, the research selects six top sectors and star cities that show more power and potential to attract FDI and DI than others as sample.

### **3.4 Validity and Reliability**

All the data in the research is extracted from Financial Times, Chinese Academy of Sciences and the National Bureau of Statistics of the P.R China.

Regarding reliability of analysis, the research carries out the following diagnostics: Multicollinearity, Variance Inflation Factor (VIF), Durbin-Watson index and Residual Test.

## 3.5 Data Analysis Methods

### 3.5.1 Trend Analysis

The research utilizes exponential index to evaluate the general growth rate of FDI and DI. In addition, the research selects 6 top sectors as subjects in terms of growth rate and total volume. The research adopts Trigg's Tracking Signal to inspect error of measuring method. In trend analysis, estimated value and standard deviation are disposed by means of exponential smoothing.

### 3.5.2 Network Analysis

The UCINET software in the research analyzes the structure of investment network in terms of the logged value from ORBIS and FDI markets. The layout features of destination cities and source are elaborated by Multidimensional scaling. Multidimensional scaling is a means of visualizing the level of similarity of individual cases of a dataset. It refers to a set of related ordination techniques used in information visualization, in particular to display the information contained in a distance matrix.

In addition, the research utilizes the centrality, structural holes and core-periphery methods to measure the city position in the network. Centrality includes 3 parameters in the research: degree, closeness and betweenness. Degree evaluates amount of each node's direct linkages; closeness is each node's sum of geodesic distances with other nodes in the network; betweenness evaluates the extent of each node locating in others' geodesic distances. When two actors in one ego-network connect each other in distance 2, there is said to be a structural hole between them. The Structural Holes method emphasizes the node's function in its ego network which is expressed by efficient size, efficiency and constraint in the research. Efficient size is ego's linkages minus redundancy. Efficiency is the outcome that efficient size divides all ego linkages. Constraint is decided by the extent of one ego's connected point's devotion to other connected points. Core-periphery is an ideal pattern which divides row and column into two categories. In ideal pattern, nodes in core block connect with each other completely so its density is 1. Nodes in periphery block have no connections with each other so its density is 0 while they may have some connections with core nodes. Therefore, in normal analysis, core block on the diagonal line has high density while the other block on the diagonal line has low density.

### 3.5.3 Manhattan Distance Analysis

The research adopts Manhattan distance as a method to analyze the similarity of destination cities. The research explores destination cities' competitors in attracting FDI and DI by sector, activity and source city. The Manhattan distance,  $d_1$ , between two points P,Q in an n-dimensional real vector space with fixed Cartesian coordinate system, is the sum of the lengths of the projections of the line segment between the points onto the coordinate axes.

More formally,

Where  $p = (p_1, p_2, \dots, p_n)$

are vectors.

### 3.5.4 GIS Analysis

The research makes use of Geographic Information System (GIS) to establish network of FDI and DI. In GIS map, the research also takes strength of linkage into account. GIS map can illustrate the layout feature of cities in the network.

### **3.5.5 Multiple Regression Model**

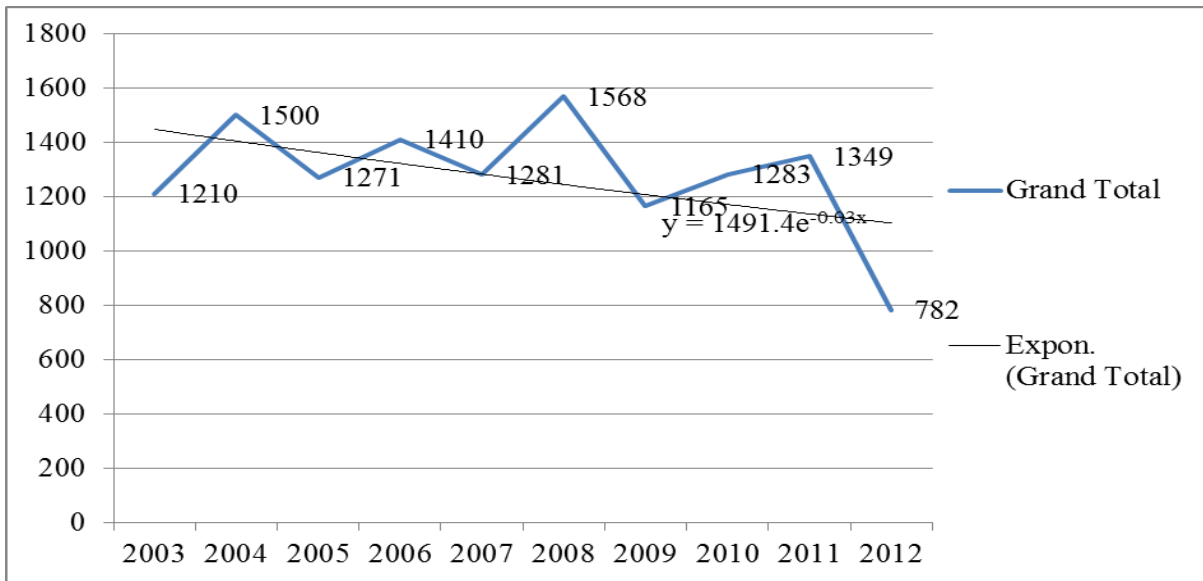
The research makes use of SPSS software to explore causality of location factors and city investment. The research imports index of location factors of Chinese cities into linear regression model. In statistics, linear regression is an approach to model the relationship between a scalar dependent variable  $y$  and one or more explanatory variables denoted  $X$ . In regression model, the research adopts stepwise method.

# Chapter 4: Research Findings

## 4.1 Overall Investment Situation in China

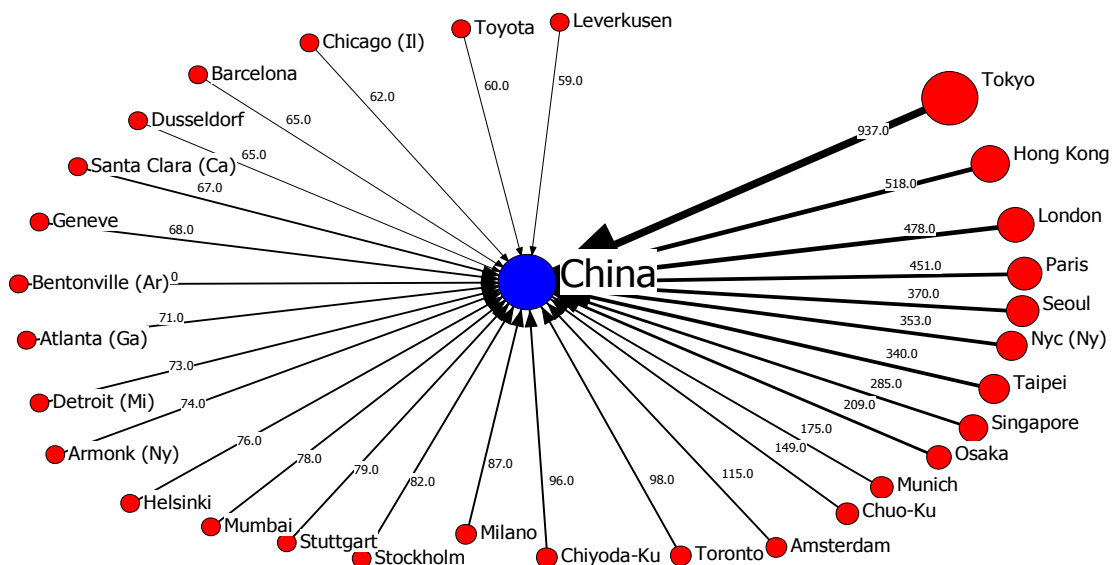
In line graph 1, it shows total growth of FDI over last decade. Although it reached the peak at 2008, it still reveals the declining trend and less driving force. In DI database, there is some source cities' information missing so the research only picks the cities which include complete information to form a small network for analysis.

Line Graph 1: Total FDI inflow (Based on FDI markets, Unit: number of FDI contracts)



The Figure 7 indicates the top 30 source cities of FDI in China. Tokyo, Hong Kong and London rank top 3 cities which invest most in China from 2003 to 2012. Most major source cities come from USA, Japan, UK and Western Europe.

Figure 4: Top 30 source cities of FDI (Based on FDI markets)



## 4.2 Layout Feature of Top Cities in FDI and DI

### 4.2.1 Top FDI Cities' Layout

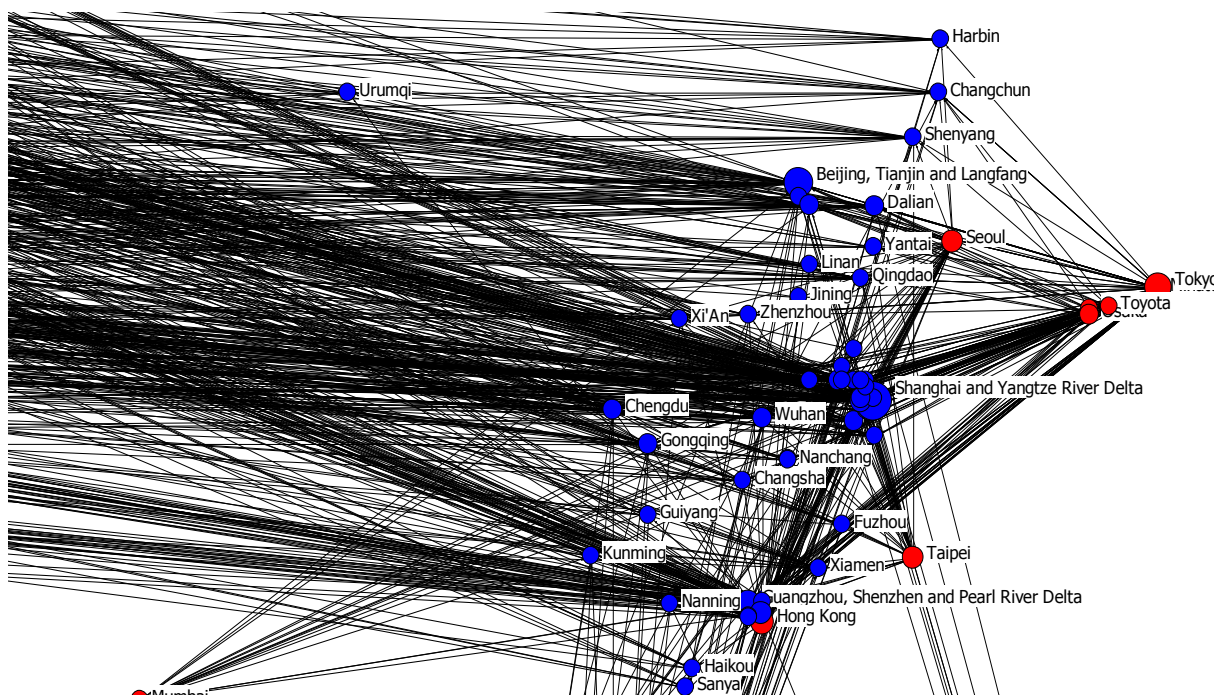
Primarily, the research selects top 100 FDI source cities and top 100 FDI destination cities as sample respectively. In order to find pattern and trait behind the data, the research utilizes the Netdraw to make different layouts by means of Metric Multidimensional Scaling (MDS) and Metric Scaling Gower (MSG). These two methods are based on nodes' distance so the research can find cities' dissimilarities.

Based on MDS, the network can be divided into two parts: central part and outside part. In central part, the density of linkage is more intense. By contrast, in the outside part, nodes are loose and scattered including some isolated nodes like Zhangjiagang, Weifang, Guigang and Langfang. In central part, source cities have less distance with major destination cities like Beijing, Shanghai, Guangzhou, Tianjin, Shenzhen, Chongqing, Chengdu, Hangzhou, Wuxi, Qingdao, Nanjing, Dalian, Wuhan and Suzhou. In MSG analysis, some cities cross the boundary between source cities and destination cities, which indicate these cities have more export-orientation and openness. This kind of cities include Beijing, Shanghai, Guangzhou, Shenzhen, Tianjin, Suzhou, Chengdu, Taipei, Tokyo, Hong Kong, Singapore, London, New York, Osaka and Paris. The layout feature also indicates that some source cities have preference to destination cities especially some medium-sized cities. For instance, besides destination cities in central part, Paris prefers to invest in Daqing, Zibo, Chuzhou, and Jiaozuo. Besides destination cities in central part, Taipei prefers to invest in Xiangyang, Qinhuangdao, Jiangyin, Shunde and Yizheng. The research has attached FDI network's MDS graph and MSG graph in Annex 1.

### 4.2.2 Top FDI Cities' Geographic Distribution

In this section, the research utilizes GIS method to display Chinese FDI distribution so as to observe layout characteristics. For the sake of clear mapping, in figure 5, the research picks top 50 source cities and top 50 destination cities.

Figure 5: Chinese FDI zoom-in map (Based on FDI markets)



The research discovers that most FDI are from European cities, American cities, Japanese cities, Korean cities, Australian cities, HK and Singapore. Few investments are from African cities and Latin American cities. As destination star cities, some Chinese cities like Shanghai, Beijing, Shenzhen, Guangzhou, Suzhou, Hangzhou and Tianjin perform better than others. In figure 5, most top 50 destination cities locate around coastal line and agglomerate as metropolitan areas such as Ring-Bohai economic zone, Yangtze River Delta economic zone and Pearl River Delta economic zone. There are few star cities locating in other parts especially in western part. However, some cities in central part are arising up like Changsha, Wuhan and Xi'an. The research has attached FDI network's world map into Annex 2.

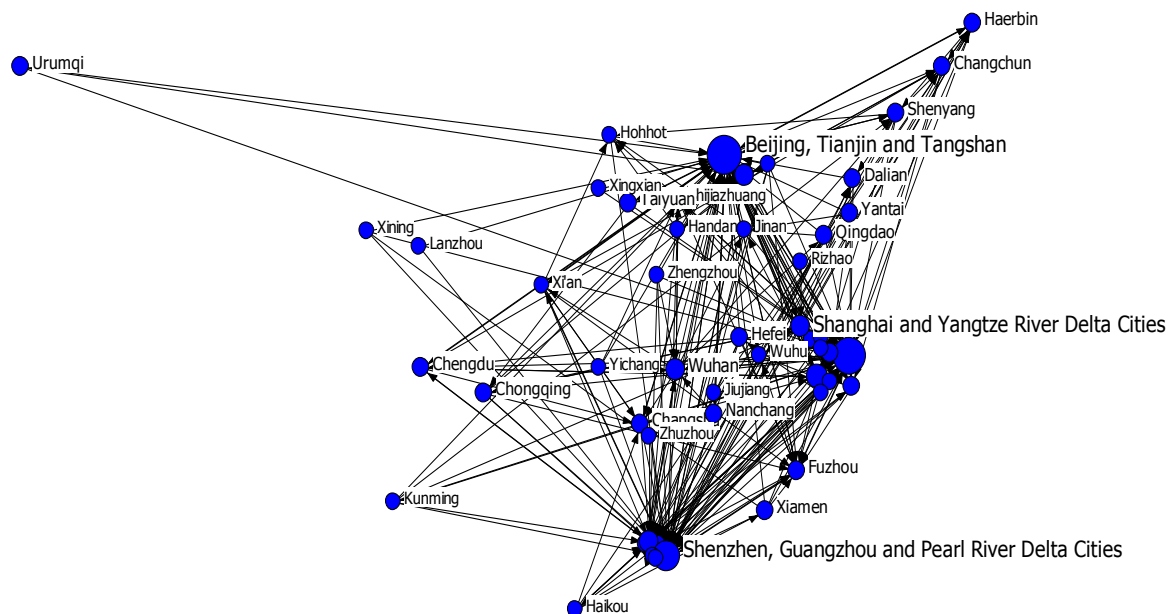
### 4.2.3 Top DI Cities' Layout

The research selects top 50 source and destination cities respectively to generate a network. Based on MDS, 5 source cities (Beijing, Shanghai, Shenzhen, Fuzhou and Guangzhou) have less distance with all the destination cities and dominate the whole network. Based on MSG, the research discovers 3 groups where cities have clear investment tendency. As a destination city, Beijing attracts some concrete cities which prefer to invest more in Beijing such as Chengdu, Changchun, Harbin, Xi'an, Shijiazhuang, Changsha, Hangzhou, Xuanwu, Taiyuan, Wuhu, Mianyang, Huizhou and Zhuji. Shanghai attracts some concrete cities which prefer to invest more in Shanghai such as Foshan, Haikou, Zhangjiagang, Weifang and Wuhan than other cities. It is found geographic distance does not influence investment a lot based on these two diagrams since some northern cities have geodesic distance with some southern cities. For instance, Tianjin invests more in Shanghai rather than Beijing in this network. The research has attached DI network's MDS graph and MSG graph in Annex 3.

### 4.2.4 Top DI Cities' Geographic Distribution

For the sake of clear mapping, in figure 6, the research picks top 50 Chinese cities as sample.

**Figure 6: DI GIS map (Based on ORBIS Database)**





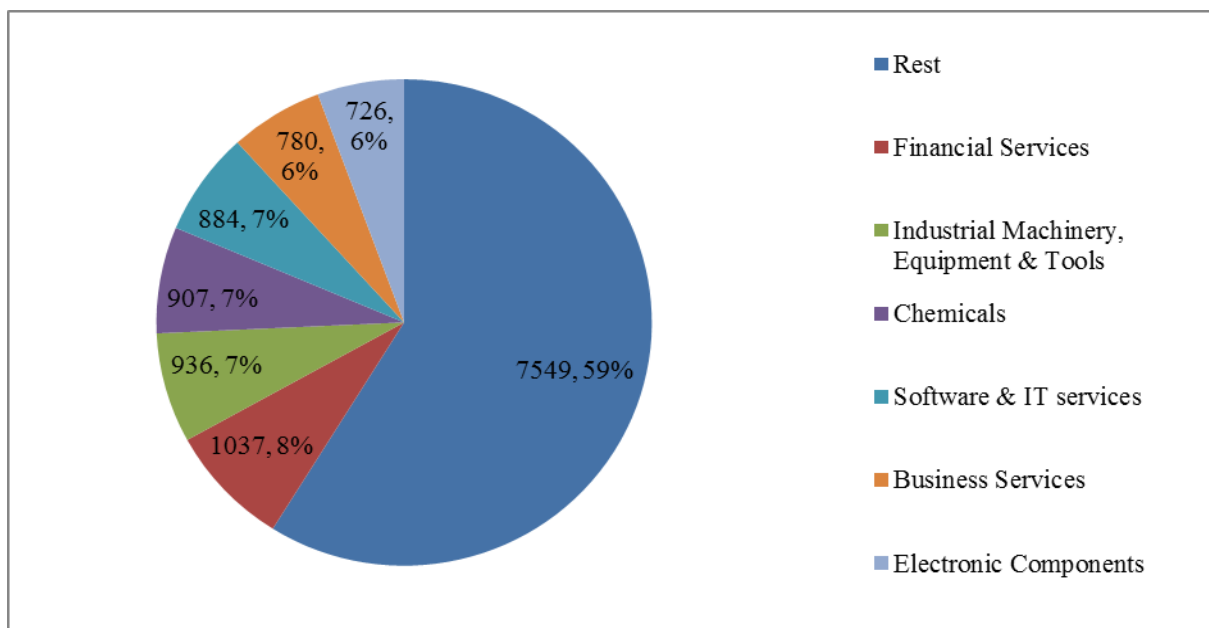
The research finds that most linkages locate in the coastal region and surround around star cities such as Ring-Bohai economic zone, Yangtze River Delta economic zone and Pearl River Delta economic zone, which is similar with FDI network. Apparently, network in west region is less dense than coastal region. In addition, Mid-Yangtze region and northeast region start to attract more investment than before.

### 4.3 Overall Sector Analysis about FDI and DI in China

#### 4.3.1 FDI Sector Analysis

There are 12819 FDI flowing into China over the last decade. As shown in Pie Chart 1, the top 6 sectors take account about 41% of all investment. Among them, *Financial Service* ranks the first position accounting for 8 % of all investments.

