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The spillover effect of foreign direct investments on the Chinese economy

By

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In 1980, China set up four special economic zones (SEZ) to attract overseas investors to gain advanced technology and economic growth. Until now China has become the largest recipient of FDI these years. This gives the author great interest to study the spillover effect of FDI in China. The research question is from 1997 to 2016, whether FDI had an impact on China's economic growth, and whether it had advantages or disadvantages. To better understand the decisions made by Chinese managers, a new sub-research question stands out: whether the special economic zones set by China have a positive impact on the economy. This thesis uses panel data to help answer research questions. The Data includes 31 provinces in China from 1997 to 2016, except GDP (t-1), which is from 1996 to 2015. The result shows the data in this paper are not enough to support the positive relationship between special economic zones and economic development and fail to provide readers with an early understanding on the establishment of special economic zones by Chinese leaders. However, there is sufficient evidence to show whether the spillover effect of FDI has an impact on China's economy.

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1. Introduction

In 1980, China set up four special economic zones (SEZ) so as to attract overseas investors, gain advanced technology and achieve economic growth. Overseas investment had become a hot topic among developing countries at that time. In the eyes of developing countries, the success of The Four Asian Tigers was inseparable from the economic benefits brought by overseas investment (Quibria, 2002). FDI, also known as a foreign direct investment (FDI), refers to a foreign investment in which investors could directly participate in the management and have certain property rights. Investors will get economic benefits, while those being invested will mainly gain technological improvement and economic growth. In 1990, China became the largest recipient of foreign investment among developing countries, which brought a lot of benefits to fledgling China (Smarzynska Javorcik, B, 2004). Yet any policy has a dual character, not just a positive one. A large amount of external investment may bring about a series of adverse effects, such as widening the gap between rich and poor areas in China, crowding out the creativity of local companies, and even excessively increasing foreign exchange reserves which lead to the unstable of Chinese economy (Cheung & Ping, 2004). Nee and Opper (2014) revealed the negative impact of FDI on Regional divergence in growth in China. From the research, FDI has highly promoted the Chinese economy and improved market efficiency by increasing human resources in the market. However, its effects are limited to areas with more FDI inflows such as eastern China, which leads to huge differences in economic and production income in western China with low FDI inflows, exacerbating the gap between the rich and the poor (Nee and Opper, 2014). In addition, Cheng and Yum (2000) believe that FDI falls in fixed places in China with better infrastructure and economic conditions for investment. As a result, it further widens the regional gap in China, leading to the imbalance of the entire Chinese economy.

According to the data above, despite of huge economic growth FDI has brought to China, it is uneven for China's overall development. China has been encouraging FDI since 1980, from the opening of special economic zones to the opening of economic cities. There is no doubt that these economic cities have played a significant role in China's economy (Hu, 2007). In this case, can other cities accept the spillover effect of FDI as the opening economic cities have done to boost the economy or will they lag behind the opening economic cities to a larger extent? When taking the province as the unit, whether the spillover effect of FDI can help the economic development of other cities in a province. It is the first research question in this paper, and also a starting point to better understand the central problem of this paper. According to Hale & Long (2006), the spillover effects refers to when an activity occurs that produces not only the expected impact of the activity but also provides other impacts that affect unrelated people or societies. In general, the spillover effect is the external benefit or deficit brought by activity or project, and it is the effect that the activity or project itself cannot deliver. Spillover effects of FDI mainly include technology spillover effect, knowledge spillover effect and economic spillover effect. According to Madariaga & Poncet (2007)'s research, FDI not only affects the cities receiving FDI, but also the surrounding

cities can gain the influence of FDI spillover effect. Moreover, the evidence shows that this is a positive and significant impact on the personal income of neighboring cities. The proportion of FDI growth rate that increases the income of residents is the same as that of surrounding areas. The spillover effect described in this paper can also be understood as the success of one industry leading to the success of neighboring industries. According to Liu (2002), Shenzhen's (one of the SEZ) manufacturing data from 1993 to 1998 revealed foreign direct investment has greatly improved the production efficiency and economic efficiency of the manufacturing industry. Also, FDI has produced a huge spillover effect, the domestic manufacturing-related industries are the main beneficiaries (Liu,2002).

Due to data limitations, this paper takes 6 special economic zones in China as dummy variables to consider the economic balance between the special economic zones and surrounding cities from another perspective. There is no doubt that SEZ has played a great role in China's economic development (Liang, 1999). When we use all the cities in the whole province where SEZ is located to measure whether this province is helpful to China's economic development, the results can show the economic gap interval of this province. If the results of SEZ in the model of regression can prove that SEZ plays a positive role in China's economic growth. It indicates that the spillover effect of FDI can not only help the development of SEZ region but also help the economic development of surrounding areas of SEZ; otherwise, it indicates that the city as a special economic zone cannot drive the development of nearby cities, and the economic gap among the cities in this province is large, which may lead to the problem of economic inequality. This will be a fundamental issue for people to understand the policy impacts of SEZ on the Chinese economy.

The main question of this paper aims to find out whether the spillover effect of FDI has really brought economic benefits to the whole Chinese economy in recent years. Compare to the first research problem, the main purpose is from a more macro perspective, not just in economic development zones. The reason is many previous studies on FDI were in the context of economic development zones, where foreign investors could only invest at SEZ at that time. However, China has become the largest recipient of FDI in recent years, and its investment areas are not limited to economic development zones so that the spillover effect of FDI does not only affect economic development zones. Also, the previous literature, the author found that a lot of data are out of date, and their impression of FDI is only at the initial stage of its impact on China. Furthermore, based on the non-intuitive spillover effect, this paper will explore the impact of FDI spillover effect on China's economy in three steps. The first step is to identify the spillover effects of FDI on factors other than China's economy in the literature. The second part is to do the regression analysis using the factors from the literature and GDP per capita (as a representation of the economy). From the regression, it described the relationship between each variable and the Chinese economy, the data used is for every province in China. Only the dummy variable (SEZ) uses the data of six special economic zone provinces and describes the data of those six provinces. Finally, combined with the results of the second part and the literature analysis of the first step, we could determine whether the spillover of FDI has an impact on China's

economy and whether SEZ bring a positive impact to the Chinese economy. In general, the main purpose of this paper is: From 1997 to 2016, whether spillover effect of FDI will bring positive impact to Chinese economy, the data will cover all provinces in China.

1.1 Research problem

The objective of the study is to investigate the spillover effect of FDI, especially in the relationship between FDI and the Chinese economy. The research question is from 1997 to 2016, whether FDI had an impact on China's economic growth, and whether it had advantages or disadvantages. To better understand the decisions made by Chinese managers, a new sub-research question stands out: whether the special economic zones set by China have a positive impact on the economy and whether it can help surrounding cities.

1.2 Aim and scope

This paper aims to explore how the spillover effect of FDI affects China's economy in recent years and explore the relationship between SEZ and economic growth to help understand the spillover effect of FDI on China's economy. This paper will use Chinese provincial data from 1997 to 2016 (except data about GDP (t-1) which is from 1996 to 2015) and will treat Fujian, Guangdong, Hainan and Xinjiang as chartered economic zones because this paper USES provincial data without municipal data. Six variables conduct in this paper, respectively: GDP per capita, FDI, export, consumption, education and GDP (t-1).

1.3 Outline of the Thesis

To better help readers understand the paragraphs of the article, the structure of the paper will describe in the remaining sections. In the second paragraph, the theoretical part is mainly about FDI; it contains how FDI affects China's economic development, the relationship between FDI and the relationship between FDI and other influencing factors. Meanwhile, the second part also includes the development and current situation of FDI in China. The third part is about the characteristics, quality, and selection of data. The fourth part expounds the choice of regression line method and the introduction of the model. The fifth part is data analysis and discussion. The sixth part is the conclusion of the article. The last part is the self-reflection and the prospect of future study.

2.Theory

This part introduces the theory of FDI and the spillover effect of FDI.

2.1 FDI

Foreign direct investment (FDI) can be defined as a trans-national investment activity, in which the primary purpose is to obtain the management right of an enterprise by investing capital or other production factors from the investors of a country, to earn profits or scarce resources (Crespo & Fontoura, 2007). For the host country, what FDI brings is the contribution of capital. FDI often occurs between developed countries and developing countries, because developing countries are short of capital. To make up for this deficiency, attracting foreign direct investment from developed countries has become one of their main goals. At the same time, the injection of FDI will bring a spillover effect to the host country (Johnson, 2006). Furthermore, Hale & Long (2006) summarises two points about the characteristics of the FDI spillover effect in the host country. The first point is that foreign investment has different spillover effects on various enterprises. The central performance is that companies with functional absorptive capacity, (sufficient production factors) have positive spillover effects, while companies with weak absorptive capacity have adverse spillover effects. The second point is that there are two mechanisms for positive FDI spillover effects on enterprises with sufficient production factors. The first is that companies which can hire technicians from abroad have higher productivity, which shows that the flow of labour provides a channel for the spillover effect of FDI. The other is that when a company hires the young employees with high education levels, and they are more willing to communicate with each other, it always pushes to higher productivity. It shows that mutual learning among employees provides space for the spillover effect of FDI.

Although FDI has many advantages, it also has disadvantages. For instance, the cost for foreign companies is too high: because China attracts foreign investment by lowering taxes, the tax rate for foreign investors in China is 12%, compared with 24% or even 30% for other Chinese enterprises. As a result, some "fake foreign investment" appears. Some Chinese investors transfer money from China to foreign countries for reinvestment, thus gaining preferential tax policies. In addition to some preferential policies of local governments, foreign investment enterprises in China will get more tax breaks. Second, the clustering of international firms has led to a more lopsided regional development in China, with foreign investment concentrated in the east, along with the coast, and scarce in the interior. The third point is that with the increase in direct foreign investment, foreign exchange reserves will also increase. When foreign exchange reserves exceed the fundamental value, it may cause adverse effects on China's economy, such as inflation. Fourth is national security: if foreign investors invest in important Chinese enterprises, it may have a significant impact on national security (Cheung & Ping, 2004).