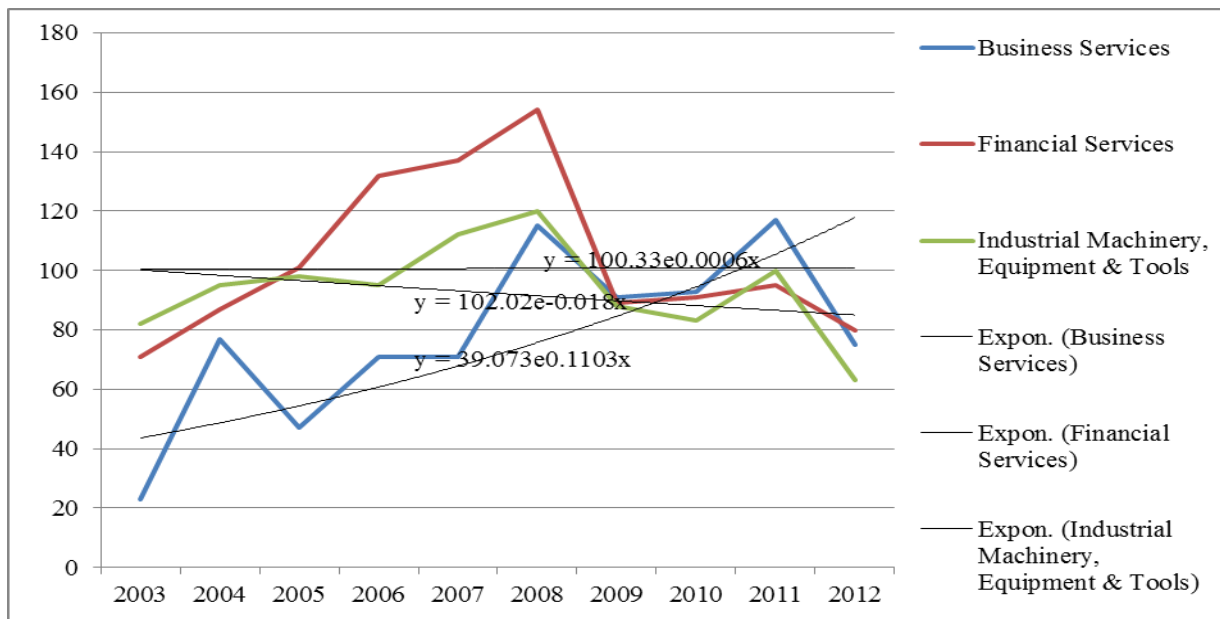
**Pie Chart 1: FDI sector composition (Based on FDI markets)**



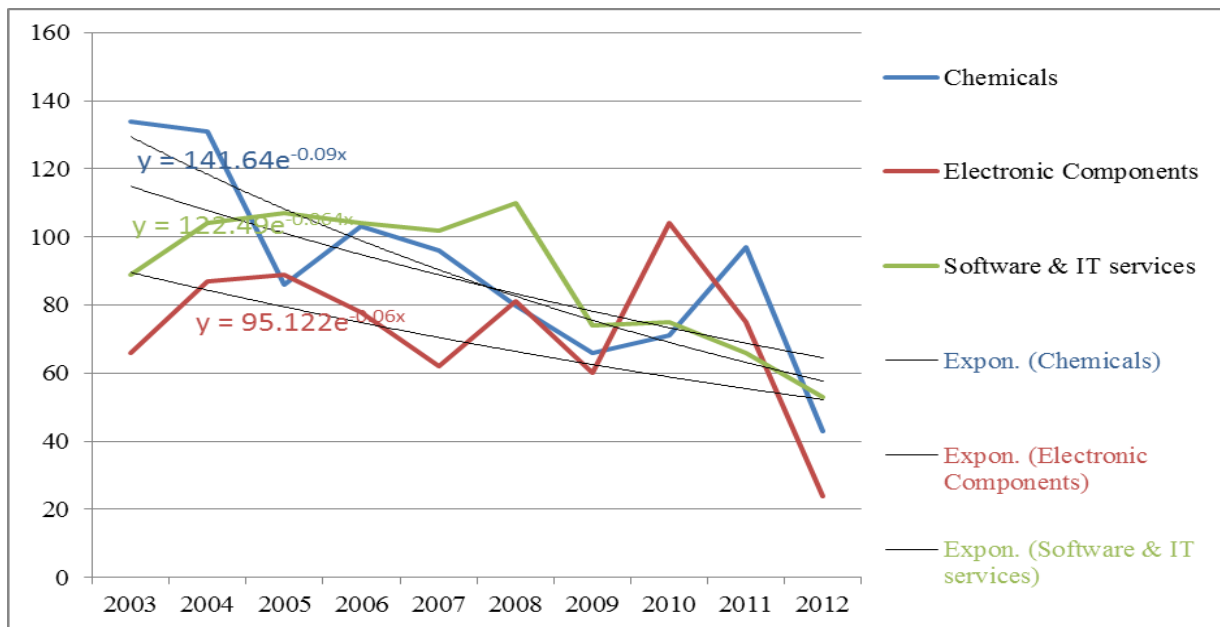
In line graph 2 and line graph 3, they indicate the trend of FDI of top 6 sectors. In order to display it clearly, the research divides them into two graphs based on the trend. In line graph 2, *Business Service* shows more potential to grow up and it is the only sector that shows the rising trend among top 6 sectors. For the other two, *Financial Service* which reached the peak at 154 (2008) tends to be stable and *Industrial Machinery, Equipment & Tools* (IMET) shows a little down trend.

In Line Graph 3, though there is fluctuation over the decade, all three sectors show apparent down trend and *Chemical Sector* shrinks severely. The research finds that most sectors relied on FDI are shrinking especially during World Financial Crisis and China's Economic Transformation. Foreign investors have moved their attention to financial and business service sectors instead of heavy industry and manufacturing.

**Line Graph 2: FDI sector trend (Based on FDI markets)**



**Line Graph 3: FDI sector trend (Based on FDI markets)**



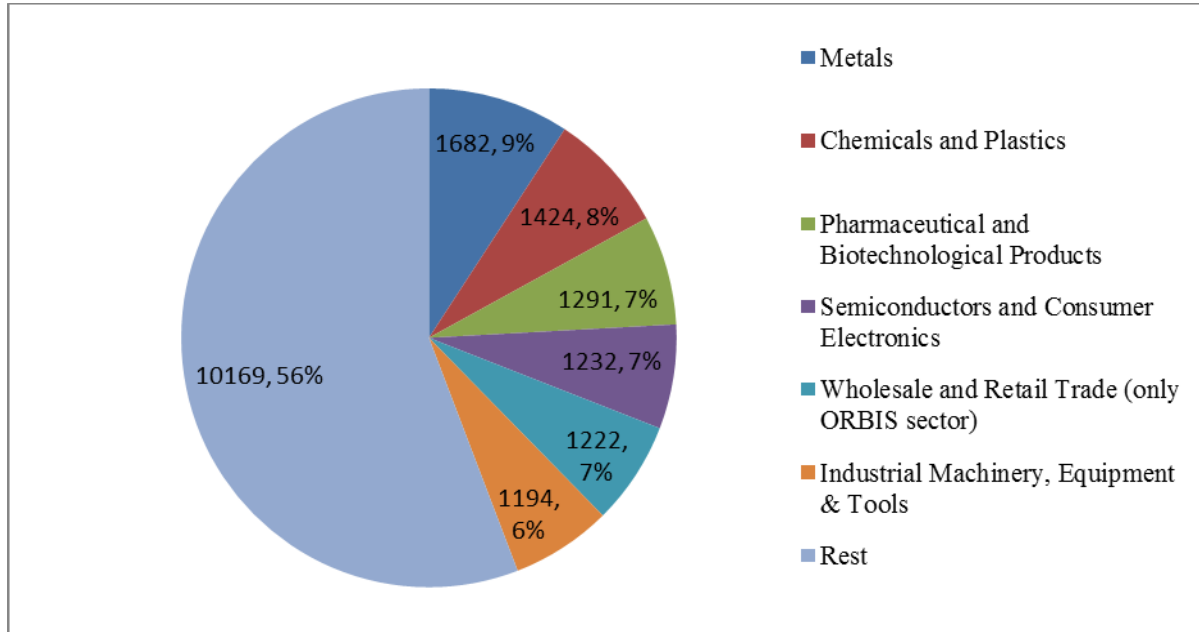
### 4.3.2 DI Sector Analysis

There are 18214 DI in 40 sectors at all in 2012. The Pie Chart 2 indicates that top 6 sectors take account about 44% among 40 sectors. *Metals* rank the first position among top sectors. Except *Metals*, *IMET* and *Chemicals and Plastics*, other top sectors belong to high-tech industry, health industry and service industry.

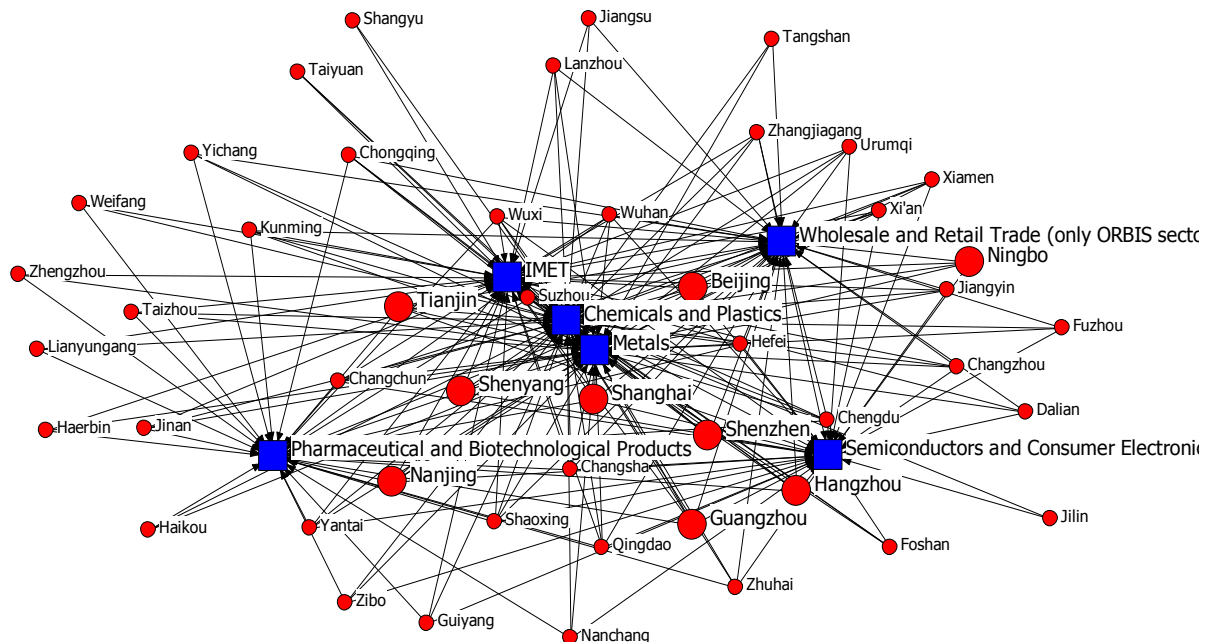
In addition, the research utilizes the Netdraw to explore the relationship between DI sectors and destination cities by GDS in figure 7. The research selects top 50 destination cities and top 6 sectors to establish a matrix. In order to show it clearly, it deletes the isolated nodes and dependent nodes. The research finds that *IMET*, *Metals* and *Chemicals and Plastics* are similar and relevant. From the side of destination cities, they have different interests in

sectors. For instance, Beijing is close to *Metals*, *Chemicals and Plastics*, *Wholesale and Retail Trade* and *IMET*, which means a great deal of investment inflows in the four sectors. The cities around *Pharmaceutical and Biotechnological Products* like Nanjing, Changchun and Haikou prefer to attract investment from this sector.

**Pie Chart 2: DI sector composition (Based on ORBIS Database)**



**Figure 7: DI city-sector MDS layout (Based on ORBIS Database)**



#### 4.4 Network Analysis

In this section, the research measures network's density, centrality and core-periphery pattern. The research selects top 100 FDI source cities and 100 FDI destination cities to form a 2-mode matrix. For domestic network, the research picks top 50 cities to form a 1-mode matrix.

#### 4.4.1 FDI Network Analysis

Primarily, the research measures FDI network's density. Since the research focuses on linkage itself rather than the strength of linkage, it dichotomizes the matrix. The output of density and average distance is 22.2% and 2.546. So the whole FDI network is a loose structure to some extent because of massive scope and power imbalance. In Table 1, it shows the top 10 foreign cities' centrality's results. Due to better performance in degree and closeness, these foreign cities have more direct linkages and geodesic distances with others. Meanwhile, they have more authority to control others because of high score in betweenness. Hong Kong and Taipei have their own different economic systems compared with mainland so the research regards them as foreign cities.

**Table 1: Top 10 central foreign cities in FDI network (Based on FDI markets)**

Top 10 cities	Degree	Top 10 cities	Closeness	Top 10 cities	Betweenness
Hong Kong	65	Hong Kong	81	Hong Kong	7
Tokyo	62	Tokyo	79.7	Tokyo	6.6
Paris	55	Paris	76.8	Taipei	6.4
Singapore	55	Singapore	76.8	Singapore	4.8
Taipei	55	Taipei	76.8	Paris	4.7
Seoul	50	Seoul	74.9	Seoul	3.7
London	46	London	73.4	London	2.6
NYC	41	NYC	71.6	Armonk	2.6
Osaka	39	Osaka	71	NYC	2.4
Armonk	37	Armonk	70.3	Osaka	2

In table 2, it shows the top 10 domestic cities' centrality based on degree, closeness and betweenness. The research discovers no variation in ranking, which confirms that they are good at building direct linkage with others, approaching and controlling other cities. However, in betweenness index, the gap between top group (Beijing and Shanghai) with other cities has enlarged, which indicates Beijing and Shanghai play incomparable roles in controlling other cities.

**Table 2: Top 10 central Chinese cities in FDI network (Based on FDI markets)**

Top 10 cities	Degree	Top 10 cities	Closeness	Top 10 cities	Betweenness
Shanghai	100	Shanghai	100	Shanghai	9.5
Beijing	98	Beijing	98.7	Beijing	8.8
Guangzhou	78	Guangzhou	87.1	Guangzhou	5.2
Suzhou	75	Suzhou	85.6	Suzhou	4.8
Shenzhen	70	Shenzhen	83.2	Shenzhen	4.3
Tianjin	63	Tianjin	80.1	Tianjin	3.5
Chengdu	60	Chengdu	78.8	Chengdu	3.2
Chongqing	53	Chongqing	76	Chongqing	2.5
Nanjing	52	Nanjing	75.6	Nanjing	2.4
Dalian	51	Dalian	75.3	Dalian	2.3

Lastly, the research adopts core-periphery method to analyze FDI network. In core block, cities are capable to coordinate and take actions relatively freely. When they transact with cities from periphery block, they will have more advantages and initiatives to affect transaction. By contrast, cities in periphery block are restricted and disadvantaged. As result of core-periphery analysis, the final fitness is 0.445 and there are 35 Chinese cities locate in the core block.

**Table 3: Core block in Core-periphery Analysis (Based on FDI markets)**

1	Shanghai	10	Dalian	19	Foshan	28	Nanning
2	Beijing	11	Wuxi	20	Changsha	29	Shaoxing
3	Guangzhou	12	Hangzhou	21	Zhuhai	30	Tangshan
4	Suzhou	13	Wuhan	22	Huizhou	31	Mianyang
5	Shenzhen	14	Qingdao	23	Kunming	32	Dongying
6	Tianjin	15	Shenyang	24	Pudong	33	Zhoushan
7	Chengdu	16	Ningbo	25	Yantai	34	Qinhuangdao
8	Chongqing	17	Xiamen	26	Jining	35	Quzhou
9	Nanjing	18	Changzhou	27	Guiyang		

#### 4.4.2 DI Network Analysis

In this section, the research chooses top 50 domestic cities to form DI network. The research dichotomizes the sample data because multivalued data will enlarge the gap between metropolis and other cities. The research does not count diagonal value in this analysis.

Firstly, the research measures its density. The output is 0.105, which indicates that DI network is a relatively loose-knit network especially for those peripheral cities. The research inserts one attribute to evaluate its sub-group situation. It divides top 50 cities into 8 groups according to Chinese economic divisions. The 8 zones are North Coast Region, Northeast Region, Mid-Yangtze Region, Southwest Region, South Coast Region, East Coast Region, Mid-Yellow River Region and Northwest Region. By measuring each group's internal links and external links, the research estimates the network's cohesion. The E-I index is 0.551. It indicates external linkages outnumber internal linkages. So the cohesion of sub-groups is not strong and DI is not confined to economic region inside. However, the research finds that some cities are relatively conservative such as Zhuhai, Shaoxing, Handan, Jiangyin and Haikou which prefer to invest in their own zones.

In the next step, the research measures its centrality index. In Table 4, it illustrates the most powerful cities by 3 dimensions. It shows that Beijing, Shanghai and Shenzhen dominate this network. The lists in degree and closeness are same, which indicate these cities are both good at building direct linkage and close to the other cities in the network. What is more, the research discovers that Guangzhou, Fuzhou and Changsha play important roles to attract direct investments while they have less power to control other cities. By contrast, Wuhan, Nanjing, Tianjin, Haikou, Xi'an and Zhuji show more power to control other cities in the network.

**Table 4: Top 10 central domestic cities (Based on ORBIS Database)**

City	Degree	City	Betweenness	City	Closeness
Beijing	45	Beijing	365.548	Beijing	55
Shanghai	41	Shanghai	268.671	Shanghai	59
Shenzhen	41	Shenzhen	238.352	Shenzhen	59
Guangzhou	18	Nanjing	51.983	Guangzhou	83
Wuhan	15	Guangzhou	26.996	Hangzhou	86
Fuzhou	15	Fuzhou	16.808	Fuzhou	86
Hangzhou	14	Wuhan	15.332	Wuhan	86
Changsha	12	Hangzhou	14.127	Changsha	89
Shenyang	12	Shenyang	13.380	Shenyang	89
Nanjing	10	Changsha	8.608	Nanjing	90

The table 5 is the result by means of Structural Holes analysis. In Efficiency dimension, Rizhao ranks first because it just has one efficient linkage. The cities that perform better in Efficient Size and Constraint Coefficient play important roles in their ego networks and are good at making use of structural holes and coordinating with other cities. The research has attached all results of Structural Holes analysis in Annex 5. Lastly, the research undertakes the Core-periphery. Its final fitness is 0.478. As shown in table6, there are 15 actors at all locating in the core block.

**Table 5: Top 10 cities in Structural Holes measurement (Based on ORBIS Database)**

City	Efficient Size	City	Efficiency	City	Constrain
Beijing	38.638	Rizhao	1	Beijing	0.102
Shanghai	33.85	Beijing	0.859	Shanghai	0.112
Shenzhen	33.74	Shanghai	0.826	Shenzhen	0.118
Guangzhou	12.523	Shenzhen	0.823	Guangzhou	0.163
Wuhan	10.111	Guangzhou	0.696	Fuzhou	0.175
Hangzhou	9.441	Wuhan	0.674	Shenyang	0.181
Fuzhou	9.278	Hangzhou	0.674	Wuhan	0.186
Shenyang	7.958	Shenyang	0.663	Hangzhou	0.189
Changsha	7.077	Nanjing	0.638	Nanjing	0.2
Nanjing	6.385	Dongguan	0.633	Changsha	0.201

**Table 6: Top 15 actors in core block (Based on ORBIS Database)**

Beijing	Changchun	Changsha	Shanghai	Chengdu
Shenzhen	Haikou	Wuhan	Hangzhou	Fuzhou
Guangzhou	Haerbin	Ningbo	Shenyang	Nanjing

## 4.5 Competitor Analysis

In competitor analysis, the research chooses the same 50 important cities in FDI and DI networks to make results comparable. The research assumes that cities compete with each other when they have similar investment structures. In order to be competitive, cities have to identify their competitors. After competitor identification, cities can put forward efficient strategies accordingly. The research has attached the whole 50 cities' FDI and DI results in Annex 4 and Annex 5 respectively.

Table 7 displays the top 10 FDI destination cities and their competitors that are striving for investment from the same source cities. Table 8 shows the top 10 FDI destination cities and their competitors that are striving for investment from the same sectors. Table 9 illustrates the top 10 destination cities and their competitors that are striving for investment from the same business activities. These tables indicate that top cities and their competitors are striving for the same foreign investors, sectors and activities respectively.

In order to define the DI competitors, the research selects top 50 cities in DI network. Due to missing values in DI network, the research just analyzes the cities' competitors based on their sector structure. Table 10 shows top 10 DI cities and their competitors that are striving for investment from similar sectors.

**Table 7: Top 10 cities' FDI competitors by source cities (Based on FDI markets)**

City	Top 3 Competitors		
Beijing	Guangzhou	Shenzhen	Tianjin
Shanghai	Beijing	Guangzhou	Shenzhen
Guangzhou	Chengdu	Dalian	Wuhan
Shenzhen	Wuhan	Chengdu	Ningbo
Tianjin	Dalian	Qingdao	Ningbo
Chongqing	Hefei	Ningbo	Zhengzhou
Changsha	Qinyuan	Taiyuan	Quanzhou
Wuhan	Zhengzhou	Hefei	Changsha
Nanjing	Hefei	Xi'An	Shenyang
Chengdu	Shenyang	Hangzhou	Wuhan

**Table 8: Top 10 cities' FDI competitors by sectors (Based on FDI markets)**

City	Top 3 Competitors		
Beijing	Guangzhou	Shenzhen	Suzhou
Shanghai	Beijing	Guangzhou	Suzhou
Guangzhou	Tianjin	Shenzhen	Nanjing
Shenzhen	Chengdu	Guangzhou	Suzhou
Tianjin	Nanjing	Chongqing	Qingdao
Chongqing	Wuhan	Hangzhou	Shenyang
Changsha	Jinan	Nanchang	Wuhu
Wuhan	Chongqing	Xiamen	Shenyang
Nanjing	Hangzhou	Wuhan	Chongqing
Chengdu	Hangzhou	Chongqing	Wuhan

**Table 9: Top 10 cities' FDI competitors by activities (Based on FDI markets)**

City	Top 3 Competitors		
Beijing	Shenzhen	Guangzhou	Shanghai
Shanghai	Beijing	Guangzhou	Suzhou
Guangzhou	Shenzhen	Tianjin	Chengdu
Shenzhen	Guangzhou	Chengdu	Nanjing
Tianjin	Guangzhou	Suzhou	Nanjing
Chongqing	Nanjing	Hangzhou	Dalian
Changsha	Zhengzhou	Haerbin	Fuzhou
Wuhan	Qingdao	Hangzhou	Ningbo
Nanjing	Chongqing	Hangzhou	Dalian
Chengdu	Hangzhou	Wuhan	Dalian

**Table 10: Top 10 cities' DI competitors by sectors (Based on ORBIS Database)**

City	Top 3 Competitors		
Beijing	Shanghai	Shenzhen	Guangzhou
Shanghai	Shenzhen	Guangzhou	Hangzhou
Guangzhou	Xiamen	Hefei	Chongqing
Shenzhen	Guangzhou	Nanjing	Shanghai
Tianjin	Lianyungang	Xiamen	Kunming
Chongqing	Changchun	Haerbin	Shenyang
Changsha	Shenyang	Zhengzhou	Hefei
Wuhan	Kunming	Nanjing	Suzhou
Nanjing	Fuzhou	Shenyang	Suzhou
Hangzhou	Nanjing	Kunming	Xiamen

## 4.6 Location Factor Analysis

In this section, the research focuses on the relationship between location factors and city competitiveness in FDI and DI. In the end, the research attempts to explore mutual influence of FDI and DI.

### 4.6.1 Location Factor Analysis for Important FDI and DI Destination Cities

Firstly, the research eliminates some rural indicators like quantity of farm crops and some overlapped indicators to avoid disturbance in regression model. Secondly, the research adopts VIF to keep indicators independent. Then the research logs the raw indicators data and gets rid of outliers by scatterplots. Meanwhile, the research adopts Durbin-Watson index and residual analysis. After filtration, the research obtains 47 cities and 17 location indicators.

Consequently, around 90% of dependent variable (FDI) can be explained by 4 independent variables: *Number of Employed Persons in Urban Private Enterprises and Self-employed Individuals*, *Average Wage of Staff and Workers*, *Gross Industrial Output Value of Foreign-funded Enterprises* and *Number of Institutions of Higher Education*. In the same way, the research analyzes location factors for DI destination cities. As a result, 74.7% of dependent variable (DI) can be explained by 4 independent variables: *Number of Employed Persons in Urban Private Enterprises and Self-employed Individuals*, *Number of Institutions of Higher*



*Education, Average Wage of Staff and Workers and Number of Public Transportation Vehicles.* Table 11 shows aforementioned independent variables' contribution level to FDI and DI respectively. As shown in table 11, market openness is the most significant factor to FDI while staff welfare is the most significant factor to DI. Furthermore, FDI is affected by agglomeration effect while DI focuses on public transportation.