According to the statistic, the amount of foreign investment in China has continuously increased, from \$61.05 billion in 2005 to \$81.03 billion in 2008. By April 2009, the number of foreign-invested enterprises had reached 700,000. In terms of China's industrial structure, China relied too much on the secondary industry at the beginning of its development, leading to a reduced emphasis on the primary and tertiary sectors,

which is quite different from other developed and developing countries. Fortunately, the proportion of foreign investment in China's primary and tertiary industries is now relatively large; it helps China to adjust its weak industrial structure and keep pace with the international situation. Although China's national policies have stimulated foreign investment in the western region, the development of the west of the area is still lagging due to its small base (Buckley, 2010).

Moreover, the investment in the western region is mainly distributed in Chongqing (9.9%), Sichuan (27.7%), Guangxi (20.8%) and Shaanxi (17.8%), which together account for 76.2 percent of the total investment in the western region. It is worth to mention that among the foreign enterprises in western China, small and medium-sized enterprises are the most critical projects, which focus on the processing of agricultural products and catering services, and there are few companies with high-tech content. As a result, FDI did not greatly promote the development of western China, and it was still in the initial stage (Buckley, 2010).

From the perspective of enterprise structure, foreign-invested enterprises played a significant role in promoting high-tech products. In terms of employment, by the end of 2008, foreign enterprises had created 30 million jobs, accounting for 16 percent of China's labour force at that time. What's more, foreign enterprises passively created three times of the employment opportunities, equivalent to 54 percent of the Chinese labour force at that time, which alleviated the employment pressure in China to a considerable extent. In terms of salary, foreign enterprises would select employees from a highly educated group and provide them with a good living standard. In terms of employment opportunities, FDI has contributed to the rapid development of China's economy and society. Meanwhile, FDI has helped China make significant progress in its foreign exchange reserves, and it has become one of the major contributors to China's foreign exchange reserves. In terms of capital, because China is a developing country and very weak in terms of capital, foreign investment has become an essential way. According to statistics, foreign investment in 2006 was 69.19 billion dollars. Three years later, in 2009, the foreign investment reached 185.3 billion dollars, nearly three times as much as in 2006. Shows that foreign investment plays a crucial role in China's economic construction (Cheung & Ping, 2004).

2.1.1 Foreign direct investment and Economy

According to Chowdhury & Mavrotas (2006)'s research, he showed that there is a positive correlation between FDI and economic growth. The function of FDI in the host country is to supplement investment and create new employment opportunities. Also, the spillover effect reflects in the technological part. Especially for developing countries, if the foreign policy of the host country and the degree of openness are sufficient, the economic growth brought by the technical spillover will be massive. According to statistics, FDI's investment in all developing countries fell by 4% in 1980 and continued to grow after that(annual growth remained at 17%), it reached a peak of

179 billion in 1999 and the FDI has declined since then, but it remains the main external financing tool for developing countries. It is worth mentioning that Chowdhury & Mavrotas (2006)'s also studied the relationship between foreign investment and economic growth during 1969 and 2000 in Chile, Malaysia, and Thailand (because the policy systems and economic events of these three countries are in different situation) He found that in Chile, the correlation between these two variables is not very high, but there is direct evidence in Malaysia and Thailand which can prove the high correlation between FDI and gross domestic product(GDP).

Li & Liu (2005) believed that FDI had a positive impact on the host country. He used samples from different countries from 1970 to 1999 to test the correlation between FDI and economic growth and concluded that FDI had no significant effect on economic endogeneity before 1980, but the two variables showed a significant correlation after 1980. Li & Liu (2005) think FDI not only directly promotes economic growth, but also indirectly promotes economic growth through the spillover effect of FDI. Furthermore, there is a significant positive relationship between FDI and human resources, so the host country's human resource capacity plays a great role in the transformation of FDI into economic growth. When the technological capacity and human resource development are improved, more FDI will be attracted, which will form a virtuous circle.

Alfaro et al. (2004) believe that FDI plays an influential role in promoting economic growth. Especially after 1980, developing countries' attitudes towards foreign direct investment have gradually come to realise that other countries' direct investment in host countries benefits not only the investors but also the invested countries. The invested country can grow, develop and learn from the technology of developed countries through the spillover effect of foreign direct investment. He also believes that governments in developing countries should improve the basic environment to attract foreign investment and increase economic development. Alfaro et al. (2004) also pointed out in particular that if the financial market of the recipient country is unstable or there is negative news, it will have a significant impact on the relations with foreign direct investment.

2.1.2 Foreign direct investment and Export

In 2007, the export growth rate of foreign-invested enterprises reached 33.5%, 1.2% higher than the average growth rate of China, which effectively promoted the development of domestic industries. Foreign direct investment contributes significantly to a country's economic growth, and the most apparent effect is to increase a country's export. Zhang (2005) believes that FDI has a significant impact on China's export, especially in labor-intensive industries. Zhang (2005) also considers that FDI does not directly generate interests but relies on national policies and the company's ability. China's preferential policies take care of subsidiaries set up by overseas Chinese in China, give foreign companies the confidence to establish a firm foothold in China and minimise the negative impact of FDI (Zhang, 2005). According to Zhao & Du (2007)'s research by VAR model, there is not much relationship between foreign direct

investment and China's rapid economic development. What is certain is that the development of China's economy has attracted a lot of foreign investment, but the development of China's economy is not necessarily driven by foreign investment, only 73 percent of the possibility of foreign investment to China to have a positive impact, the other negative impact. Therefore, Zhao & Du believes that previous literature exaggerates FDI. Also, Shan (2002) found there is a mutually causal relationship between FDI and export growth, but the impact of export growth on FDI is higher than that of FDI on export. In other words, FDI is not the main reason for China's economic growth, but when China's export increases or attracts more FDI in China, it leads to the re-increase of export. He believes that when the proportion of FDI in China's export influence grows, the impact of FDI will also increase (Shan, 2002)

Chen, Sheng & Findlay (2013) made a detailed study on the relationship between FDI and the export of Chinese enterprises. He found that between 1993 and 2003, FDI in China had no positive impact on the export of Chinese domestic enterprises, which, on the other hand, showed that FDI did not have a massive impact on China's economy. It may also be that during this period, China just joined the WTO, the proportion of FDI export has not increased, which is not enough to affect the export of Chinese domestic enterprises (Shan, 2002). Chen et al. (2013) also said that two factors cause this, the first is that China cannot absorb too advanced technology, and local Chinese enterprises subject to excessive competitive pressure. Secondly, China is a labor-intensive country, and the technology spillover effect of FDI cannot influence them. Therefore, the technology of Chinese domestic enterprises will not increase, so the export will not increase. Chen et al. (2013) believes that the indirect effect of FDI on China is not very good, but because it is tough to analyse, it cannot directly point out which defect.

2.1.3 Foreign direct investment and Education

Through Wang & Wong (2011).s study on FDI, it can found that the average FDI inflow in the world increased by 20% in 1980 and by nearly 40% in 1990. They believed that FDI transferred not only real assets but also some hidden assets, such as better technology and management wisdom, which would promote the economic development of host countries. However, Borensztein et al., (1998) believe that only when the educational level of the host country is sufficient, the economy of the host country can grow under the spillover effect of FDI. Borensztein et al., (1998) Using the data of 69 least developed countries between 1970 and 1989 and found out the economy in the host country can only grow up by the spillover effect of FDI when the country reach the minimum standard of the educational index. The average education was calculated based on the age of 25 or higher and the percentage of students who completed secondary school. Borensztein et al., (1998) found out even the countries with the lowest education level, they still need 0.88 years of education index to make FDI have a positive impact on the economy. This result shows that education can improve people's labour efficiency, knowledge absorption ability, and economic innovation ability. Borensztein et al. (1998) argue that the spillover effects of FDI

generate economic growth through the stimulation of technology. Wang & Wong (2011) also believed that FDI and the education of the host country were complementary. They built another model to calculate the measure of education level. The lowest educational threshold they found was 0.27 lower than that of Borensztein et al., (1998)'s education index; the reason is improvements in the quality of education lead to declines in the education index. Anyway, education plays a crucial role in the spillover effect of FDI on host countries (Wang & Wong, 2011).

2.1.4 Foreign direct investment and Special economic zones

In Wang (2013)'s study, he studied the impact of economic characteristics on foreign direct investment. He used data from 1978 to 2007 in municipal level to evaluate the effect. From his conclusion, it shows that special economic zones indeed attract the attention of FDI, and the amount of investment is 58 percent more than other places. Most of the foreign enterprises invested are foreign-funded enterprises and export-oriented enterprises. Moreover, the capital and technology of special economic zones are higher than those in other regions, and the government's policies are also in favour of special economic zones.

Wang (2013) also believes that there are two ways for a local economy to benefit from becoming a special economic zone. The first is to increase the capital of the city, namely the investment of FDI capital and talent and technology. The second is the increase in productivity, in all aspects of productivity, not just in the production of goods. Graham (2004) believes that other countries may not imitate the success of China's special economic zones. The first point is that when China opened up its economic zone, after 1980, it was at the beginning of China's reform and opening up. At that time, the central government delegated power to local governments, giving them enough ability to attract foreign investment on their own. The second point is that most of China's special economic zones are locating in coastal cities, and the prosperous cities are very close to each other, so these are the conditions for congenital FDI attraction. Moreover, because of the success of special economic zones in the early stage, the state will give more preferential policies to foreign investors to attract investment. The old SEZs set an example of how this approach can replicate to some extent in other coastal cities that are underdeveloped in China. For other developing countries, this method is not necessarily applicable, because China has many inherent advantages over other developing countries, such as large land, high literacy rate and the rising trend of education index. Moreover, China's infrastructure development is better than that of other countries. China has cracked down hard on corruption that foreign investors fear, with corrupt officials in Xiamen, for instance, having been arrested and, worse, sentenced to death. So, China also has an advantage in terms of crime, because it has a low rate of individual crime compared to developing countries, and it also restricts the crimes of senior officials. In general, China can attract so much foreign investment based on its early success and advantages in infrastructure and other conditions (Wang , 2013).