**Table 11: Independent variables' contribution level**

Independent Variables	Contribution Level (FDI)	Contribution Level (DI)
Number of Employed Persons in Urban Private Enterprises and Self-employed Individuals	0.357	0.291
Average Wage of Staff and Workers	0.337	0.337
Gross Industrial Output Value of Foreign-funded Enterprises	0.304	none
Number of Institutions of Higher Education	0.136	0.300
Number of Public Transportation Vehicles	none	0.213

In addition, Durbin-Watson index is 1.856 and 2.055 respectively. Based on residual analysis, it is confirmed that residuals comply with normal distribution and fluctuate between -2 and 2. The research has attached Normal P-P plot and Scatterplot of residuals in Annex 6 (dependent variable: FDI and DI).

#### **4.6.2 Location Factor Analysis for FDI Cities and DI Cities by Categories**

In this section, the research sorts the selected indicators into 3 categories, namely Humanities Indicators, Environment Indicators and Economy Indicators. Humanities Indicators include *Population Density, Expenditure for Science Administration, Number of Institutions of Higher Education and Theaters and Music Halls.* These indicators can reflect population, science, market size, human capital, education and culture to some extent. Environment Indicators include *Park, Garden and Green Area, Number of Hospitals, Number of Public Transportation Vehicles, Industry Solid Waste Comprehensive Use Factor, Volume of Sulphur Dioxide Exhausted and Proportion of Industrial Waste Water Discharge Qualifying Standard.* These indicators can reflect city view, environmental issues, social insurance and transportation. Economy Indicators include *Number of Employed Persons in Urban Private Enterprises and Self-employed Individuals, Construction, Gross Industrial Output Value of Domestic-funded Enterprises, Gross Industrial Output Value of Foreign-funded Enterprises, Investment in Fixed Assets and Average Wage of Staff and Workers.* These indicators can reflect the macroeconomics, consumption level, market openness and human capital.

##### **4.6.2.1 Location Factor Analysis for FDI and DI by Humanities Indicators**

In this section, the research also utilizes the stepwise method in regression model. Consequently, around 70% of dependent variable (FDI) can be explained by 3 independent variables: *Expenditure for Science Administration, Population Density and Number of Institutions of Higher Education.* Meanwhile, around 60% of dependent variable (DI) can be explained by 2 independent variables: *Expenditure for Science Administration and Number of Institutions of Higher Education.* Table 12 shows aforementioned independent variables' contribution level to FDI and DI respectively. As shown in table 12, both FDI and DI are attracted by science level and higher education. However, population size is considered to attract FDI.

**Table 12: Independent variables' contribution level by Humanities Indicators**

Independent Variables	Contribution Level (FDI)	Contribution Level (DI)
Expenditure for Science Administration	0.552	0.493
Population Density	0.279	none
Number of Institutions of Higher Education	0.217	0.438

Durbin-Watson index is 1.759 and 1.834 respectively. In addition, the research carries out Residual Analysis, which proves residuals comply with normal distribution and most of them locate between -2 and 2 randomly. The research has attached Normal P-P plot and Scatterplot in Annex 7 (dependent variable: FDI and DI).

#### 4.6.2.2 Location Factor Analysis for FDI and DI by Environment Indicators

In Environment Indicators analysis, the research also utilizes the stepwise method. In the end, 2 indicators are significant to explain FDI, namely *Park, Garden and Green Area* and *Number of Public Transportation Vehicles*; 3 indicators are significant to explain DI, namely *Number of Public Transportation Vehicles, Park, Garden and Green Area* and *Number of Hospitals*. And 40% of FDI and 45% of DI can be explained by the model. Table 13 illustrates contribution level of significant independent variables to FDI and DI. As shown in table 13, green area and public transportation are significant to FDI and DI. In addition, DI also focuses on social insurance and medical environment.

**Table 13: Independent variables' contribution level by Environment Indicators**

Independent Variables	Contribution Level (FDI)	Contribution Level (DI)
Park, Garden and Green Area	0.526	0.365
Number of Public Transportation Vehicles	0.351	0.455
Number of Hospitals	none	0.273

Durbin-Watson index is 1.292 and 1.545 respectively. In addition, Residual Analysis confirms that residuals comply with normal distribution and most of them locate between -2 and 2 randomly. The research has attached Normal P-P plot and Scatterplot in Annex 8 (dependent variable: FDI and DI).

#### 4.6.2.3 Location Factor Analysis for FDI and DI by Economy Indicators

In regression model, 3 economic indicators as independent variables are selected to explain FDI, namely *Number of Employed Persons in Urban Private Enterprises and Self-Employed Individuals, Gross Industrial Output Value of Foreign-funded Enterprises* and *Average Wage of Staff and Workers*. Around 90% of FDI can be explained by the model. On the other side, DI can be explained by 2 independent variables, namely *Average Wage of Staff and Workers* and *Construction*. Around 70% of dependent variable can be explained by the model. In table 14, it illustrates contribution level of significant independent variables to FDI and DI by Economy Indicators. As shown in table 14, market openness is still the most significant indicator to attract FDI while staff welfare is the most significant to attract DI. Furthermore, FDI is also affected by staff welfare but to less extent. And agglomeration effect plays an important role in FDI network. On the other side, DI is more associated with real estate. To sum up, compared with Humanities Indicators and Environment Indicators, Economy Indicators can explain FDI and DI further.

**Table 14: Independent variables' contribution level by Economy Indicators**

Independent Variables	Contribution Level (FDI)	Contribution Level (DI)
Urban Private Enterprises and Self-Employed Individuals	0.440	none
Average Wage of Staff and Workers	0.362	0.756
Gross Industrial Output Value of Foreign-funded Enterprises	0.253	none
Construction	none	0.453

Durbin-Watson index is 1.700 and 1.956 respectively. In addition, Residual Analysis confirms residuals comply with normal distribution and most of them locate between -2 and 2 randomly. The research has attached Normal P-P plot and Scatterplot in Annex 9 (dependent variable: FDI and DI).

### 4.6.3 Location Factor Analysis for Coastal Cities

In this section, the research divides the selected cities into coastal cities and inland cities, based on economic situation and geographic location. Consequently, the research can explore the distinction between two regions in FDI and DI. In order to avoid instability in regression model, the research eliminates 3 outliers (Shanghai, Beijing and Shaoxing) and some independent variables in VIF test. In the end, 22 cities and 10 indicators are identified.

The research adopts the same method in the model. As a result, 3 independent variables are significant to explain FDI in coastal cities: *Expenditure for Science Administration*, *Industry Solid Waste Comprehensive Use Factor* and *Gross Industrial Output Value of Domestic-funded Enterprises*. Around 93% of dependent variable can be explained by the model. As for DI in coastal cities, 4 indicators are significant to explain DI: *Scientific Research, Technical Service and Geologically Prospecting*, *Expenditure for Science Administration*, *Volume of Sulphur Dioxide Exhausted* and *Average Wage of Staff and Workers*. Around 92% of dependent variable can be explained by the model. As shown in table 15, the research finds that science and technology do play an important role in coastal cities to a great degree. In addition, environmental issue is emphasized in coastal cities. Furthermore, in coastal cities, DI has a little crowd-out effect on FDI, which manifests competition between foreign-funded enterprises and domestic-funded enterprises is stiff. And staff welfare is not a key point to attract DI in coastal cities though it is significant in most selected cities.

**Table 15: Independent variables' contribution level in coastal cities**

Independent Variables	Contribution Level (FDI)	Contribution Level (DI)
Expenditure for Science Administration	1.123	0.929
Industry Solid Waste Comprehensive Use Factor	0.195	none
Gross Industrial Output Value of Domestic-funded Enterprises	-0.214	none
Scientific Research, Technical Service and Geologically Prospecting	none	0.559
Volume of Sulphur Dioxide Exhausted	none	-0.367
Average Wage of Staff and Workers	none	-0.306

In this model, Durbin-Watson index is 1.812 and 2.294 respectively. In addition, Residual Analysis confirms residuals comply with normal distribution and most of them locate between -2 and 2 randomly. The research has attached Normal P-P plot and Scatterplot in Annex 10 (dependent variable: FDI and DI).

#### 4.6.4 Location Factor Analysis for Inland Cities

In this section, the research sets inland cities as a new sample. And the research takes the same to filter indicators and cities. In the end, 4 outliers (Zhuzhou, Jiujiang, Yichang and Xining) are removed. The research works our logged values of indicators and operate VIF test. Finally, 22 cities and 14 indicators are identified.

With the same method, regression model gets 4 indicators which are significant to explain FDI: *Scientific Research, Technical Service and Geologically Prospecting, Gross industrial output of Foreign-funded Enterprises, Park, Garden and Green Area* and *Number of Public Transportation Vehicles*. Around 92% of dependent variable (FDI) can be explained. On the other side, around 65% of dependent variable (DI) can be explained by 2 indicators, namely *Average Wage of Staff and Workers* and *Real Estate*. As shown in table 16, foreign investors still focus on science, technology and environment. However, compared with coastal cities, agglomeration effect affects investment positively. Therefore, the research finds agglomeration effect contributes to attracting FDI obviously when one city is not equipped with advanced industrial system or faces resource scarcity. Under this condition, city needs FDI to make up its deficiency especially in some undeveloped Chinese cities. However, when domestic enterprises are strong enough and have engaged in every business activity, localism is coming up and poses negative influence on foreign investment. In inland cities, real estate drives DI on a large scale. Furthermore, FDI and DI in inland cities have less connection.

**Table 16: Independent variables' contribution level in inland cities**

Independent Variables	Contribution Level (FDI)	Contribution Level (DI)
Scientific Research, Technical Service and Geologically Prospecting	0.524	none
Gross industrial output of Foreign-funded Enterprises	0.279	none
Park, Garden and Green Area	0.394	none
Number of Public Transportation Vehicles	0.247	none
Average Wage of Staff and Workers	none	0.530
Real Estate	none	0.477

In addition, Durbin-Watson index is 2.568 and 1.451 respectively. And residuals comply with normal distribution and all of them locate between -2 and 2 randomly. The research has attached Normal P-P plot and Scatterplot in Annex 11.

#### 4.7 Exploration for Mutual Influence between FDI and DI

In the last part, the research explores the mutual influence between FDI and DI. Since only one independent variable is tested, the research adopts enter method. Table 17 indicates around 60% of FDI can be explained by DI and Durbin-Watson index is around 2. On the other side, as shown in table 18, around 60% of FDI can be explained by DI.

**Table 17: Regression model summary about relationship between FDI and DI (Based on FDI markets and ORBIS)**

R Square	Adjusted R Square	Durbin-Watson	Independent Variable	Beta	Constant	Sig.
.611	.603	2.014	DI	1.335	-2.558	.000

**Table 18: Regression model summary about relationship between FDI and DI (Based on FDI markets and ORBIS)**

R Square	Adjusted R Square	Durbin-Watson	Independent Variable	Beta	Constant	Sig.
.611	.603	2.147	FDI	.458	3.137	.000

The research also explores the relationship between FDI and DI in land cities and coastal cities respectively. Table 19 illustrates the results of regression model. Around 53% of FDI and DI can be explained in coastal cities. And around 62% of FDI and DI can be explained in inland cities. Table 19 indicates that FDI has less power to attract DI in coastal cities and inland cities while DI has more power to attract FDI.

**Table 19: Regression model summary about relationship between FDI and DI for coastal cities and inland cities (Based on FDI markets and ORBIS)**

Coastal Cities	R Square	Adjusted R Square	Durbin-Watson	Independent Variable	Beta	Constant	Sig.
	.542	.517	1.746	Domestic Investment	.985	-.192	.000
.542	.517	1.770	FDI	.550	2.440	.000	
Inland Cities	R Square	Adjusted R Square	Durbin-Watson	Independent Variable	Beta	Constant	Sig.
	.630	.612	1.788	Domestic Investment	1.393	-3.292	.000
.630	.612	2.451	FDI	.453	3.302	.000	

In addition, the research carries out Residual Analysis. Consequently, the residuals comply with normal distribution and most of them locate between -2 and 2 randomly. The research has attached Normal P-P plot and Scatterplot in Annex 12.

## Chapter 5: Conclusions and Recommendations

In transformation period in economy, China is confronted with danger of hard landing due to shrinking FDI and global economic malaise. China has slowed down marvelous growth and paid more attention to domestic market. China has begun to take steps to liberalize interest rates, allow its currency to strengthen and reduce its dependency on exports. Given this complex context, cities need to clarify their positions based on network perspective. In addition, besides social connections among cities, location factors are attributed to attracting FDI and DI. In the final chapter, the research aims at explanation for cities' positions in the network and their significant location factors which are worked out in Chapter 4. Then the research proposes recommendations for Chinese cities on basis of literature and research findings.

### 5.1 General Situation and Sector Conclusion

It is clear that some international investors are retreating from Chinese market. They have begun to search for new markets to reduce costs when the price of Chinese resources is increasing. Among the top 6 sectors, all the sectors are fading except *Business Service* and *Financial Service*. In value chain, China is mainly leading in manufacturing. If China desires for keeping competitive in attracting FDI, it has to expand limited value chain. China must pay more attention to research & development, sales & marketing and service segments which create the most value of product and encourage innovation industry and educational industry. Furthermore, if China wants to keep economic development steady and be a really powerful economy not only in numbers, the development of domestic market is a fundamental issue. Although *Metal Sector* and *Chemical & Plastics Sector* still dominate the top 2 DI sectors, some marketing-related sectors and technology-related sectors are catching up like *Pharmaceutical & Biotechnological Products*, *Semiconductors and Consumer Electronics* and *Wholesale and Retail Trade*. As for DI sectors, China has to upgrade resource-intensive industries and develops new energy industries so as to reduce dependence on natural resources. Since cities are equipped with abundant human capital, financial capital, instructional capital and social capital, the inter-investment among them promotes circulation of resources to obtain maximum profit.

### 5.2 Star Cities in FDI and DI Networks and Recommendations

Only when cities recognize their positions in the hierarchy, they can lock their own targets and identify their competitors. Only in this way, cities can compete more efficiently. The research has analyzed cities' positions in FDI and DI networks respectively by means of MDS, MSG, centrality and core-periphery analysis. Some special cities in MDS and MSG layout, analyzed in Chapter 4, should be paid more attention due to their unique positions in network. The cities that get high grades in degree and closeness perform better in building direct linkage and proximate to other cities, which indicate they are good at opening new markets and have easy access to other cities. The cities that get high grades in betweenness are regarded as bridges between isolated cities. Therefore, these outstanding cities ought to recognize their advantaged position and make good use of it to expand market and make strategy. In addition, based on core-periphery analysis, cities in core block play pivotal roles in the network and power to control some cities in periphery block. If they want to be core players in long run, they should promote cooperation with other cities in core block so as to consolidate their core position. Meanwhile, they also should develop their branches in periphery block and consolidate their dominant role in their ego networks. In terms of cities

in periphery block, they should build more linkages with cities in core block instead of being restricted with only one or two cities. And they should cooperate with each other so as to reduce dependence on core actors.

Furthermore, regarding DI cities, the research adopts E-I index and Structural Holes to analyze cities' characters in DI network in Chapter 4. The E-I index confirms that DI is not confined to happening within one economic zone and domestic investors search for resources on a national scale except some conservative cities like Zhuhai, Shaoxing, Handan, Jiangyin and Haikou. According to these conservative cities' contexts, they are suggested to cooperate with cities from other economic regions so as to obtain optimization of resources allocation. On basis of Structural Holes analysis, the cities that get the high score have better ability to make use of structural holes and coordinate with other cities in their ego-networks. The cities as structural holes should make use of advantage to create information benefit and social capital mobility benefit. Other cities should make connection with structural hole cities to make investment efficient and try to cooperate each other so as to reduce dependency on structural holes.

Last but not least, cities also need to pay attention to other cities which have the similar investment structure. They have much more potential in competition because they are striving for investment from the same city, sector or activity. In terms of competitors, cities had better develop cooperative projects to establish alliances with complementary partners that can integrate resources and circulate information efficiently; on the other side, they should make prospective strategy according to their competitors. It is confirmed that spill-over effect is not obvious in high-end industries and information circulation happens indigenously and spontaneously. Therefore, finding suitable allies is significant in competition. In the end, cities get involved in competition in the form of group and develop their factor endowment individually.

### **5.3 Location Factor Contribution and Recommendations**

When investors make decisions to invest in one city, they would consider if city can satisfy their requirements and further development. Besides network itself, location factors play significant role to attract investment.

Based on results in Chapter 4, *Number of Employed Persons in Urban Private Enterprises and Self-employed Individuals* contributes most to attract FDI. It indicates that the openness of market is essential to attract FDI especially in China. In addition, *Average Wage of Staff and Workers*, *Gross Industrial Output Value of Foreign-funded Enterprises* and *Number of Institutions of Higher Education* are also significant to attract FDI. Above 3 indicators manifest that human resources, agglomeration effect and education are significant to attract FDI. In terms of DI, there are also 4 significant indicators based on regression model. The most important indicators is *Average Wage of Staff and Workers* instead of *Number of Employed Persons in Urban Private Enterprises and Self-employed Individuals*, which indicates staff treatment gets more weights to attract DI. The other difference is that domestic investors pay more attention to *Public Transportation Factor* because DI is mainly inflowing in manufacturing and heavy industries which rely on traditional transportation.

Therefore, city should make policies to encourage entrepreneurship and open some economic sectors for private capital like *Public Service, Banking, Post & Communication* and *Education*. In addition, high-skilled workers and talents are normally attracted by high salary and excellent social service. The local government should reform *Household Registration System (HRS)* and offer outstanding social services to outsiders equally so as to improve their sense of belonging. At the same time, it is a better way to develop local education which

can provide steady and qualified human resources. The government should popularize basic education and diversify the education system. For instance, the local government can encourage building private schools, training schools and institutions of higher education. The local government can promote the collaboration between enterprises and schools, which can solve employment issue and attract more investors. Regarding education, academic liberty is essential so governments need to decentralize more authority to academic institutions rather than central administration. The research shows *Gross Industrial Output Value of Foreign-funded Enterprises* is significant to attract FDI, which means FDI investors consider agglomeration effect positively. As for this factor, the local governments need to put forward policies to offer convenience to foreign investors such as better business atmosphere, land policy, tax policy and infrastructure. What is more important, the local government must persist on their preferential policies regardless of leadership transition. Currently, governments are responsible for transportation sector to large extent. Firstly, government should finance more transportation projects and make connections with pivotal cities. Secondly, local governments should advocate transportation tools' diversity like bicycles, electronic vehicles, hybrid-fuel vehicles, public transportation and underground transportation. Thirdly, governments are supposed to improve the bidding system and fight corruption. Meanwhile, scientific urban planning is necessary as well. Lastly, governments should pay more attention to maintenance of transportation system and encourage private enterprises to be involved in transportation system.

As for location factor analysis by categories, *Expenditure for Science Administration* is most important to attract both FDI and DI in Humanities Factors; *Park, Garden and Green Area* and *Number of Public Transportation Vehicles* contribute most to attract FDI and DI respectively in Environment Factors; *Number of Employed Persons in Urban Private Enterprises and Self-Employed Individuals* and *Average Wage of Staff and Workers* contribute most to attract FDI and DI respectively in Economy Factors. In Humanities Factors, the research discovers that science and technology are the most attractive points for investors. Local governments should increase financial support for scientific institutions and offer preferential policies to attract high-tech industries. In Environment Factors, foreign investors focus on soft environment while domestic investors pay more attention to hard environment. Therefore, governments should take account of green area in urban planning. As for domestic investors, they pay more attention to public transportation. In Economy Factors, market openness and employee welfare are the most important factors to attract FDI and DI respectively.

As for location factor analysis of coastal cities, *Expenditure for Science Administration* is the most significant factor to attract both FDI and DI. And the research has presented suggestions in above argument. However, for coastal cities, investors focus on the environmental pollution including solid waste process and sulphur dioxide exhaust. For coastal cities, the research recommends 4 points as follows. Firstly, factories of heavy industries should move out of downtown and government should support for new factory location. For instance, governments can establish industrial park for factories. Meanwhile, governments should encourage technology upgrading and production line's reform. Secondly, the governments need to advocate public transportation and build green belt. Thirdly, environmental regulation is necessary to be implemented strictly given the lack of supervision. The research suggests that *Emissions Trading System* can be introduced into scheme. If emission exceeds what is permitted by its allowances, factories must purchase allowances from others. Conversely, if a plant performs better at reducing its emissions, it can sell its leftover credits. Lastly, citizens' environmental awareness should be raised by means of mass media. NGO can play an important role in the progress.



For inland cities, *Technical Service and Geologically Prospecting* and *Average Wage of Staff and Workers* are the most significant factors to attract FDI and DI respectively. The research has represented suggestions in above argument. In addition, *Real Estate* is significant to attract DI for inland cities. Hence, promotion of bidding system and scientific urban planning are highlighted again. Meanwhile, governments should be sober and alert about the bubbles in real estate market. Underlying the prosperity of real estate, it is loaded with hot money and officials' alienated views on political achievement. Governments should reform the officials' evaluation system and strengthen supervision towards cities' financial situation so as to avoid severe fiscal deficits. In 2012, local government debts have accumulated to 10.7 trillion Yuan that is about one-quarter of China's annual economic output. Hence, central government should restrict municipal governments' power in case local governments put forward cheap land policies or conduct large-scale projects to attract investment blindly.

In the end, the research confirms that FDI and DI influence each other positively except some coastal cities. However, DI is more attractive to absorb FDI. Given this finding, cities are determined to further stimulate domestic demand and consumer spending.

Overall, different cities should have their own emphasis and make specific strategies according to their own circumstances. In conclusion, the research claims 4 points: firstly, cities should clarify their own positions in network; secondly, cities should make connections with other cities especially pivotal cities in the network; thirdly, cities should improve their location factors according to their circumstances; lastly, cities should acknowledge the mutual effects between FDI and DI. Besides above 4 points, if cities want to be really competitive, cities have to be active to attract investment rather than improving location factors passively. Therefore, city branding and marketing are significant as well. The think tanks of cities can attempt to establish a target investors' database and search for the suitable investors actively. Due to sample size limitation and time limitation, the research does not have a comprehensive analysis about Chinese cities. In addition, location factor analysis for each sector, activity or economic zone is also an angle for further exploration and detailed research.