The opening of five special economic zones in 1978 was an experimental project, but it is now clear that the original experiment was very successful. To this day, China has become an economic power. The financial crisis in 2008 did not have a significant impact on China because foreign exchange reserves accumulated by FDI helped China withstand part of the crisis. But more worryingly, the low-skilled workers who help the economy in the special economic zones are already facing unemployment. Guangdong has closed more than 1,000 factories since 2008. This is because factories set up too early, pollution levels have exceeded standards, and most factories have closed down or upgraded to low-pollution jobs. During this period, China implemented many innovative policies and economic transformation projects. At the third plenum in October 2008, Shenzhen gets praised by the Chinese government, and Guangdong is considered to be in a fast-developing region driven by special economic zones (Yeung et al., 2009).

2.2 The development of FDI policy in China

The author divides the development of FDI into five paragraphs in this section.

Stage1: The starting point of foreign direct investment (1979-1986): In 1979, the National People's Congress (NPC) promulgated the law of the People's Republic of China on Sino-foreign joint ventures, allowing foreign investors to establish joint ventures with domestic enterprises. This marks the beginning of China's use of foreign direct investment curtain. Subsequently, Shenzhen, Zhuhai, Shantou and Xiamen special economic zones (SEZ) were established, and the law on wholly foreign-owned enterprises abolished the control on foreign ownership (Chen et al., 1995). The introduction of these exploratory policies laid the policy foundation for the initial stage of China's utilisation of foreign capital and also marked that China's usage of foreign capital has entered an exploratory and experimental stage. At this time, foreign capital mainly comes from Hong Kong, Macao, and Taiwan. The investment scale is small, and the growth rate is slow. The investment was mainly concentrated in the eastern economic opening zones, centred processing zones (Nee & Opper, 2014).

Stage2: Incremental phase of foreign direct investment (1987-1991): In October 1986, the state council issued the "provisions on encouraging foreign investment", the provisions talks about the preferential to the foreign investment enterprises advanced technology enterprise and products export enterprises in the income tax, land, water and electricity, labor costs, profits, export, import and export quota, the respect such as tariffs, foreign exchange swap, secure of enterprises with foreign investment shall have the right to managed according to international practice (Chai, 2011). The proposal and implementation of this specific policy and measure effectively promoted the small increase in the absorption and utilisation of foreign investment in China's coastal areas in the mid-to-late 1980s, thus entering the stage of using market for capital and resources for technology. After 1989, foreign direct investment began to surpass foreign loans and gradually replaced foreign loans as the preferred way of utilising foreign capital in China. However, foreign direct investment in this period was mainly in the

form of point and line in the coastal and open cities, but not in the whole country (Huang, 1998).

Stage3 Period of the rapid development of FDI (1992-1994): Between January 18 and February 21, 1992, Deng Xiaoping went south to several special economic zones and Shanghai to make inspection Tours and speeches. He believed that China must reform and develop toward the direction of internationalization, and the utilization of FDI is the best way for China's economic development and opening up (Chai, 2011). As a result, China's investment environment began to improve significantly; the country began to set off a wave of attracting foreign direct investment; foreign capital began to flood into China. During this period, investment from the United States and Japan became one of the primary sources of foreign investment in China. The direction of foreign investment was basically located in the coastal areas and open cities, forming the Yangtze river delta, pearl river delta, and other public spaces to attract foreign investment for processing and production. According to statistics, the amount of foreign investment drawn in 1992 was already higher than that in the previous 13 years in China. Throughout the 1990s, foreign direct investment in China accounted for 50 percent of foreign direct investment flows to developing countries (Chen et al. 1995).

Stage 4: The low growth phase of foreign direct investment(1994-1998): In 1994, because of the investment environment and the impact of China's macro economy, China's actual use of foreign amount decreased, especially after the financial storm in 1997, China has cancelled the free tax policy for the foreign investment projects under \$30 million, influence the attention of the foreign direct investment to China and make investment fell by thirty percent. However, in 1997, China's foreign direct investment still accounts for a third of the whole of the developing countries (Chai, 2011).

Stage 5: Sustainable development of China's foreign direct investment (1999-present): after 1999, with the rapid growth of China's economy, China joined the world trade organization (WTO) in 2002, improving the investment environment and entering the stage of stable development of foreign direct investment in China. Since then, international investment has become the main way of economic growth (Nee & Oppen, 2014). In 2010, China gradually became the most popular country for foreign direct investment, with the total amount of foreign investment reaching us \$1094.7 billion, equivalent to 14% of China's total financial volume and 12.7% of total social assets. On the other hand, foreign direct investment accounted for 5 percent of urban fixed-asset investment in 2010, which shows that the economic scale of state asset investment has been enormous. As China opens wider to the outside world, it's integration with the world economy will become more harmonious. At this stage, China's attitude towards foreign investors has changed, and with stronger guidance, the direction of investment will determine by the investment directory and China's development plan. China has encouraged foreign investors to focus on quality rather than quantity and expand the scope of investment (Chai, 2011).

2.3 Hypothesis

Based on the above theory and previous study, the two hypothesis will be described as follows.

FDI will have the positive impact on China's economy.

The SEZ will benefit to Chinese economy and the surrounding cities.