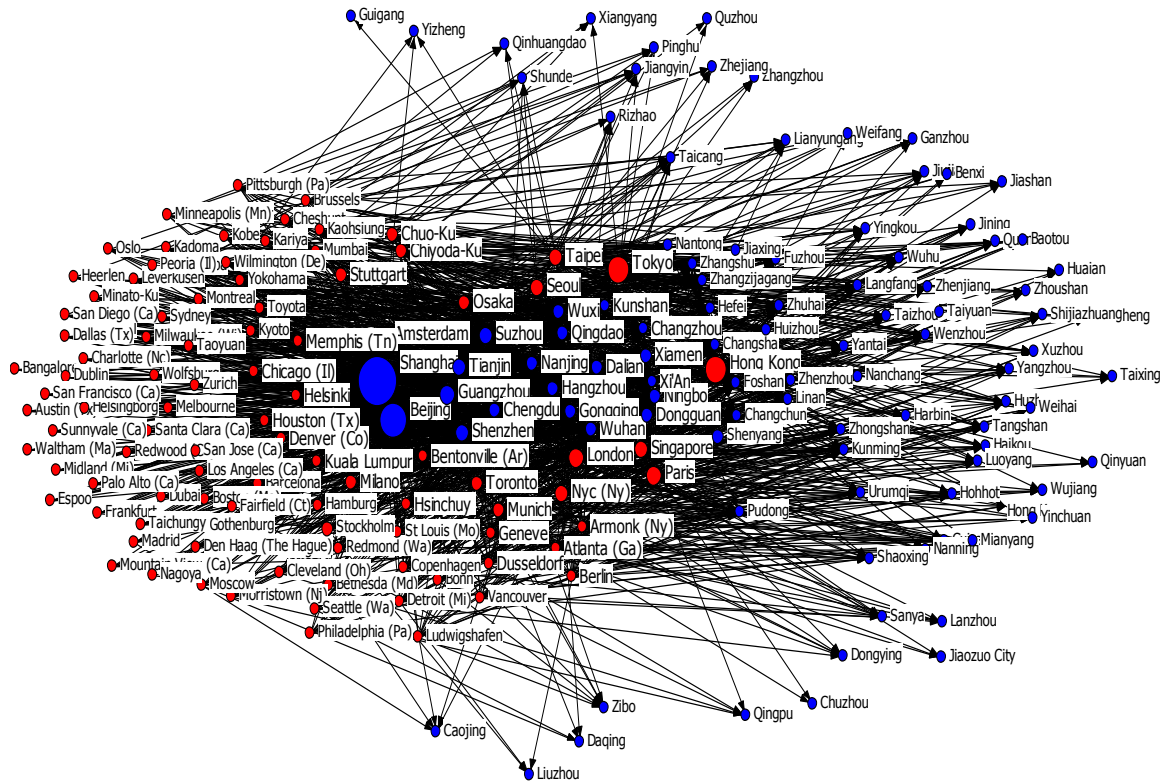
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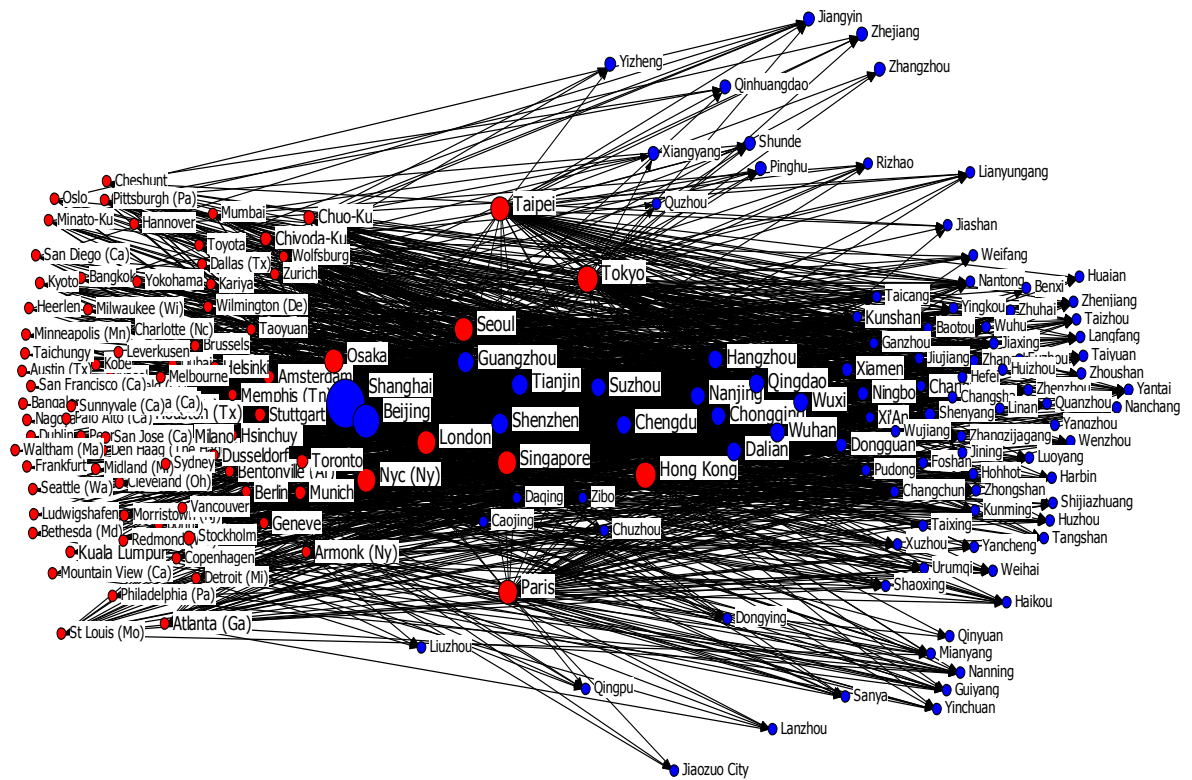
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# Annex 1

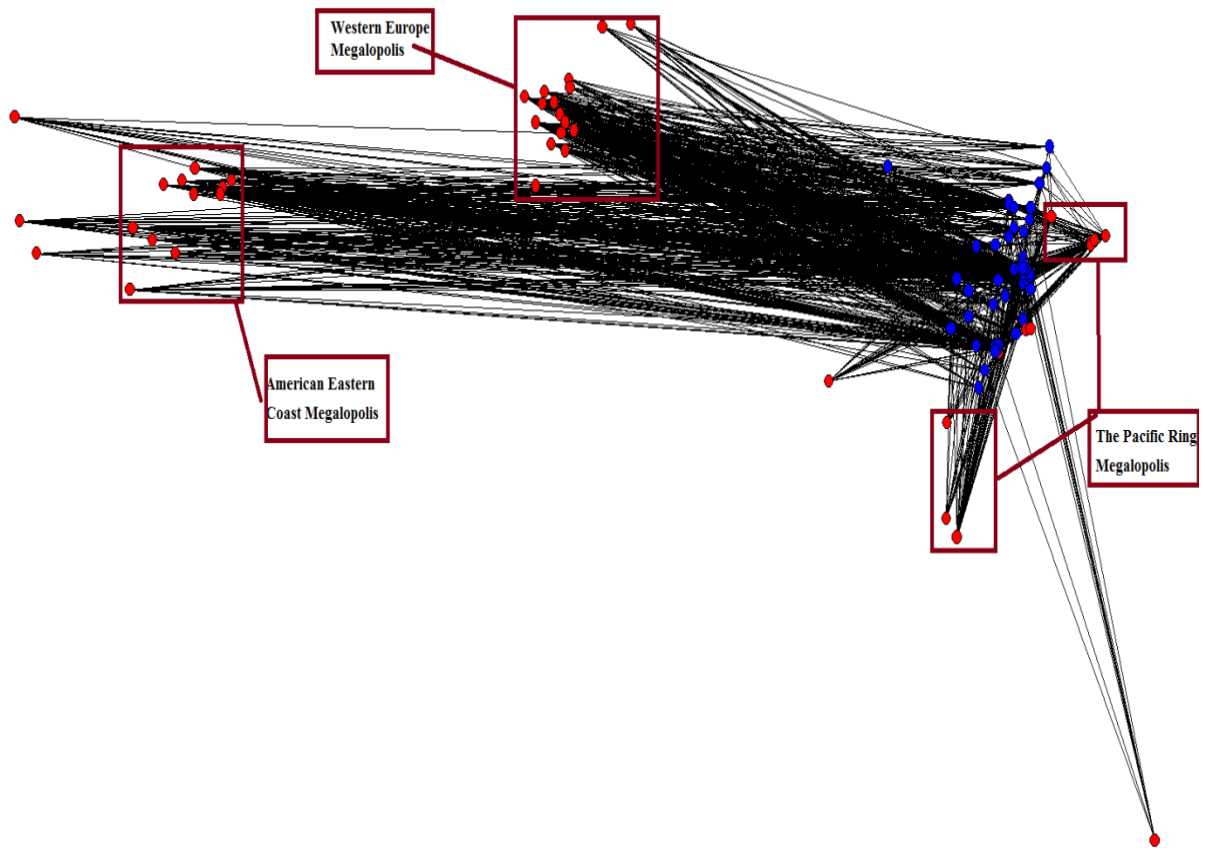
## Top FDI 200 cities' MDS layout network (Based on FDI markets)



## Top FDI 200 cities' Gower layout network (Based on FDI markets)



## Annex 2





## Annex 4

### Source city competitors of FDI

City	Top 3 Competitors		
Beijing	Guangzhou	Shenzhen	Tianjin
Changchun	Qinyuan	Weihai	Quzhou
Changsha	Qinyuan	Taiyuan	Quanzhou
Changzhou	Jining	Qinyuan	Rizhao
Chengdu	Shenyang	Hangzhou	Wuhan
Chongqing	Hefei	Ningbo	Zhengzhou
Dalian	Shenyang	Hangzhou	Wuhan
Dongguan	Hefei	Jining	Huaian
Foshan	Taiyuan	Zhoushan	Qinyuan
Fuzhou	Taiyuan	Jiashan	Huaian
Guangzhou	Chengdu	Dalian	Wuhan
Haerbin	Sanya	Benxi	Yinchuan
Haikou	Yinchuan	Taiyuan	Weifang
Hangzhou	Hefei	Changsha	Jining
Hefei	Quzhou	Taiyuan	Qinyuan
Hohhot	Yinchuan	Hong Kong	Luoyang
Jiangyin	Yizheng	Quzhou	Benxi
Jinan	Benxi	Qinyuan	Zhoushan
Jiujiang	Benxi	Zhejiang	Quzhou
Kunming	Benxi	Qinyuan	Yinchuan
Lanzhou	Yinchuan	Qinyuan	Liuzhou
Nanchang	Qinyuan	Zhoushan	Taiyuan
Nanjing	Hefei	Xi'An	Shenyang
Ningbo	Huaian	Sanya	Qinyuan
Qingdao	Hefei	Haerbin	Taiyuan
Rizhao	Zhangjiang	Benxi	Jiashan
Shanghai	Beijing	Guangzhou	Shenzhen
Shaoxing	Benxi	Qinyuan	Lanzhou
Shenyang	Qinyuan	Taiyuan	Yinchuan
Shenzhen	Wuhan	Chengdu	Ningbo
Shijiazhuang	Benxi	Qinyuan	Lanzhou
Suzhou	Wuxi	Ningbo	Dalian
Taiyuan	Jiashan	Yinchuan	Qinyuan
Tangshan	Xiangyang	Yinchuan	Yizheng
Tianjin	Dalian	Qingdao	Ningbo
Urumqi	Benxi	Qinyuan	Yinchuan
Wuhan	Zhengzhou	Hefei	Changsha
Wuhu	Benxi	Jiashan	Linyi
Wuxi	Hefei	Nantong	Yinchuan
Xiamen	Huaian	Qinyuan	Zhoushan
Xi'an	Qinyuan	Benxi	Yinchuan
Yantai	Yinchuan	Rizhao	Benxi
Zhengzhou	Lanzhou	Taiyuan	Xiangyang
Zhongshan	Jining	Qinyuan	Quzhou
Zhuhai	Benxi	Qinyuan	Taixing

### Sector competitors of FDI

City	Top 3 Competitors		
Beijingg	Guangzhou	Shenzhen	Suzhou
Changchun	Huizhou	Yancheng	Yantai
Changsha	Jinan	Nanchang	Wuhu
Changzhou	Kunshan	Zhangshu	Foshan
Chengdu	Hangzhou	Chongqing	Wuhan
Chongqing	Wuhan	Hangzhou	Shenyang
Dalian	Hangzhou	Wuhan	Qingdao
Dongguan	Xiamen	Hefei	Kunshan
Foshan	Hefei	Kunshan	Changsha
Fuzhou	Urumqi	Nanchang	Haikou
Guangzhou	Tianjin	Shenzhen	Nanjing
Haerbin	Shijiazhuang	Urumqi	Wenzhou
Haikou	Hohhot	Yinchuan	Panyu
Hangzhou	Dalian	Nanjing	Chongqing
Hefei	Yantai	Huizhou	Jiaying
Hohhot	Yinchuan	Lanzhou	Zhanjiang
Jiangyin	Ganzhou	Qinhuangdao	Rizhao
Jinan	Nanchang	Haerbin	Mianyang
Jiujiang	Linyi	Dongying	Quzhou
Kunming	Shijiazhuang	Nanning	Daqing
Lanzhou	Yinchuan	Benxi	Zhangzhou
Nanchang	Yingkou	Mianyang	Nanning
Nanjing	Hangzhou	Wuhan	Chongqing
Ningbo	Zhuhai	Zhangzijagang	Foshan
Qingdao	Ningbo	Kunshan	Dalian
Rizhao	Zhangzhou	Pinghu	Ganzhou
Shanghai	Beijing	Guangzhou	Suzhou
Shaoxing	Quanzhou	Taiyuan	Quzhou
Shenyang	Changsha	Xi'An	Hefei
Shenzhen	Chengdu	Guangzhou	Suzhou
Shijiazhuang	Benxi	Guiyang	Taiyuan
Suzhou	Tianjin	Nanjing	Shenzhen
Taiyuan	Daqing	Weifang	Zibo
Tangshan	Huzhou	Zibo	Huzhou
Tianjin	Nanjing	Chongqing	Qingdao
Urumqi	Hohhot	Mianyang	Hong Kong
Wuhan	Chongqing	Xiamen	Shenyang
Wuhu	Anting	Jiashan	Yingkou
Wuxi	Changzhou	Kunshan	Dongguan
Xiamen	Dongguan	Ningbo	Hefei
Xi'an	Pudong	Jinan	Yantai
Yantai	Wenzhou	Weihai	Jiangyin
Zhengzhou	Nanchang	Fuzhou	Urumqi
Zhongshan	Huizhou	Hefei	Nanchang
Zhuhai	Zhenjiang	Huizhou	Caojing



### Activity competitors of FDI

City	Top 3 Competitors		
Beijing	Shenzhen	Guangzhou	Shanghai
Changchun	Nantong	Zhangzijiang	Foshan
Changsha	Zhengzhou	Haerbin	Fuzhou
Changzhou	Kunshan	Dongguan	Zhangshu
Chengdu	Hangzhou	Wuhan	Dalian
Chongqing	Nanjing	Hangzhou	Dalian
Dalian	Qingdao	Wuhan	Hangzhou
Dongguan	Kunshan	Changzhou	Ningbo
Foshan	Zhangzijiang	Changchun	Zhangshu
Fuzhou	Yantai	Jinan	Zhengzhou
Guangzhou	Shenzhen	Tianjin	Chengdu
Haerbin	Jinan	Yangzhou	Zhengzhou
Haikou	Shijiazhuang	Shaoxing	Weihai
Hangzhou	Wuhan	Qingdao	Dalian
Hefei	Huizhou	Zhongshan	Zhenjiang
Hohhot	Lianyungang	Taiyuan	Daqing
Jiangyin	Caojing	Jining	Qinhuangdao
Jinan	Haerbin	Fuzhou	Yangzhou
Jiujiang	Taixing	Wujiang	Pinghu
Kunming	Nanning	Urumqi	Guiyang
Lanzhou	Liuzhou	Guigang	Zhejiang
Nanchang	Yangzhou	Jiangyin	Tangshan
Nanjing	Chongqing	Hangzhou	Dalian
Ningbo	Foshan	Dongguan	Xiamen
Qingdao	Wuhan	Dalian	Dongguan
Rizhao	Ganzhou	Yizheng	Zhanjiang
Shanghai	Beijing	Guangzhou	Suzhou
Shaoxing	Shijiazhuang	Weihai	Guigang
Shenyang	Xiamen	Ningbo	Zhuhai
Shenzhen	Guangzhou	Chengdu	Nanjing
Shijiazhuang	Shaoxing	Xiangyang	Taizhou
Suzhou	Tianjin	Nanjing	Wuxi
Taiyuan	Guigang	Zhangzhou	Daqing
Tangshan	Yangzhou	Huzhou	Xuzhou
Tianjin	Guangzhou	Suzhou	Nanjing
Urumqi	Wenzhou	Hohhot	Taiyuan
Wuhan	Qingdao	Hangzhou	Ningbo
Wuhu	Jiujiang	Taixing	Yancheng
Wuxi	Dongguan	Nanjing	Kunshan
Xiamen	Ningbo	Shenyang	Xi'an
Xi'an	Changsha	Fuzhou	Jinan
Yantai	Fuzhou	Nanchang	Yancheng
Zhengzhou	Nanchang	Haerbin	Changsha
Zhongshan	Huizhou	Taicang	Jiaying
Zhuhai	Huizhou	Hefei	Changchun

## Annex 5

### Sector competitor of DI

City	Top 3 Competitors		
Beijing	Shanghai	Shenzhen	Guangzhou
Changchun	Chongqing	Zhuhai	Haerbin
Changsha	Shenyang	Zhengzhou	Hefei
Changzhou	Zhuji	Jiangyin	Dongguan
Chengdu	Shaoxing	Foshan	Shangyu
Chongqing	Changchun	Haerbin	Shenyang
Dalian	Changzhou	Dongguan	Wuxi
Dongguan	Jiangyin	Changzhou	Zhuji
Foshan	Shangyu	Zhuji	Zhangjiagang
Fuzhou	Suzhou	Zhongshan	Xiamen
Guangzhou	Xiamen	Hefei	Chongqing
Haerbin	Xining	Zhuhai	Zhuzhou
Haikou	Zhuzhou	Wuhu	Jiujiang
Guiyang	Taizhou	Zhongshan	Weifang
Hangzhou	Nanjing	Kunming	Xiamen
Hefei	Shenyang	Xi'an	Xiamen
Hohhot	Zhengzhou	Zhuhai	Zhuzhou
Jiangyin	Dongguan	Changzhou	Zibo
Jinan	Xining	Zhuji	Wuxi
Jiujiang	Zhangjiagang	Shangyu	Weifang
Kunming	Taizhou	Lianyungang	Xining
Lanzhou	Zhongshan	Zhuji	Shangyu
Nanchang	Haerbin	Zhuhai	Zhuzhou
Nanjing	Fuzhou	Shenyang	Suzhou
Ningbo	Changzhou	Jiangyin	Xiamen
Qingdao	Foshan	Shangyu	Zhuzhou
Lianyungang	Taizhou	Shijiazhuang	Kunming
Shanghai	Shenzhen	Guangzhou	Hangzhou
Shaoxing	Jiujiang	Zhangjiagang	Shangyu
Shenyang	Guiyang	Zhuhai	Hefei
Shenzhen	Guangzhou	Nanjing	Shanghai
Shijiazhuang	Taizhou	Lianyungang	Zhuzhou
Suzhou	Wuxi	Zhangjiagang	Weifang
Taiyuan	Zhangjiagang	Wuxi	Xining
Tangshan	Wuhu	Zhangjiagang	Xining
Tianjin	Lianyungang	Xiamen	Kunming
Urumqi	Tangshan	Shaoxing	Zhangjiagang
Wuhan	Kunming	Nanjing	Suzhou
Wuhu	Tangshan	Zhuzhou	Jiujiang
Wuxi	Xining	Zhuji	Jiangyin
Xiamen	Zhuji	Changzhou	Shenyang
Xi'an	Wuxi	Zhuji	Dongguan
Taizhou	Lianyungang	Shijiazhuang	Jiujiang
Xining	Zhuzhou	Zhuhai	Jiujiang
Yantai	Shaoxing	Zhangjiagang	Weifang
Yichang	Jiujiang	Hohhot	Zhengzhou
Zhengzhou	Zhuji	Zhuzhou	Zhongshan
Zhongshan	Zhuji	Dongguan	Zhengzhou
Zhuhai	Zhuzhou	Xining	Zibo
Zhuji	Zhongshan	Changzhou	Zhangjiagang
Zhuzhou	Xining	Zhuhai	Zhengzhou
Shangyu	Foshan	Jiujiang	Weifang
Weifang	Zhangjiagang	Shangyu	Jiujiang

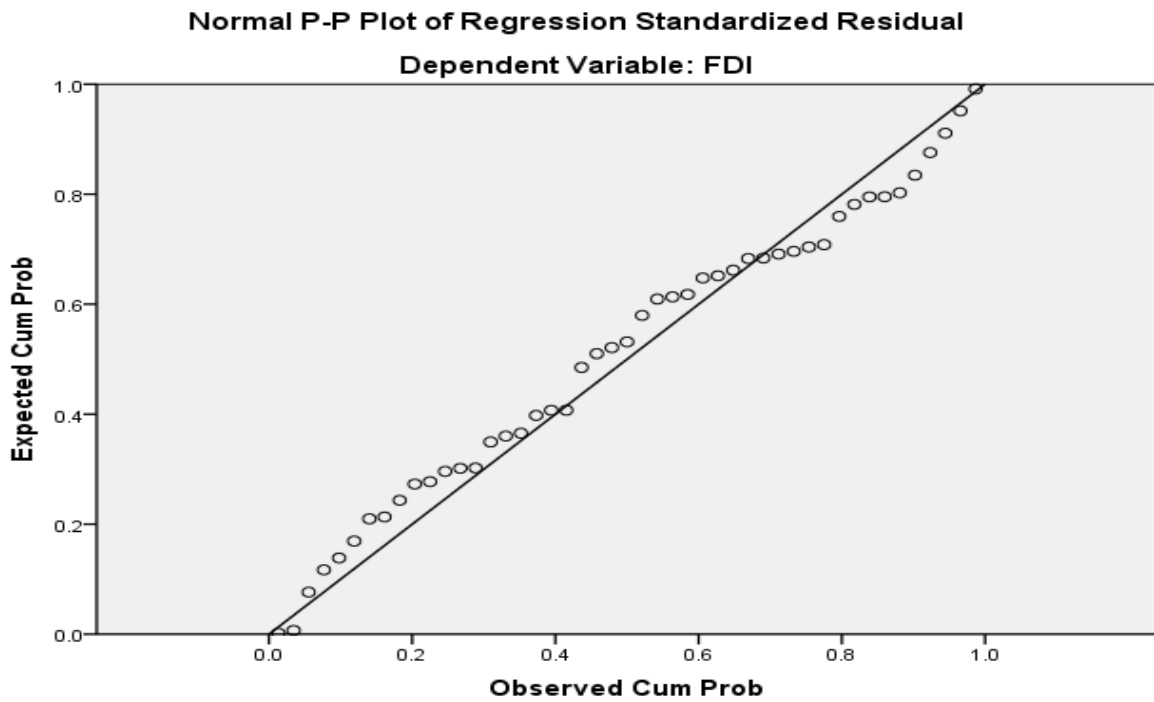
Zhangjiagang	Weifang	Jiujiang	Zhuji
Zibo	Jiangyin	Dongguan	Zhuhai