3. Data

This section introduces the sources of all data and the description of data.

3.1 Research approach

In terms of data collection methods, it can divide scientific research into quantitative research and qualitative research. Quantitative research mainly focuses on the study of a phenomenon or an experiment with numbers and measurements. It has high requirements for the neutrality, objectivity, and rigour of the investigation objects. The most important thing is to respect the objective facts. In quantitative research, the researcher will present a "basic theory" and then collect data to verify the previous conjecture or model. Quantitative research as the deductive method, a top-down process, a process from the top to down (Bryman& Bell, 2015). Qualitative research is relatively subjective research, which means to conduct in-depth research on a phenomenon in the natural environment through interviews and one-to-one communication. It needs to make detailed records and reports on the process of the experiment, and also needs to consider the background relationship between the interviewer and the interviewee. The most important thing is that the data collected should not be falsified. Qualitative research as the inductive research, which is a bottom-up process (Patton, 1990).

3.2 Data source

The nature of the data can be divided into two parts, which are primary data and secondary data. Primary data can be called original source, which refers to the data collected or sorted by investigators or collectors themselves. Primary materials are accurate and scientific materials, which are usually obtained by case study design or questionnaire survey. Secondary sources are primary sources that he has used at least once, as opposed to primary sources, which it has access to in a variety of ways. The advantages of secondary data over primary data lie in the following aspects. The first is the low cost; the secondary data do not need to interview with the interviewee. The second point is that it takes less time. Researchers only need to search the Internet for what they need, and then they can get the answer quickly. Secondary materials on the

web are generally books and data. (Bryman& Bell, 2015).

3.3 Justification for choosing method

In this paper, the author will use quantitative research and secondary data to help complete the assumptions. This article hypothesizes that the spillover of foreign direct investment has a good impact on the Chinese economy. In terms of the difficulty of collecting materials, it is difficult to conduct large-scale sampling through a questionnaire survey, and there is not enough time to practice. So, the author chooses the econometric method in quantitative research. There are three main research methods in econometrics, which are, cross-section data, time series data and panel data (Granger, 1981). According to Johnston & DiNardo (1972), cross-sectional data refers to the data of different observation objects collected at a time point, which is specially used to study the economic situation at a time point. Time series data refers to the data collected from an observation object at different time points. This method usually measures the change of a phenomenon over a period of time. Panel data is characteristic of both cross-section data and time series data. It can study the changes in different observed objects at different time points (Hill, Griffiths, Lim & Lim, 2008). To have better study on the spillover effect of FDI on the Chinese economy, the author selected panel data as the research data and looked for second-hand data in the statistical yearbooks of every province in China. These data were collected every year between 1997 and 2016. The data used were GDP per capita, GDP, Population, data on education in the sample survey (This includes the number of people who are 6 years old or older and who are not in school, and the number of people who are in primary school, junior high school, regular high school, secondary vocational school, junior college, undergraduate, master.), export, consumption per capita and FDI. In terms of reliability, some data about education in the Chinese yearbook are from random check, which may affect the experiment to a small extent, but the statistical yearbook of each province is published by the Bureau of statistics of each province, with high reliability. In terms of validity, The Chinese Bureau of statistics is also a right choice, but after the author's experiment, the Chinese Bureau of statistics lacks some critical data needed in this paper, which may be because there are too many data and the records are not very detailed. For instance, the number of students in each grade, the total population before 1999 in each province. However, the statistical yearbook of each province can well record the development of each province and can date back to the 1970s.

3.4 Data selection

The following paragraphs describe the characteristics of the six variables and the reason to choose as the variable in this paper.

GDP per capita stands for the dependent variable in the regression. According to Blomstrom, Lipsey & Zejan (1992) income per capita and GDP per capita measure the development level of a country or region, and according to the report of the world bank,

it can be found that the world bank divides all countries into four levels through GDP per capita. Therefore, the author believes the GDP per capita can effectively measure the spillover effect brought by foreign direct investment to China (Blomstrom et al., 1992).

FDI stands for the explanatory variable in this regression. There are two reasons why FDI treat as the explanatory variable. Through Li, Woodard & Leatham (2013)'s study, they found that there is a direct connection between FDI and economic growth. FDI promotes economic growth, and economic growth can drive FDI. Moreover, there is a certain consistency between these two variables. GDP per capita is equal to GDP divided by population, so the growth of GDP can represent the growth of GDP per capita to some extent.

Education stands for the control variable in the regression. Hanushek & Woessmann (2010) believes the quality of education has a powerful influence on economic growth, because economic growth is closely related to the skills of workers, and economic growth accelerates when workers know what they are doing and what they can do to improve the quality of products. Hanushek & Woessmann (2010) also found that in the past 15 years, states that in the past 15 years, developing countries have paid particular attention to the development of graduation level, but they lack the awareness to the quality of education. The country should pay more attention to the quality of the school rather than the length of the school day.

Consumption stands for the control variable in the regression: Palley (2010) believes that in the macroeconomic theory of Keynes, consumption is a form of income cycle. When a customer purchases a product, it is called consumer spending, and in the macro perspective, when one person spends money is equal to the income of another person or group of people. So, when a person's increase in consumption, from another point of view, it is another person or a group of people's income increase, which equals the growth in GDP.