### Structural Holes Analysis in DI network

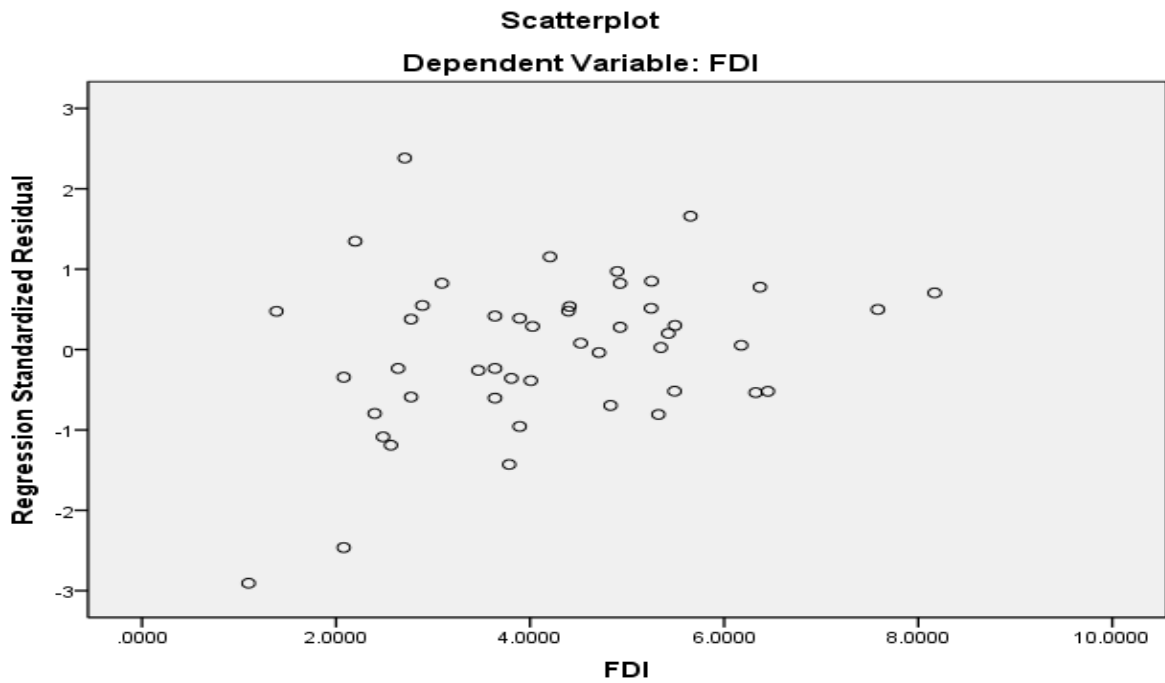
City	Efficient Size	City	Efficiency	City	Constrain
Changchun	6.3	Changchun	0.63	Foshan	0.375
Foshan	5.727	Fuzhou	0.619	Changchun	0.399
Chongqing	5.2	Haikou	0.598	Shijiazhuang	0.405
Dongguan	5.063	Wuxi	0.597	Hefei	0.418
Hefei	5.056	Xining	0.594	Chongqing	0.426
Shijiazhuang	5.05	Changsha	0.59	Haerbin	0.432
Xi'an	5	Hohhot	0.582	Tianjin	0.437
Tianjin	4.909	Chongqing	0.578	Ningbo	0.442
Haerbin	4.6	Foshan	0.573	Xi'an	0.447
Ningbo	4.5	Hefei	0.562	Jinan	0.461
Jinan	4.375	Shijiazhuang	0.561	Dongguan	0.466
Haikou	4.188	Xi'an	0.556	Suzhou	0.467
Hohhot	4.071	Handan	0.556	Tangshan	0.496
Suzhou	3.75	Jinan	0.547	Hohhot	0.505
Tangshan	3.714	Tianjin	0.545	Xiamen	0.512
Wuxi	3.583	Tangshan	0.531	Chengdu	0.517
Wuhu	3.357	Haerbin	0.511	Kunming	0.519
Xiamen	3.286	Ningbo	0.5	Haikou	0.525
Chengdu	3.25	Zhuzhou	0.5	Wuhu	0.53
Kunming	3.143	Changzhou	0.5	Wuxi	0.541
Zhuzhou	3	Lanzhou	0.5	Zhongshan	0.574
Dalian	2.917	Xingxian	0.5	Qingdao	0.578
Qingdao	2.833	Dalian	0.486	Yichang	0.581
Yichang	2.75	Wuhu	0.48	Dalian	0.582
Zhongshan	2.75	Qingdao	0.472	Zhuzhou	0.584
Yantai	2.417	Suzhou	0.469	Yantai	0.585
Xining	2.375	Xiamen	0.469	Shaoxing	0.655
Zhuji	2.333	Zhuji	0.467	Zhuji	0.685
Shaoxing	2.25	Chengdu	0.464	Jiangyin	0.69
Jiangyin	2.2	Yichang	0.458	Zhengzhou	0.703
Handan	1.667	Zhongshan	0.458	Xining	0.749
Taiyuan	1.6	Shaoxing	0.45	Taiyuan	0.787
Zhengzhou	1.6	Kunming	0.449	Zhuhai	0.792
Zhuhai	1.5	Jiujiang	0.444	Handan	0.84
Jiujiang	1.333	Urumqi	0.444	Nanchang	0.956
Urumqi	1.333	Jiangyin	0.44	Rizhao	1
Nanchang	1.25	Nanchang	0.417	Jiujiang	1.049
Changzhou	1	Yantai	0.403	Urumqi	1.049
Lanzhou	1	Taiyuan	0.4	Changzhou	1.125
Rizhao	1	Zhuhai	0.375	Xingxian	1.125
Xingxian	1	Zhengzhou	0.32	Lanzhou	1.389

## Annex 6

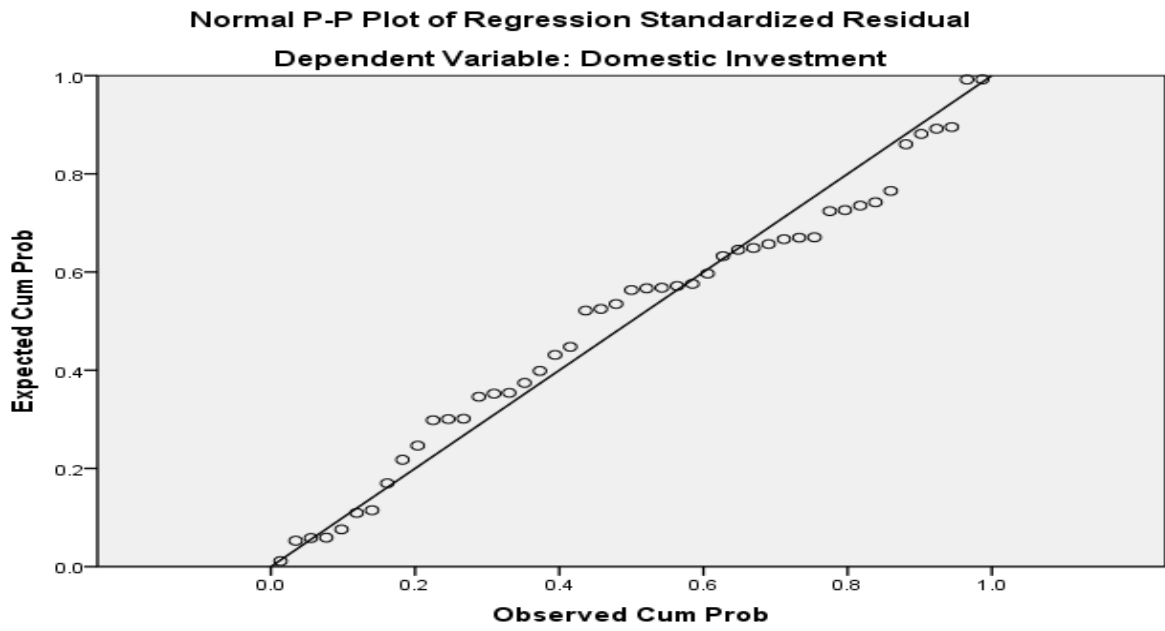
FDI P-P Plot of Regression Standardized Residual for all cities



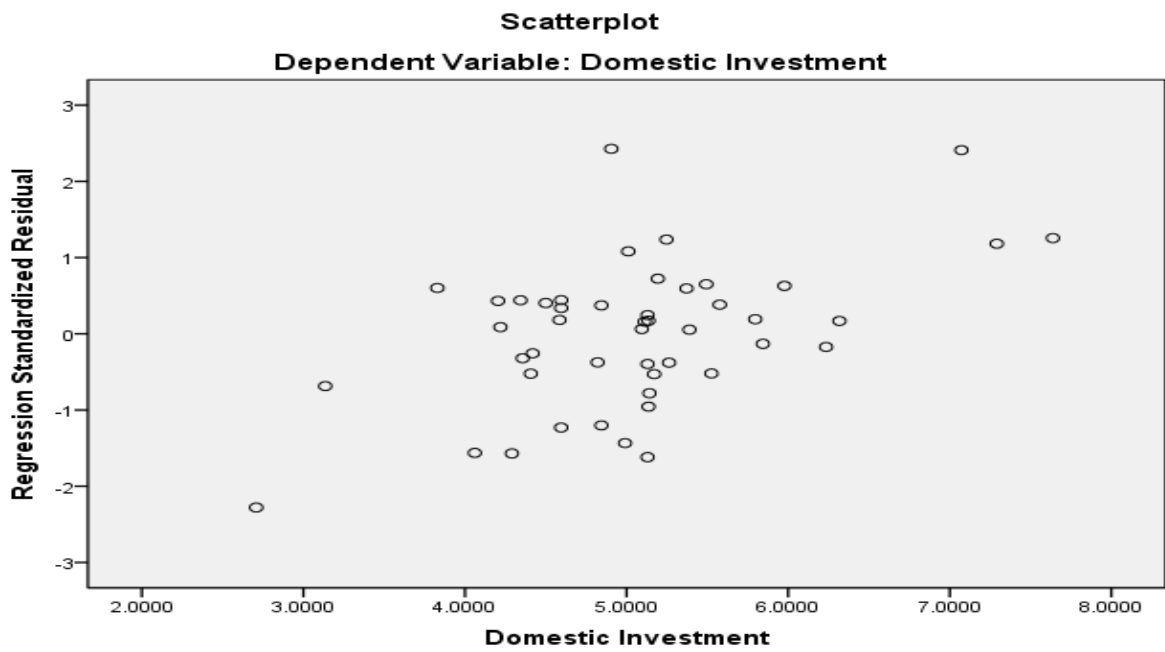
FDI Scatterplot of Regression Standardized Residual for all cities



**DI P-P Plot of Regression Standardized Residual for all cities**

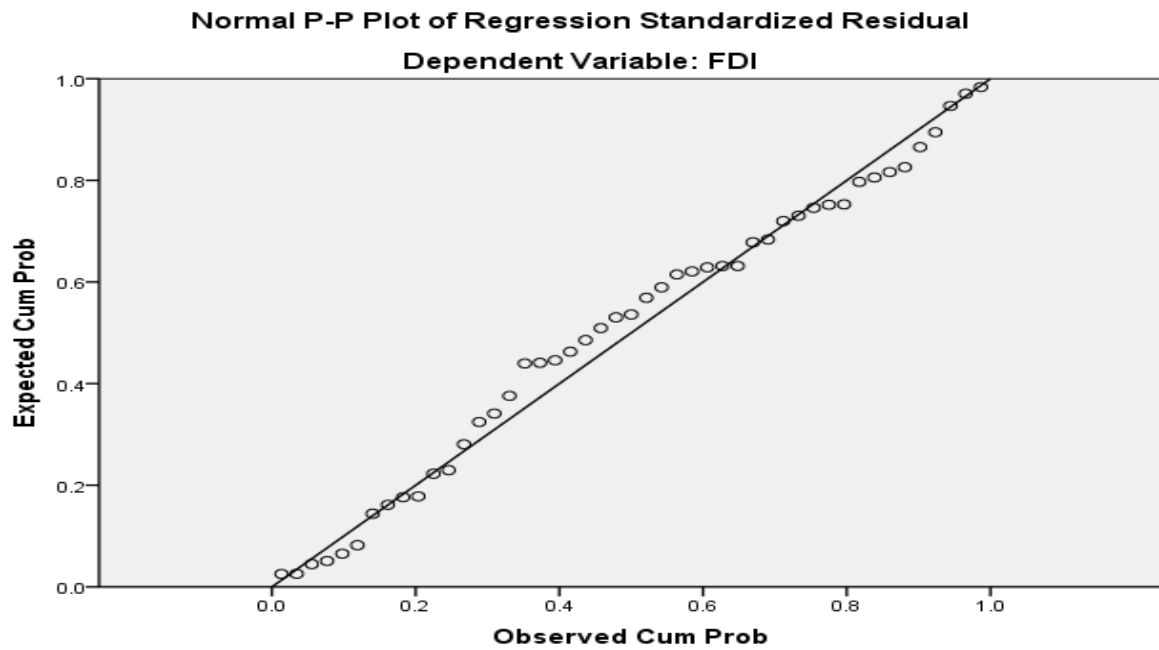


**DI Scatterplot of Regression Standardized Residual for all cities**

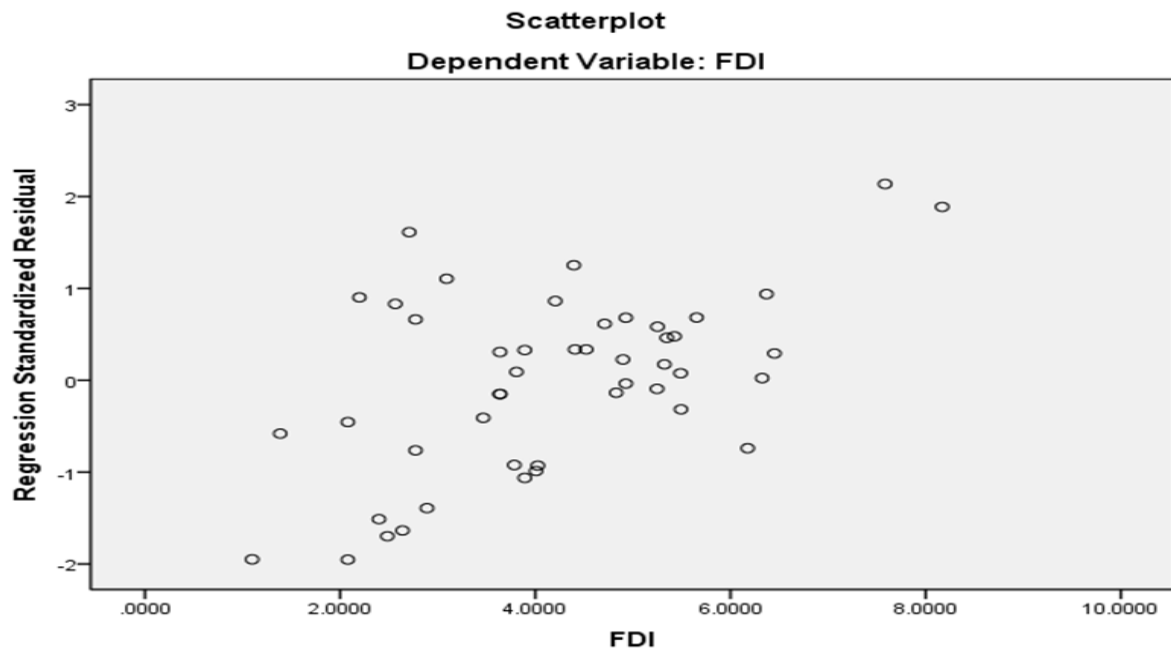


## Annex 7

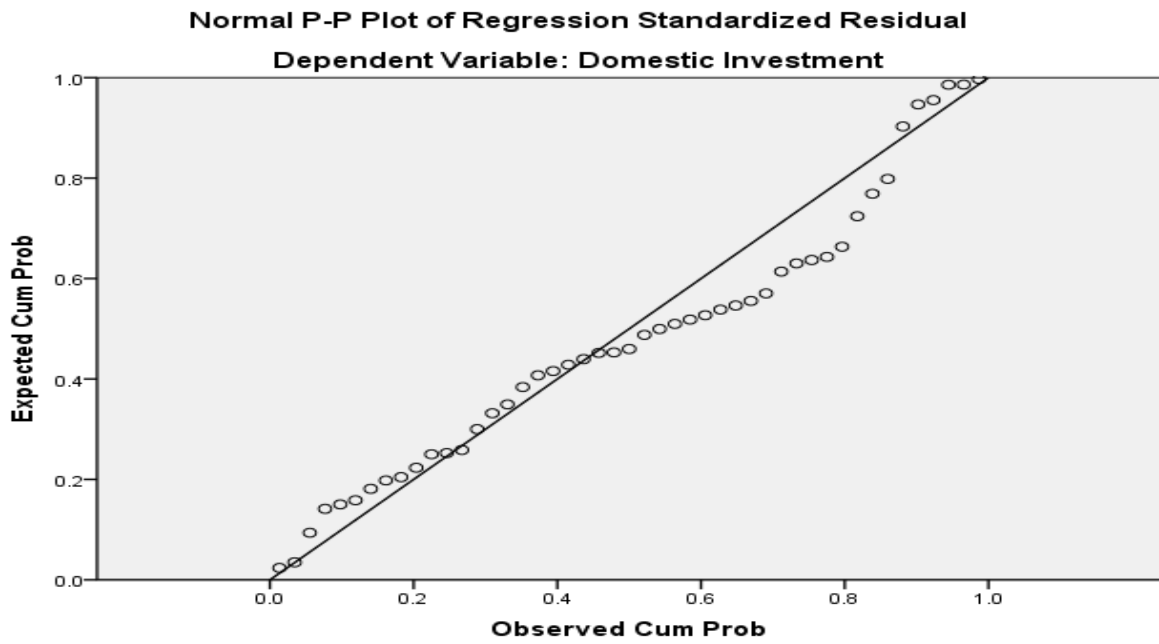
### FDI P-P Plot of Regression Standardized Residual by Humanities Indicators



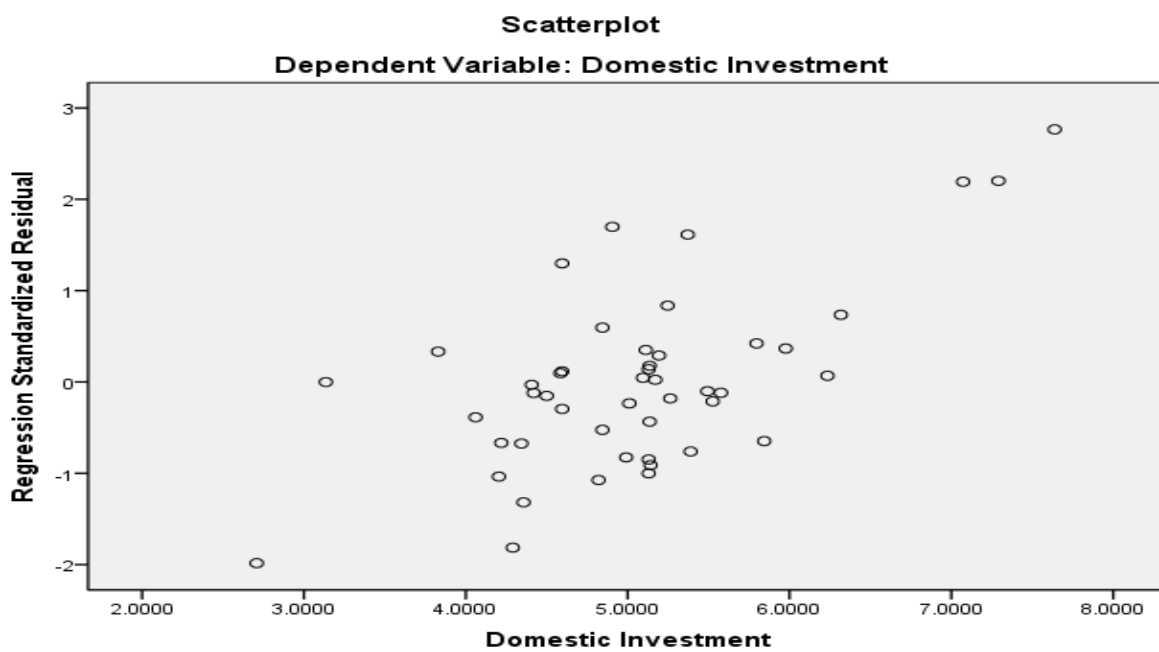
### FDI Scatterplot of Regression Standardized Residual by Humanities Indicators



**DI P-P Plot of Regression Standardized Residual by Humanities Indicators**

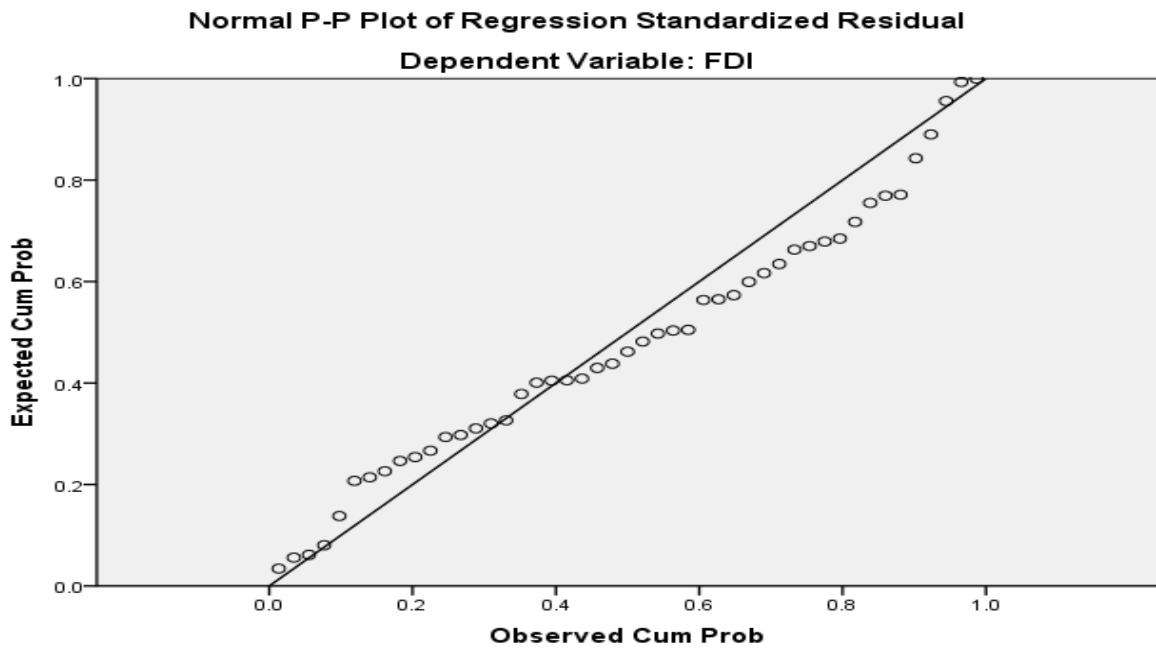


**DI Scatterplot of Regression Standardized Residual by Humanities Indicators**

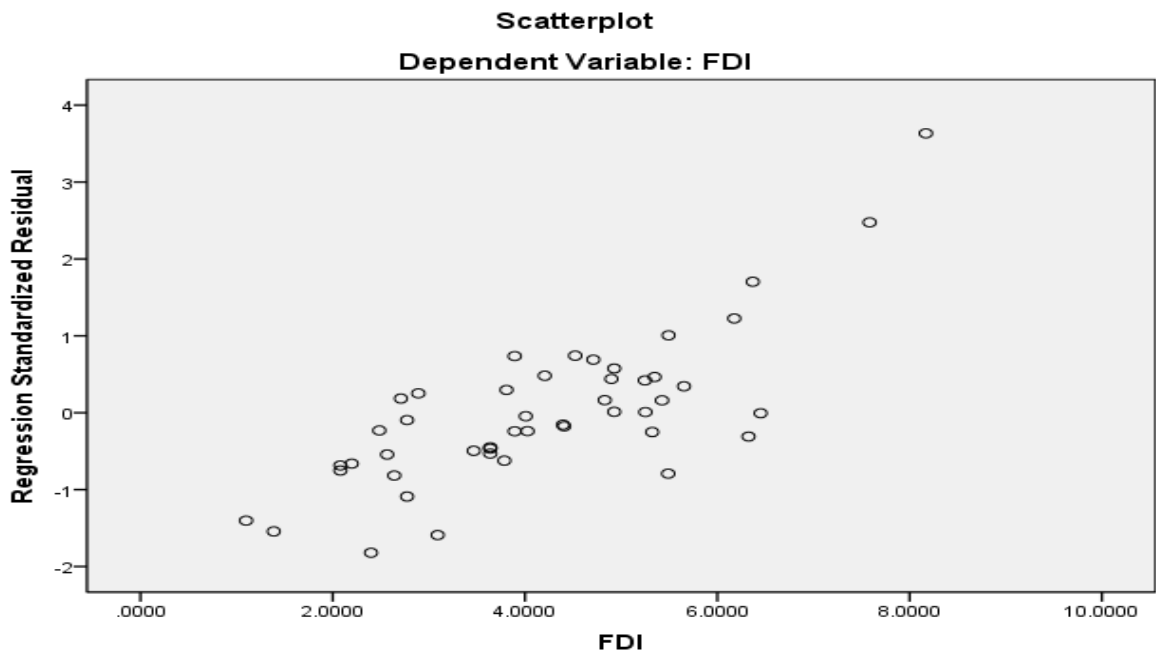


# Annex 8

## FDI P-P Plot of Regression Standardized Residual by Environment Indicators

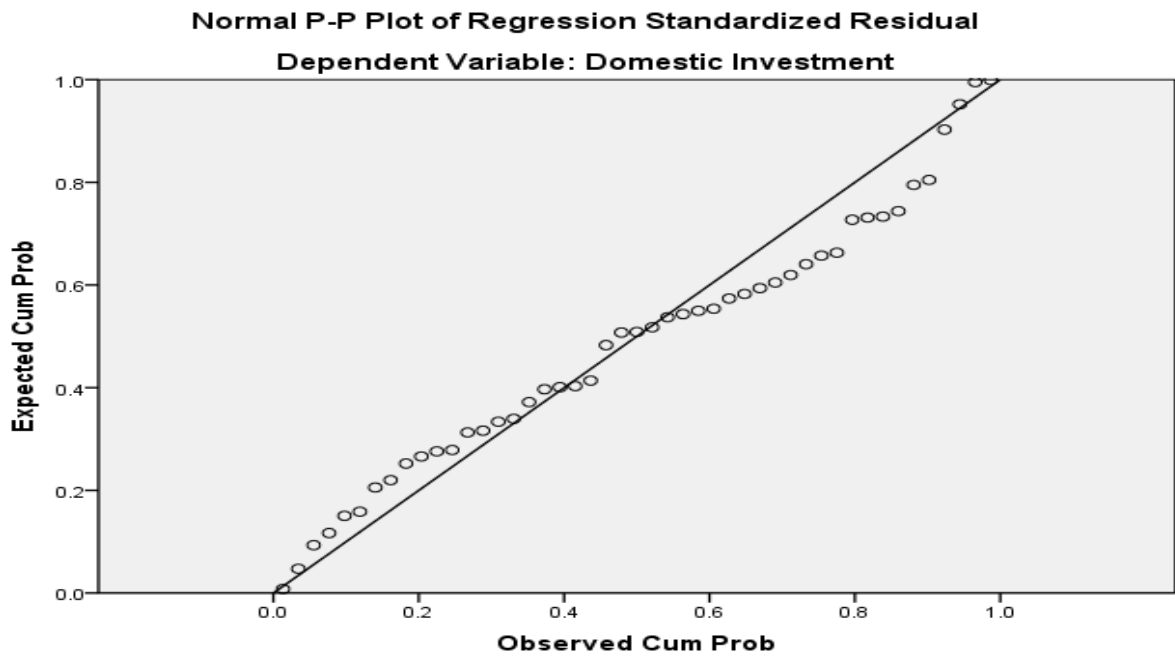


## FDI Scatterplot of Regression Standardized Residual by Environment Indicators

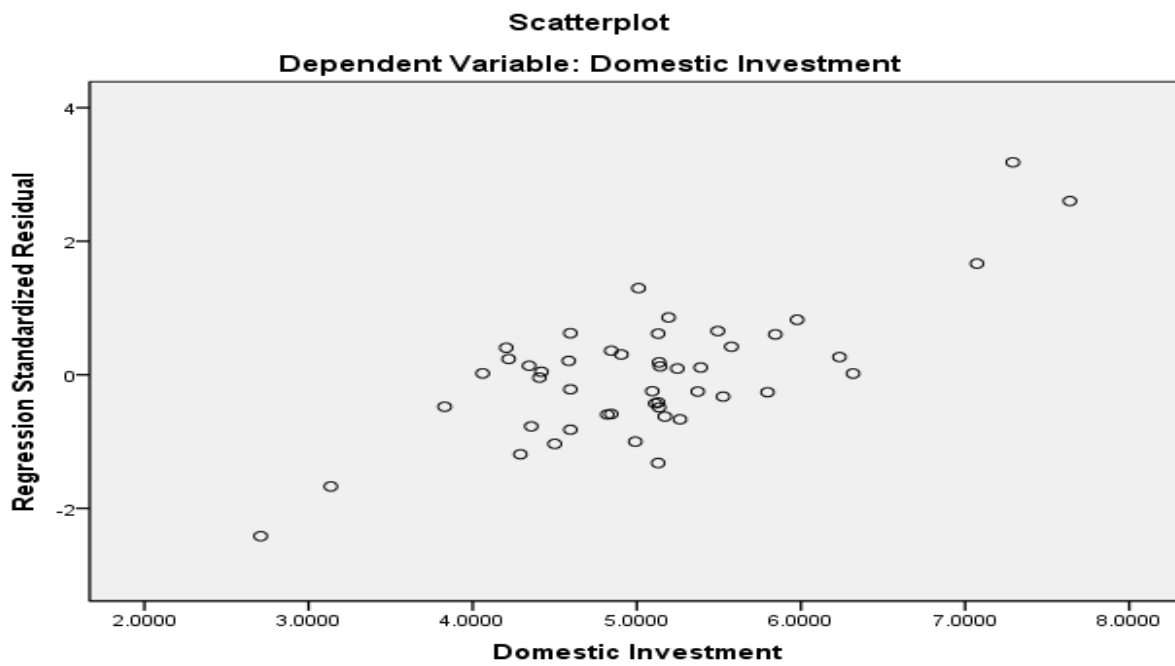




**DI P-P Plot of Regression Standardized Residual by Environment Indicators**

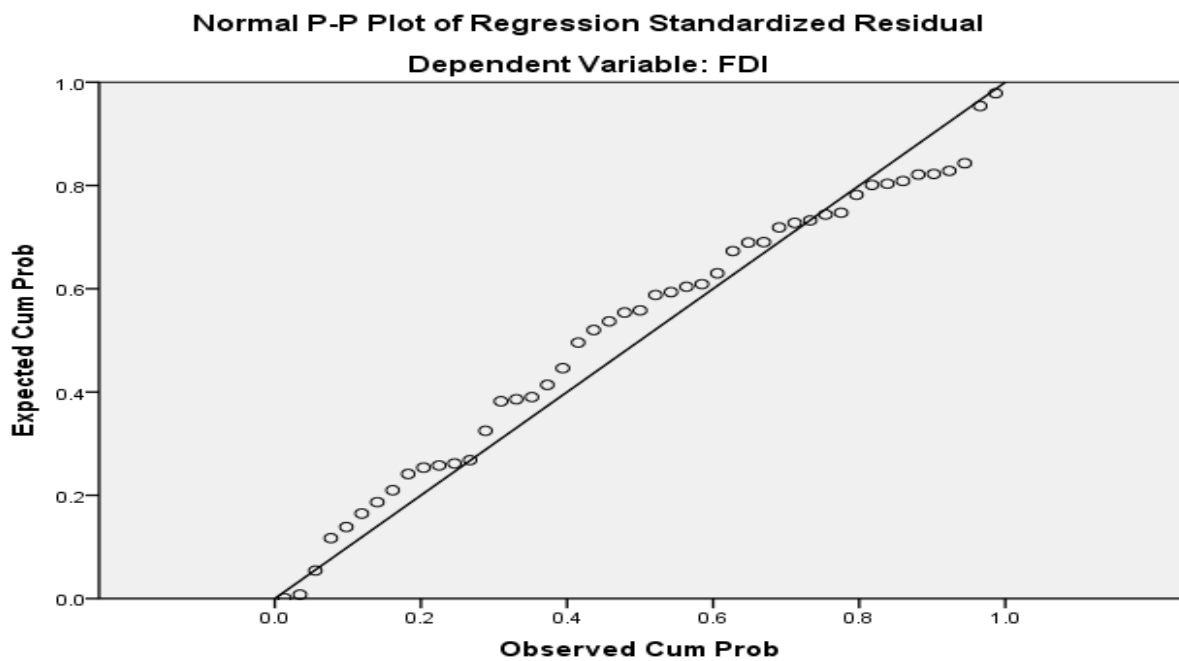


**DI Scatterplot of Regression Standardized Residual by Environment Indicators**

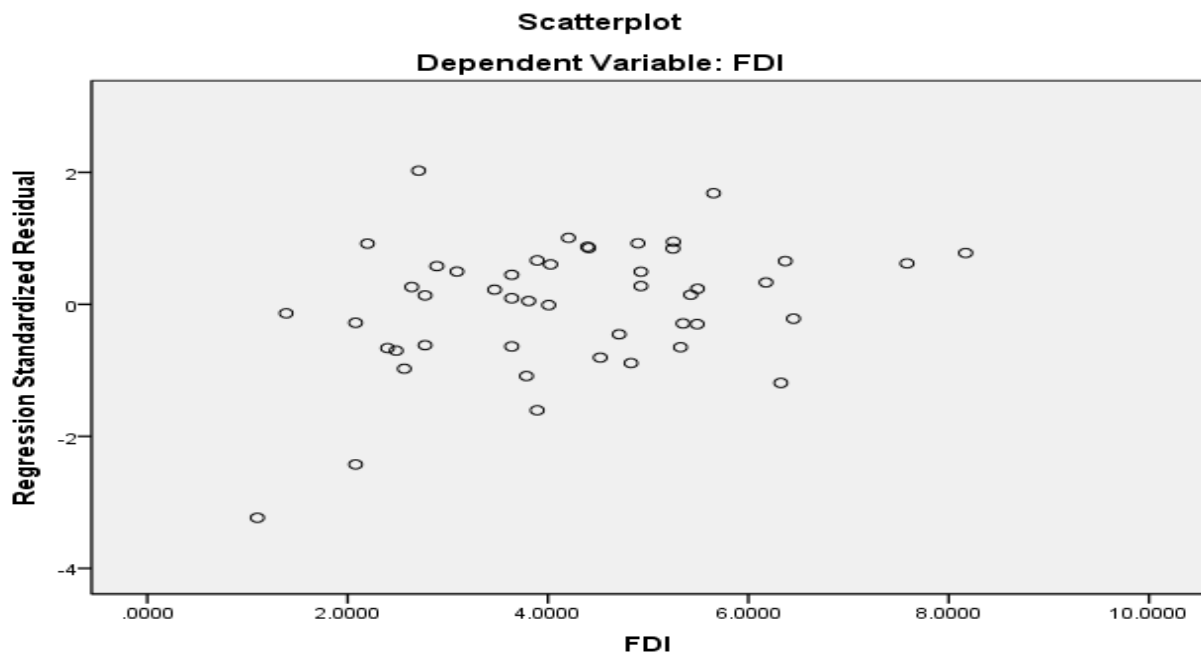


## Annex 9

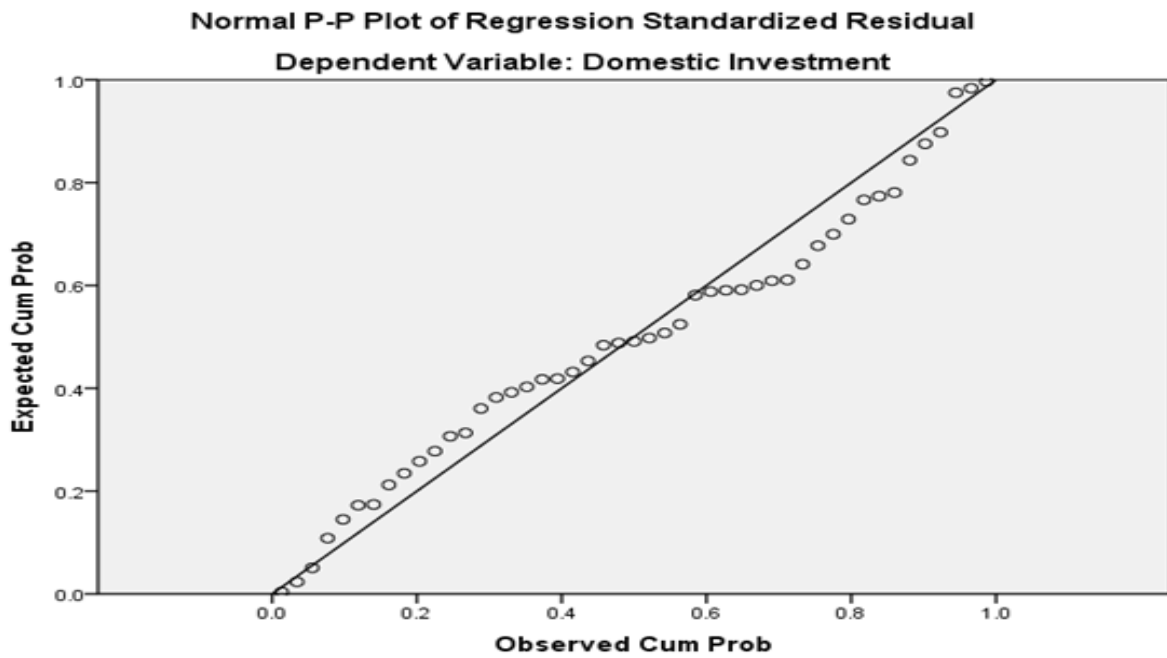
### FDI P-P Plot of Regression Standardized Residual by Economy Indicators



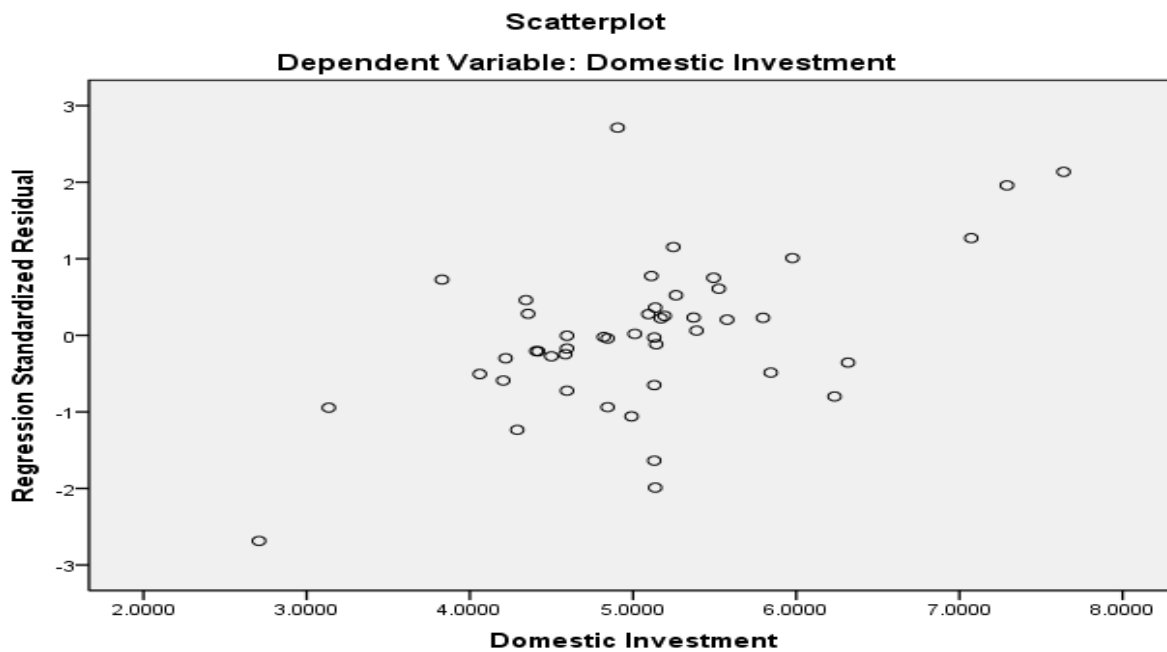
### FDI Scatterplot of Regression Standardized Residual by Economy Indicators