Xexport stands for the control variable in the regression. According to Jarreau & Poncet (2012)'s research shows that China's export growth has played a positive role in promoting China's economy. Especially after globalization, export plays an increasingly important role in economic growth. In China's case, the growth rate of foreign trade is higher than the growth rate of GDP, which indicates that export has become one of the main factors of China's economic development (Christmann & Taylor, 2001).

GDP(T-1) stands for the control variable in the regression. The reason for using this lagging variable is that many economic behaviors are lagging and may be influenced not only by contemporaneous factors but also by their past factors. For instance, people's purchasing power may not only depend on their salary in this month but also on how much money they have left in the last month (Bellemare, Masaki &

Pepinsky,2017). So GDP (t-1) is the variable added to ensure that GDP per capita may have a delayed effect.

3.5 Data description

All the data used in the paper are from the statistical yearbook of Chinese provinces on the China Statistics Yearbooks Database from 1997 to 2016 (except the data of GDP(t-1) is from 1996 to 2015) which contains 15 columns of data, so the total number of data extracted from the statistical yearbook of Chinese provinces is 9,300. The figures cover 31 Chinese provinces, included autonomous regions and provincial-level cities. The units of variables are different in the data of China statistical yearbook. For instance, the unit of FDI is millions of dollars, the unit of GDP is millions of people's yuan, and the unit of consumption is per capita. To unify all units, the author uses two steps to unify the units. The first step is to find out the average dollar-yuan exchange rate from 1997 to 2016 at the website of the National Bureau of Statistics of China and then convert the dollar into yuan units. From the diagram 1, we can see the exchange rate between us dollar and the RMB gradually decreased from 8.3142 in 1996 to 6.6432 in 2016. The second step is to divide FDI, GDP, and EXPORT to the population so that the units of these variables are the same as the rest. It is important to note that one of the variable education calculated by the weighted average method, with the number of 6 * elementary school + 9 on junior middle school, the number of + 12 * middle school and secondary vocational schools, the number of the number of college specialized subject + + 15 * 16 on the number of university undergraduate course + 19 * * the number of graduate students / 6 years of age and the number of more than 6, The higher the final data, the more years of education. Also, according to Farole & Akinci (2011), China has six special economic zones which are: Shenzhen, (Guangdong), Zhuhai, (Guangdong), Shantou, (Guangdong), Xiamen, (Fujian), Hainan, (Hainan), Kashi (Xinjiang). In this case, Guangdong, Fujian, Hainan and Xinjiang are dummy variables; these four provinces will =1, other provinces =0 in the regression. The idea is to test the contribution of special economic zones to GDP per capita.

	Year	Exchange Rate
Table 1	2016	6.6423
USD to RMB	2015	6.2284
	2014	6.1428
	2013	6.1932

2012	6.3125
2011	6.4588
2010	6.7695
2009	6.831
2008	6.9451
2007	7.604
2006	7.9718
2005	8.1917
2004	8.2768
2003	8.277
2002	8.277
2001	8.277
2000	8.2784
1999	8.2783
1998	8.2791
1997	8.2898
1996	8.3142

(National Data, 2019)

Table 2 Descriptive statics for sample between 1996-2016

	GDP per capita	EXPORT	FDI	EDUCATION	CONSUMPTION	GDP(t-1)	SEZ
Mean	25424.07	5495.126	754.9491	8.093092	8984.402	22894.80	0.129032
Median	18410.98	1353.263	354.0996	8.169669	6226.000	15583.59	0.000000
Maximum	118127.0	59154.47	8509.051	12.38909	49617.00	106903.7	1.000000
Minimum	2235.164	40.13270	0.064182	2.947940	1473.000	2034.262	0.000000
Std. Dev.	22178.39	9838.238	1093.003	1.317026	7706.222	20604.21	0.335506
Skewness	1.508267	2.882324	3.037001	-0.469045	1.942105	1.573835	2.213176
Kurtosis	5.299951	12.13461	15.36492	4.970675	7.860788	5.444847	5.898148
Sum	15762924	3406978.	468068.4	5017.717	5570329.	14194773	80.00000
Sum Sq. Dev.	3.04E+11	5.99E+10	7.39E+08	1073.691	3.68E+10	2.63E+11	69.67742
Observations	620	620	620	620	620	620	620

As table 2 shows, the number of each variable is 620, which means the total number of data used in the regression is 3720. It is also indicating that the number of each variable is the same, and there is no lack of them. From the extreme values, it shows that the maximum amount of GDP is 118127, while the minimum value is 2235.16, and the standard deviation is 22178.39, indicating that the difference of GDP is very high. It also shows the maximum value of education is 12.39, the minimum amount is

2.95, and the standard deviation is 1.31, which is the smallest in the data. This may be because the original value of education is relatively small, or the other reason is the value of education is most concentrated in all variables.