**DI P-P Plot of Regression Standardized Residual by Economy Indicators**

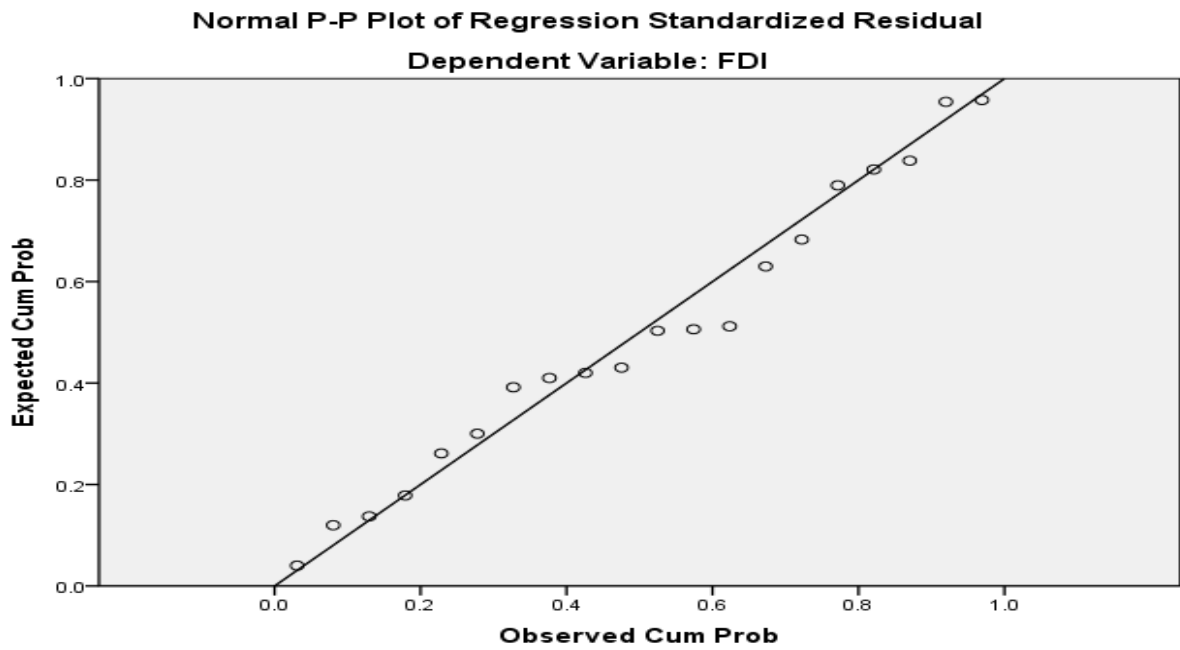


**DI Scatterplot of Regression Standardized Residual by Economy Indicators**

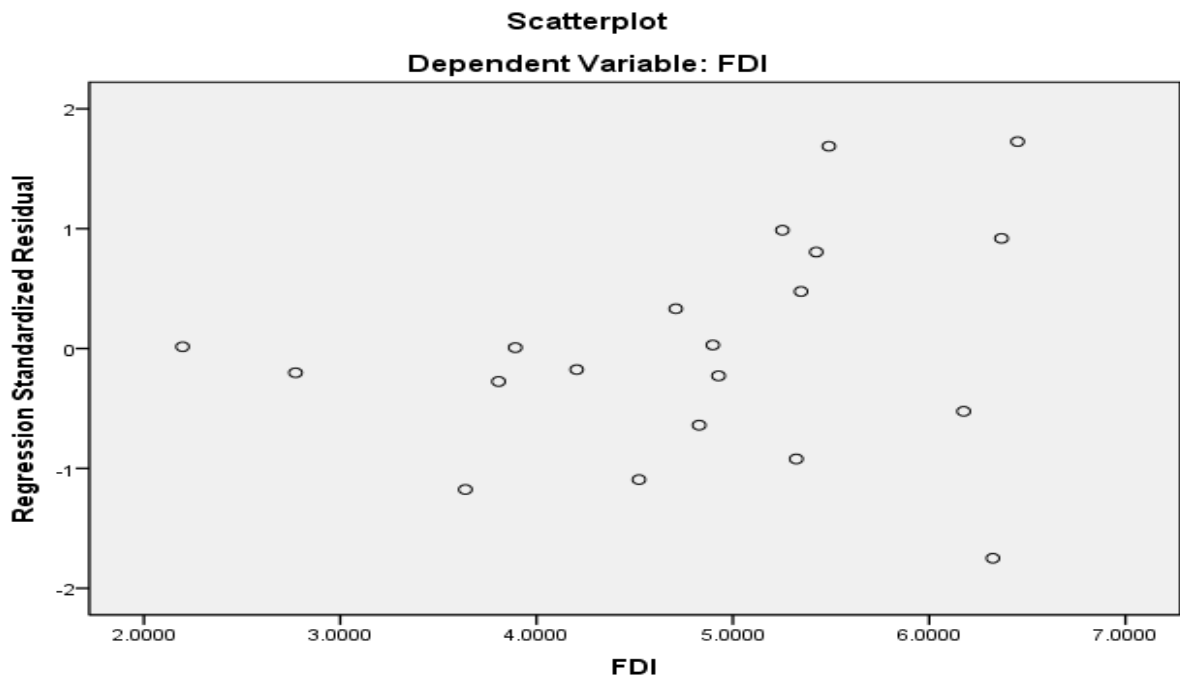


# Annex 10

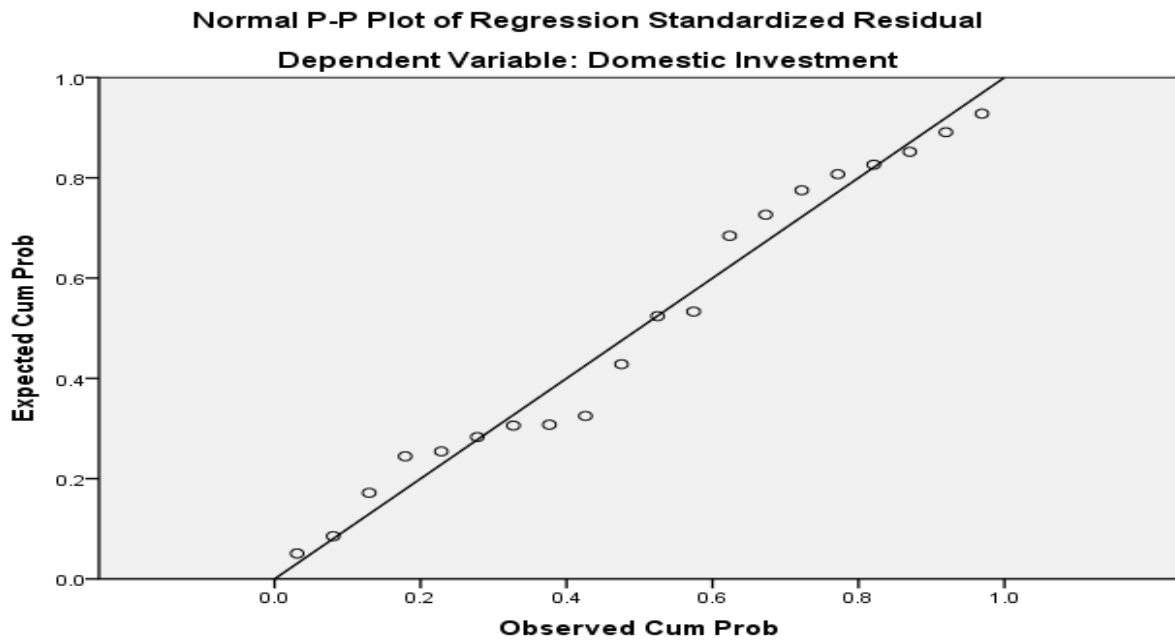
FDI P-P Plot of Regression Standardized Residual for coastal cities



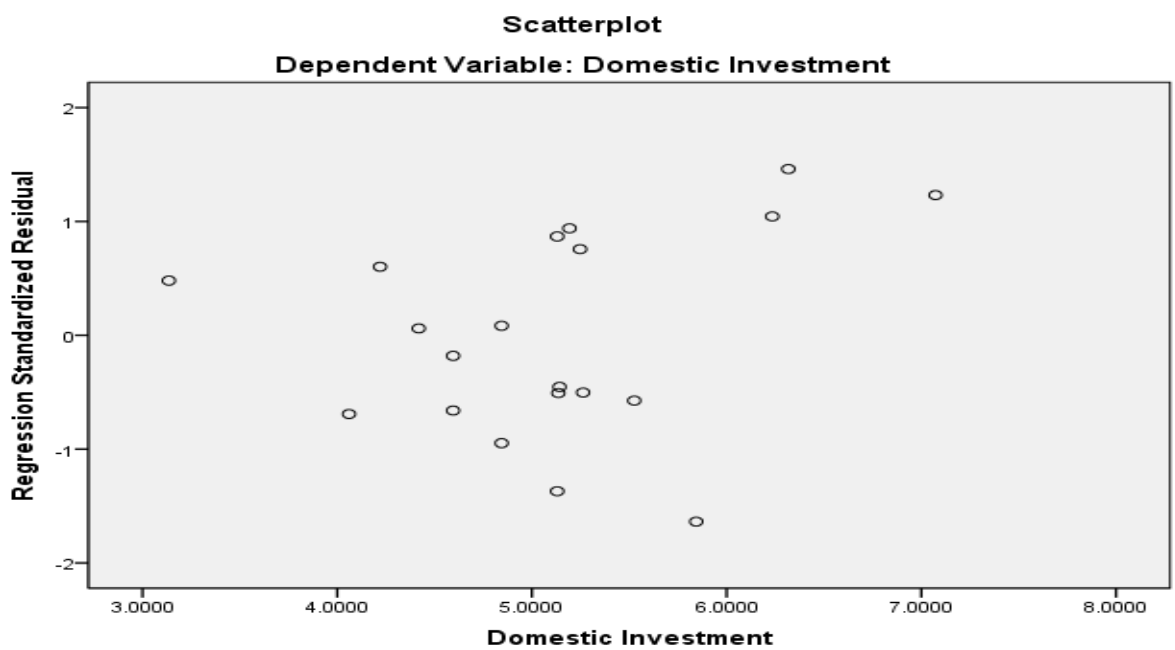
FDI Scatterplot of Regression Standardized Residual for coastal cities



**DI P-P Plot of Regression Standardized Residual for coastal cities**

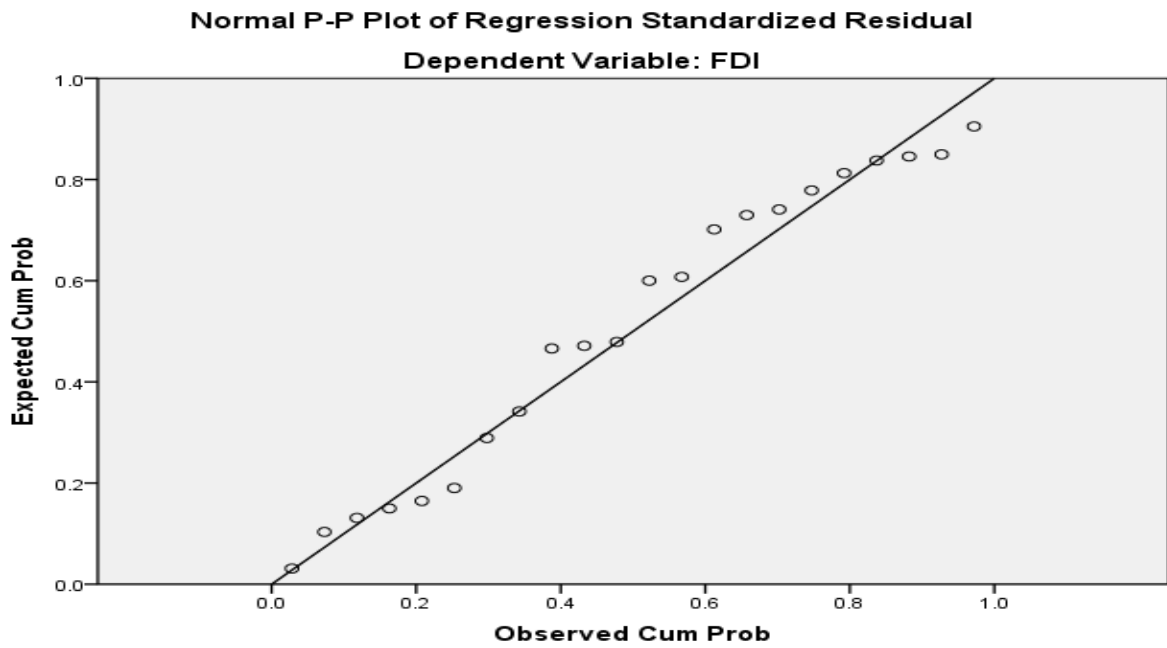


**DI Scatterplot of Regression Standardized Residual for coastal cities**

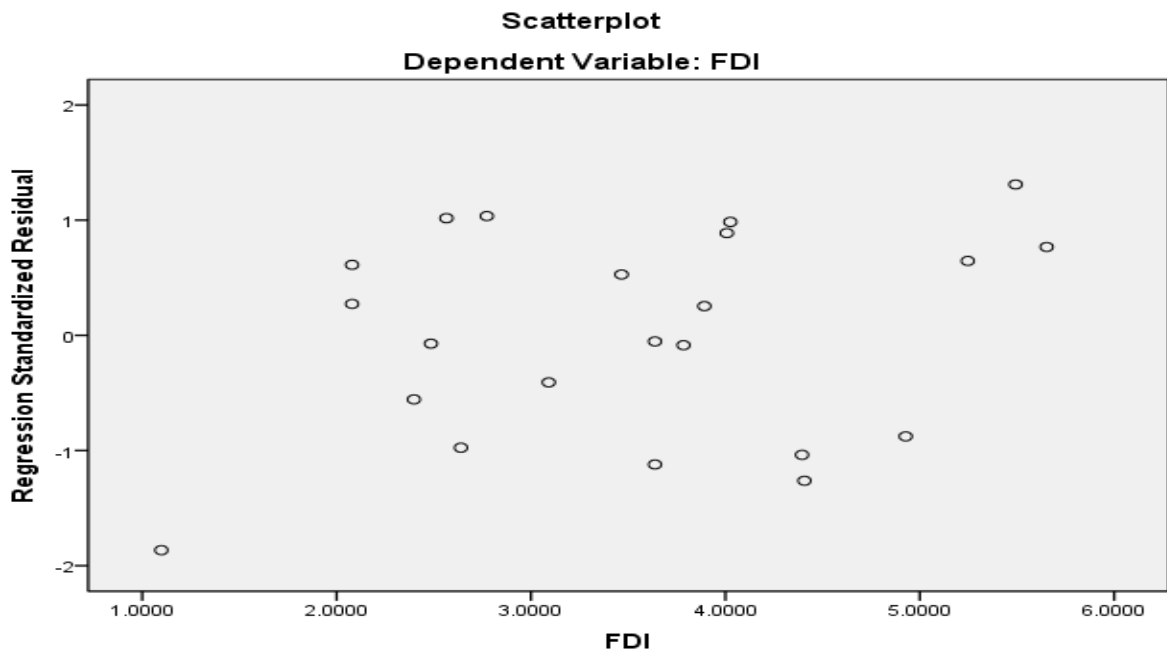


# Annex 11

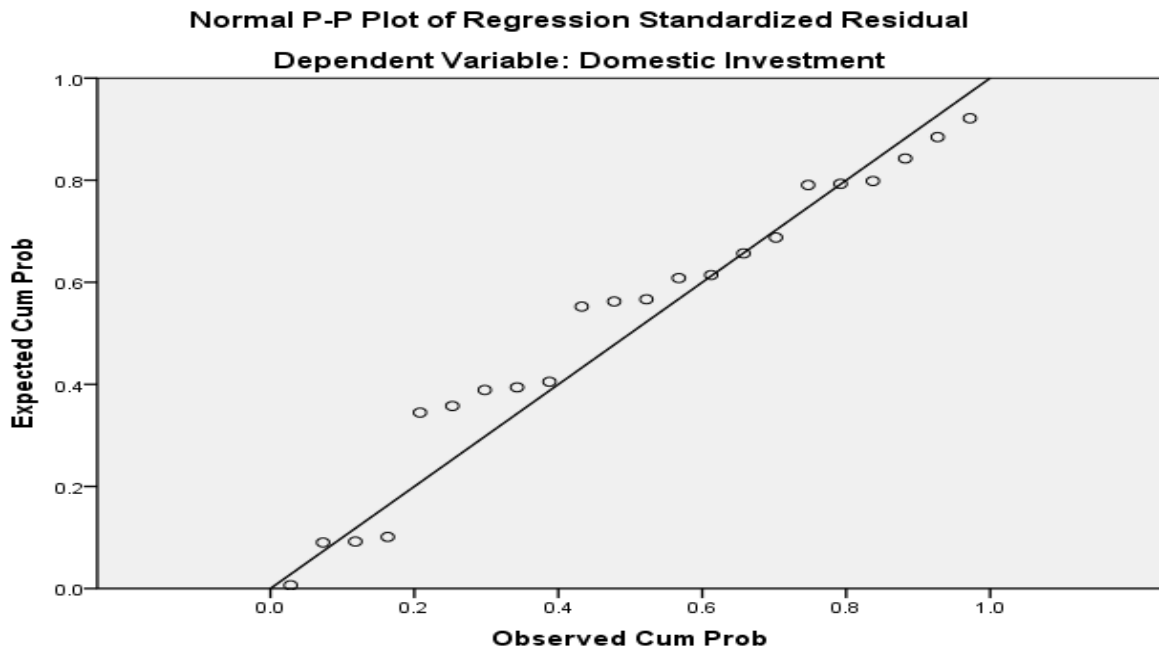
FDI P-P Plot of Regression Standardized Residual for coastal cities for inland cities



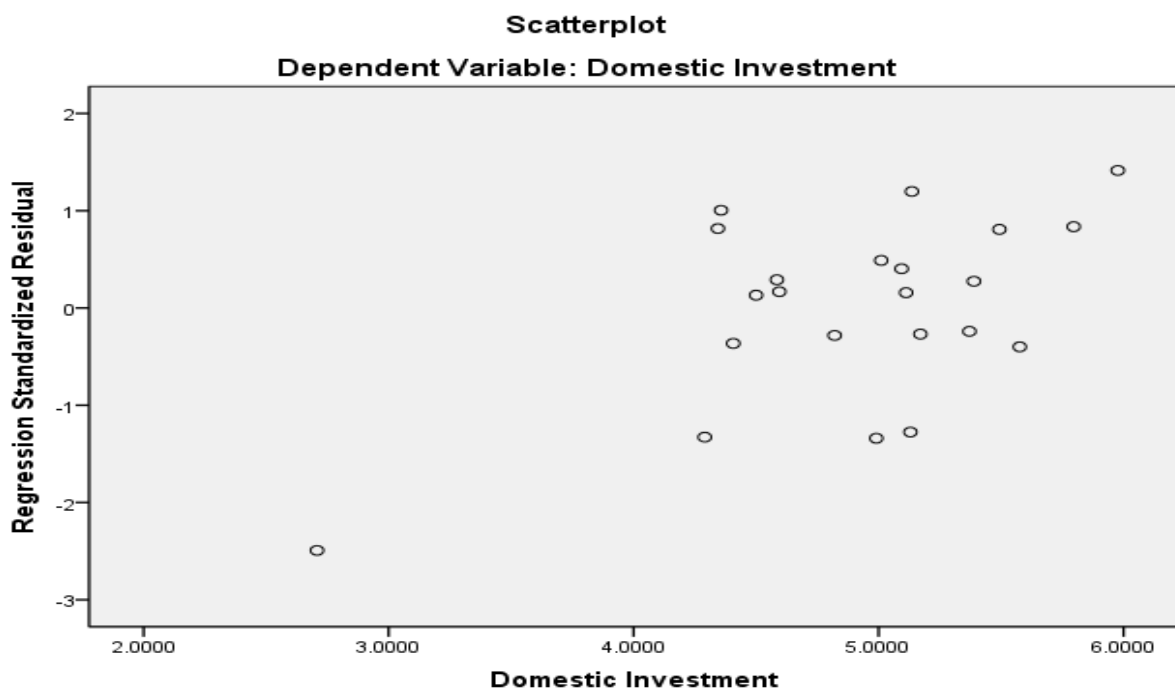
FDI Scatterplot of Regression Standardized Residual for inland cities



DI P-P Plot of Regression Standardized Residual for inland cities



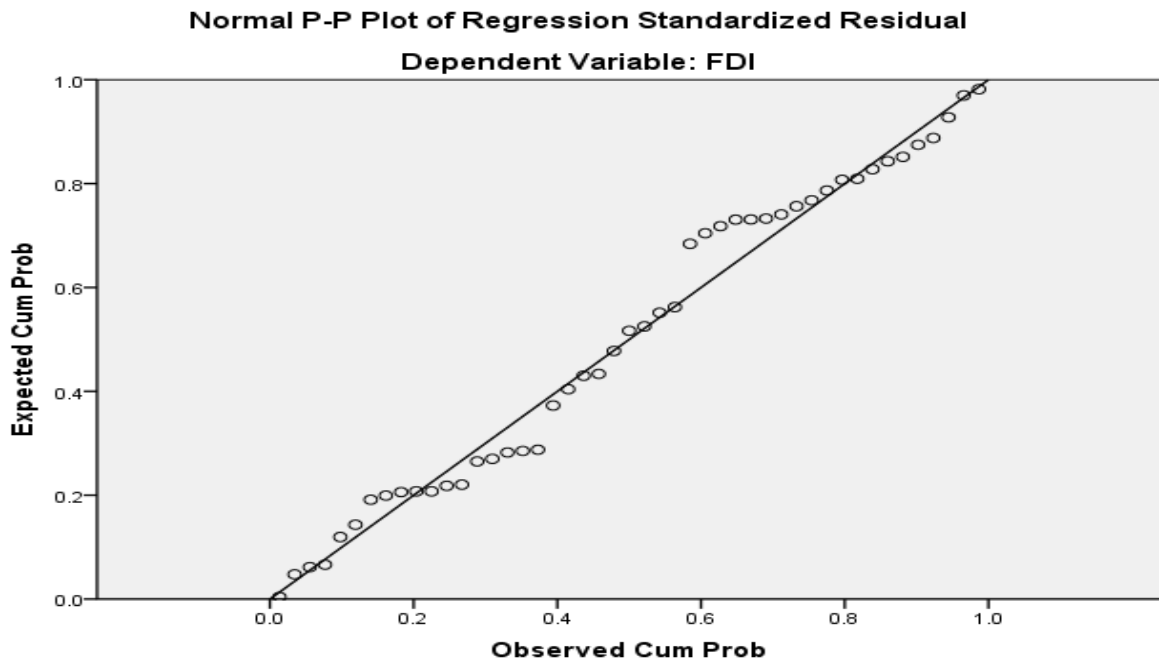
DI Scatterplot of Regression Standardized Residual for inland cities



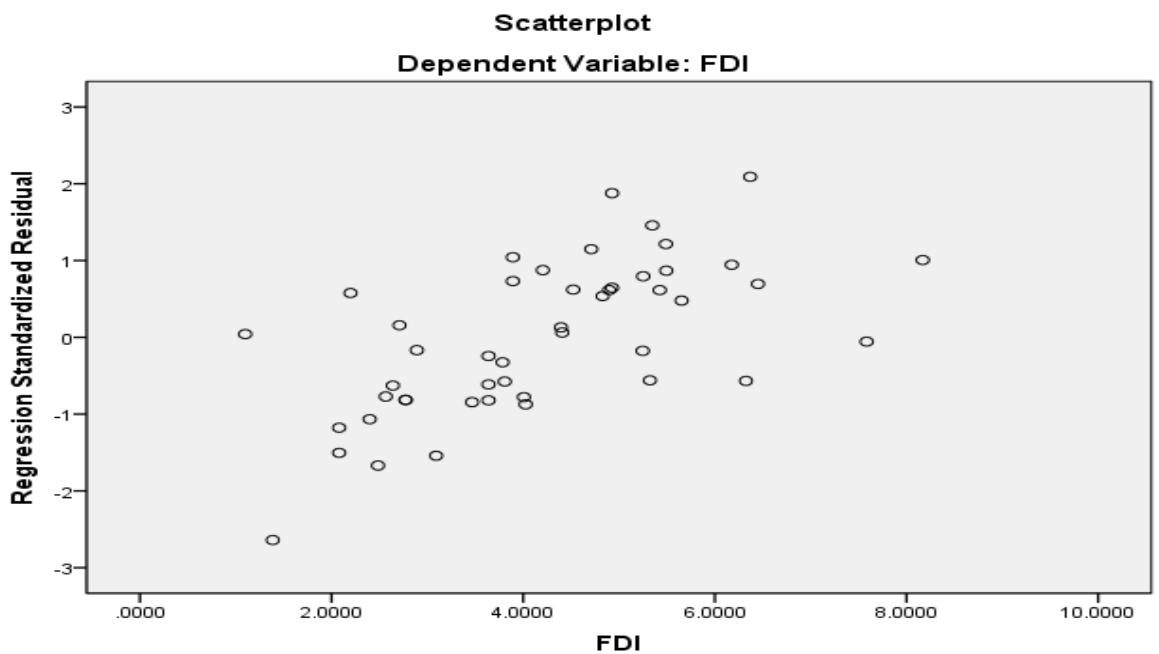
# Annex 12

FDI and DI relationship of all the Cities

FDI P-P Plot of Regression Standardized Residual

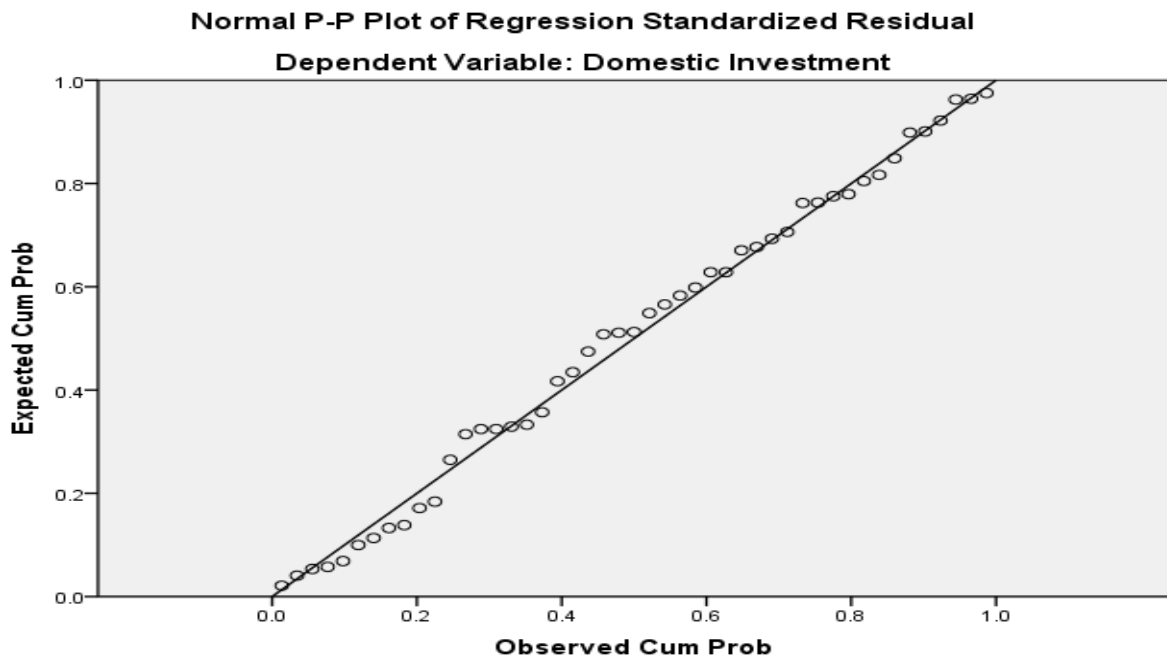


FDI Scatterplot of Regression Standardized Residual

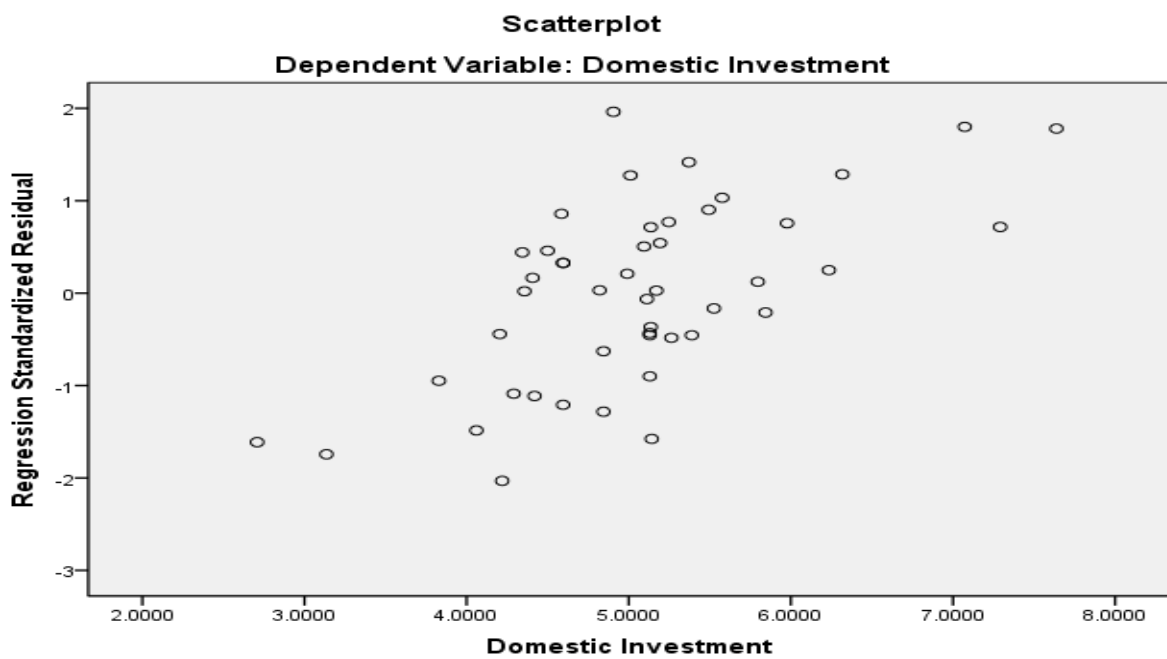




### DI P-P Plot of Regression Standardized Residual

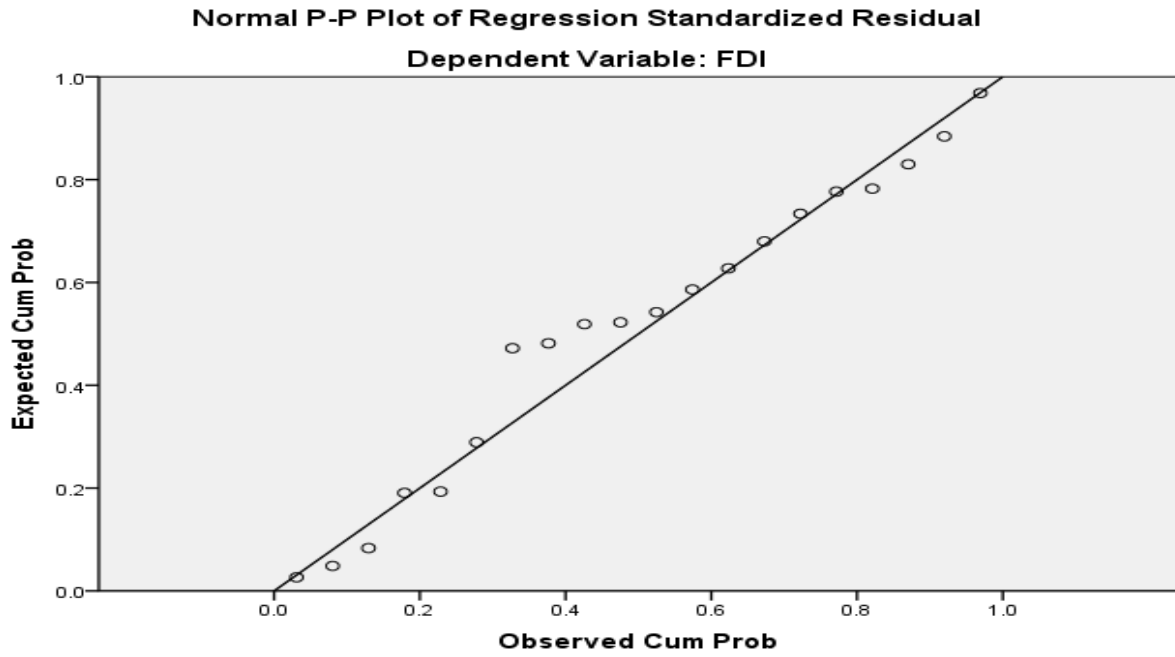


### DI Scatterplot of Regression Standardized Residual

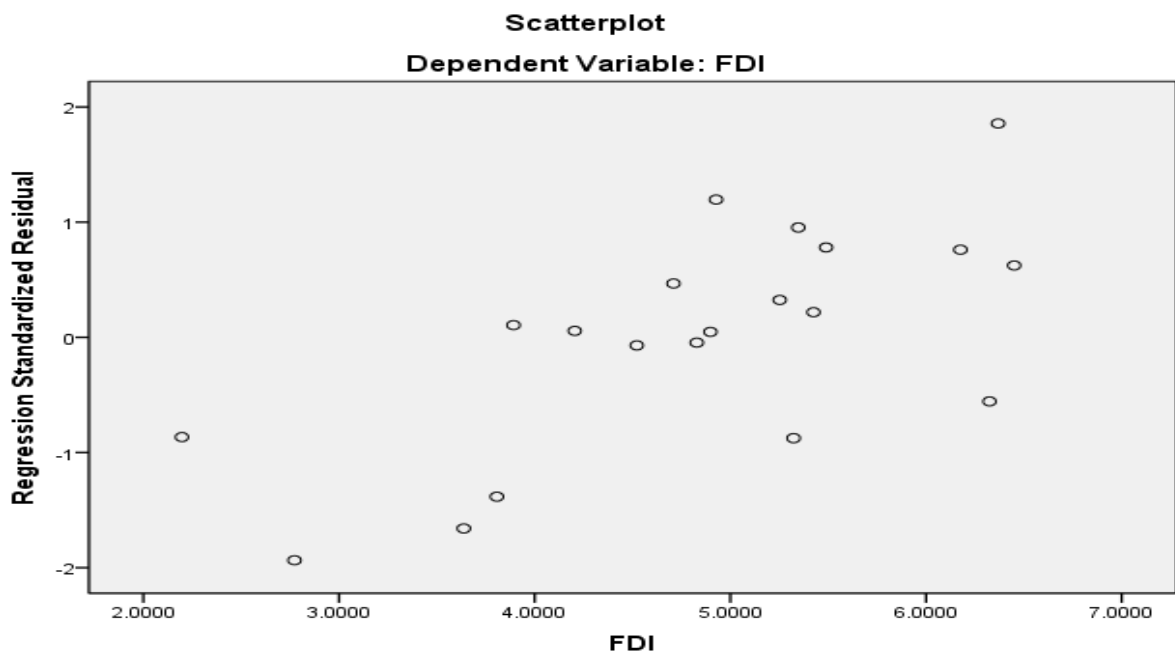


**FDI and DI relationship of coastal cities**

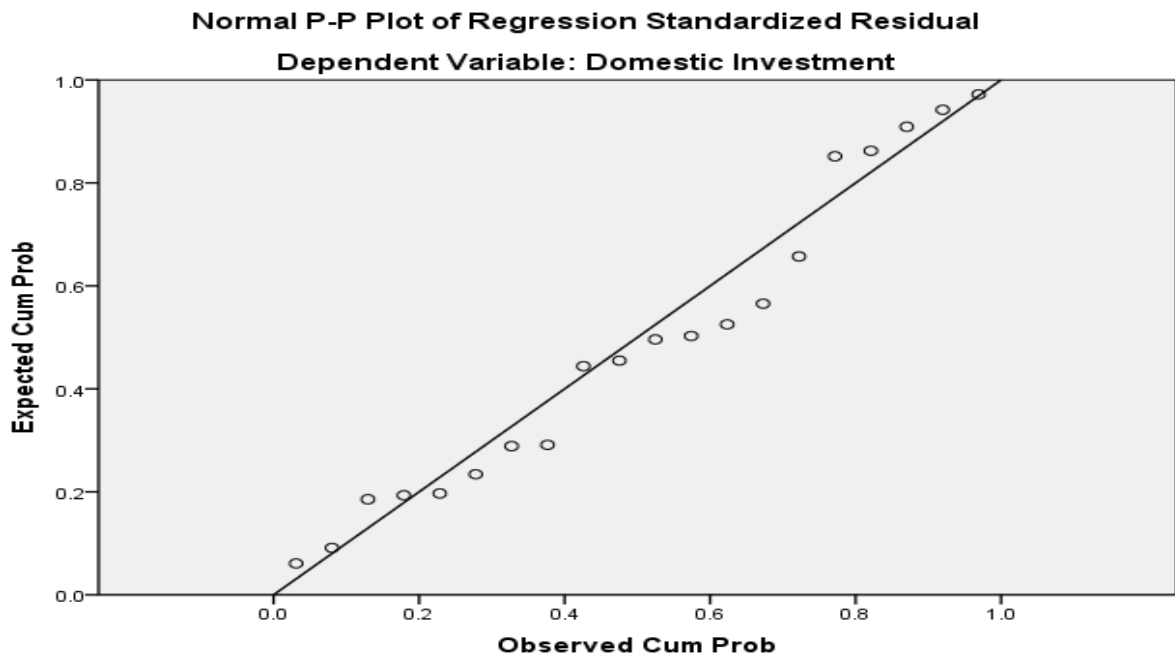
**FDI P-P Plot of Regression Standardized Residual for coastal cities**



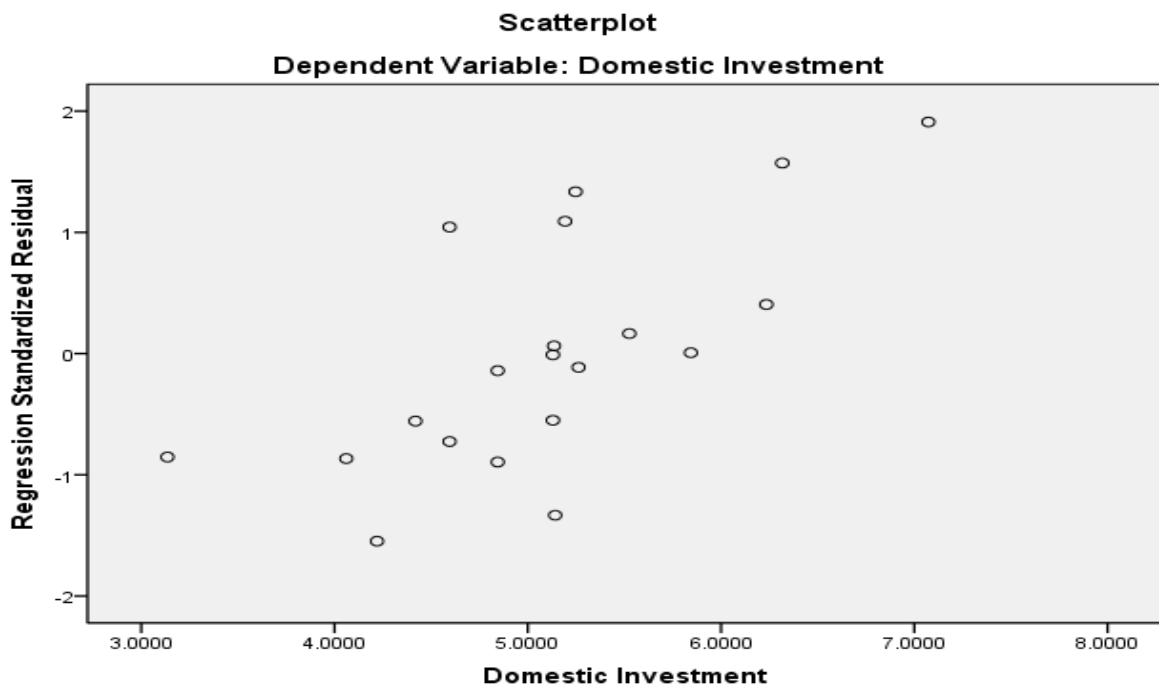
**FDI Scatterplot of Regression Standardized Residual for coastal cities**



**DI P-P Plot of Regression Standardized Residual for coastal cities**

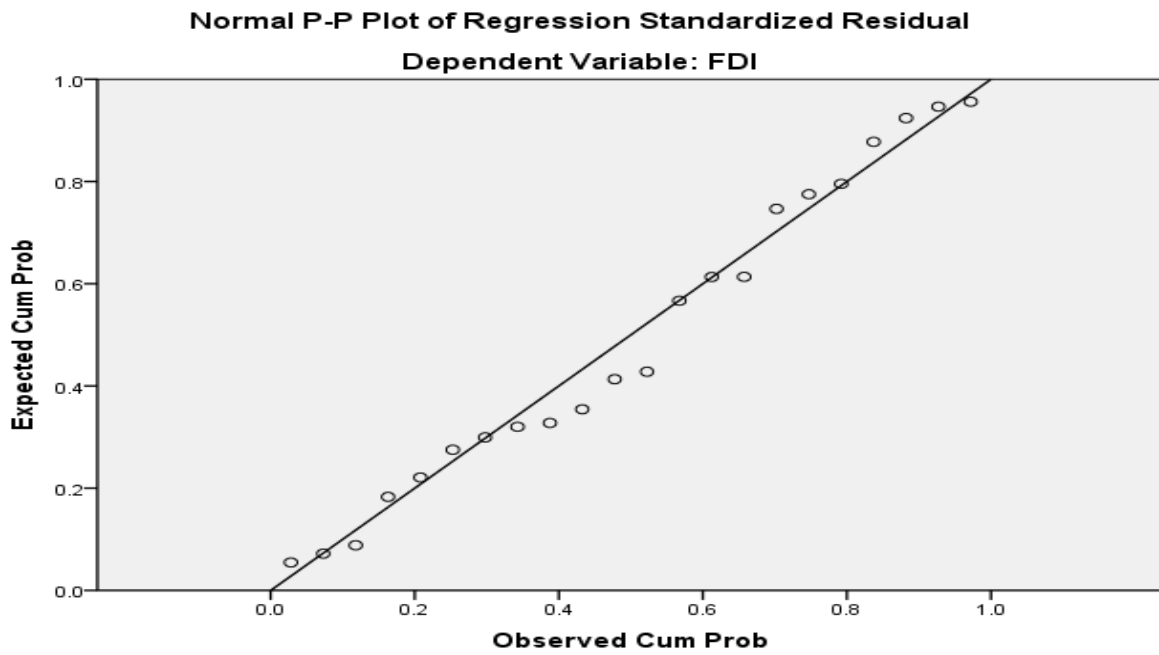


**DI Scatterplot of Regression Standardized Residual for coastal cities**

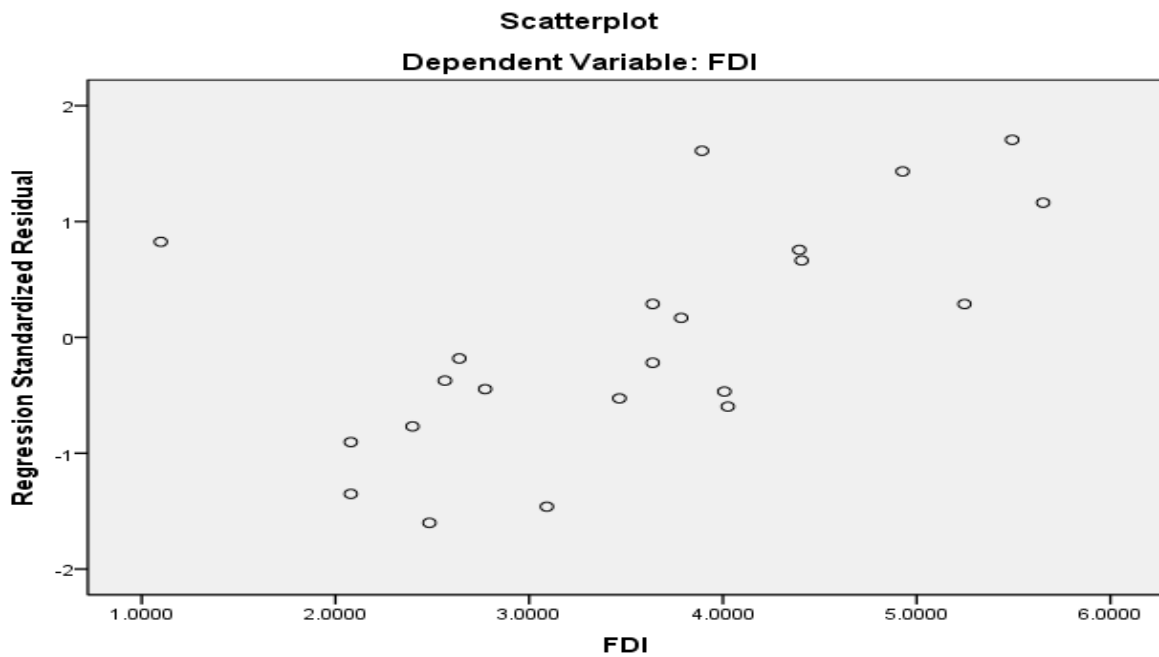


**FDI and DI relationship of inland cities**

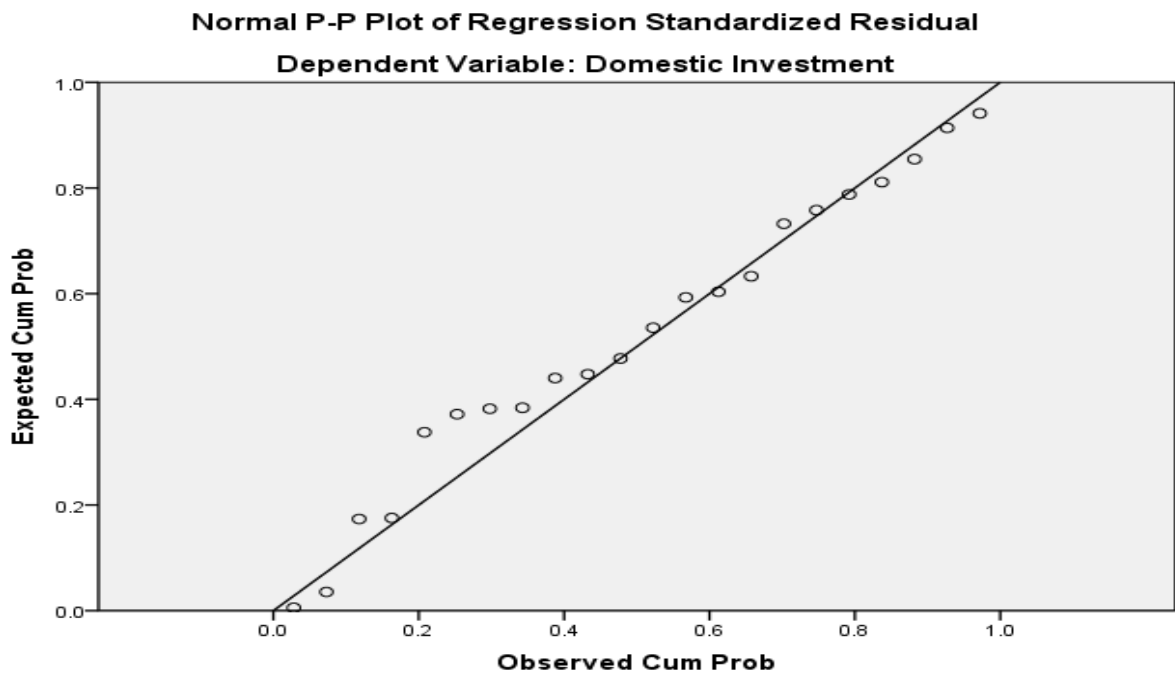
**FDI P-P Plot of Regression Standardized Residual for inland cities**



**FDI Scatterplot of Regression Standardized Residual for inland cities**



**DI P-P Plot of Regression Standardized Residual for inland cities**



**DI Scatterplot of Regression Standardized Residual for inland cities**