Table 3 Normality test

Skewness/Kurtosis tests for Normality

joint -----

Variable Obs Pr(Skewness) Pr(Kurtosis) adj chi2(2) Prob>chi2

e1 620 0.8043 0.0900 2.791 0.1342

According to the normality test, the P value is greater than 0.1, the null hypothesis that the residual term is normally distributed cannot be rejected, which conforms to the residual normal distribution.

Table 4 The comparison between the original data and the first-order difference data

Testing methods Variables	LLC	ADF	PP	Conclusion
GDP	-4.5310** (0.0012)	23.1091 (1.0000)	13.9648 (1.0000)	Unstable
D(GDP)	-4.1927*** (0.0000)	80.1518*** (0.0000)	108.878*** (0.0000)	Stable
FDI	-1.1097 (0.1335)	35.2850 (0.9975)	31.6779 (0.9995)	Unstable
D(FDI)	-9.8597*** (0.0000)	215.679*** (0.0000)	397.685*** (0.0000)	Stable
EXPORT _t	-5.2564*** (0.0000)	46.1197 (0.9343)	34.5913 (0.9981)	Unstable
D(EXPORT)	-9.0867*** (0.0000)	206.293*** (0.0000)	467.707*** (0.0000)	Stable
CONSUMPTION _t	2.2531 (0.9879)	6.6730 (1.0000)	1.6488 (1.0000)	Unstable
D(CONSUMPTION)	-10.5763*** (0.0000)	243.548*** (0.0000)	316.347*** (0.0000)	Stable
EDUCATION	-4.6896*** (0.0000)	41.1274 (0.9811)	33.6793 (0.9987)	Unstable
D(EDUCATION)	-10.7409***	272.065***	1561.83***	Stable

	(0.0000)	(0.0000)	(0.0000)	
<i>LnGDP(t-1)</i>	-2.6730*** (0.0038)	14.1361 (1.0000)	16.8854 (1.0000)	Unstable
<i>D(LnGDP(t-1))</i>	-2.6016*** (0.0000)	269.7156*** (0.0013)	95.8849*** (0.0000)	Stable

Table 4 shows that all variables are unstable at the beginning, but become stable after the first difference transformation, so these variables are first-order stationary variables. For instance, GDP per capita is unstable at the beginning, but it becomes stable after the first difference transformation and the sign of variable turn to D (GDP per capita).

Table 5 Model setting form test results

Testing method	Hausman test	F test	Conclusion
Big scale	9.7408 (0.0829)	0.4565 (0.9947)	Mixed effect

Table 5 shows two different testing methods. In this article, f-test is the first test used to test the relationship between the fixed effect model and the mixed effect model. Where the F test value is equal to 0.4565, and the P value is equal to 0.9947 > 0.10, indicating that the mixed effect is superior to the fixed effect and then the Hausman test of random effect model and fixed effect model is carried out. The Hausman test value is equal to 9.7408, and the P value is equal to 0.0829, indicating that the assumption about the random effect is superior to the fixed effect is wrong. Therefore, the model finally selects the mixed effect, and the final calculation results show in table 6. Moreover, according to the above analysis, GDP per capita is taken as the dependent variable and GDP(t-1), FDI, consumption, export and education are treated as independent variables for regression. In order to prevent the existence of heteroscedasticity, this paper adopts weighted least square method for regression.

4. Method

In this paper, weighted least square (WLS) method will apply to the regression. Weighted least square method is a technique for weighting the original model, which can make the new model have no heteroscedasticity, and then estimate the parameters with the most basic least square method (Tellinghuisen, 2007). The reason why the author conducts this method is to avoid the interference of heteroscedasticity on the whole model. Heteroscedasticity has a great impact on the significant effect and validity of the model, so it is critical to exclude the interference of heteroscedasticity

on the model. In order to better test the hypothesis, the model of weighted least square list below.

$$\ln(\text{GDP per capita}) = \beta_0 + \beta_1 \ln(\text{FDI}) + \beta_2 \ln(\text{Education}) + \beta_3 \ln(\text{Export}) + \beta_4 \ln(\text{Consumption}) + \beta_5 \ln(\text{Gdp}(t-1)) + \varepsilon$$

- β_0 represents the constant term.

-GDP per capita represents the GDP per capita in each province of China in yuan.

-FDI represents the actual utilization of foreign investment in each province of China in yuan

-Education represents the education index of each province in China; the higher the index is, the older the education age is.

-Export represents the actual export amount in each province of China in yuan

-Consumption represents the per capita consumption level of each province in China in yuan

-GDP(t-1) represents the actual GDP amount in each province of China in yuan

- ε stands for the error term.

5. Empirical Analysis

This section describes the results of all data and discusses the results.

5.1 Result and tests

5.1.1 Multicollinearity test

Table 6 The Variance Inflation Factors (VIF) test

Variable VIF	1 / VIF	
Lngdp(t-1)	24.19	0.041338
Inconsumption	19.02	0.052566
Inexport	5.02	0.199172
Infdi	3.65	0.273653
Ineducation	2.36	0.423720
SEZ	1.17	0.853716
Mean VIF	9.235	

The VIF test is used to find out if there is multicollinearity in the formula which leads to the inaccuracy of the formula. Before analyzing the results, this paper carried out multicollinearity test on the model and calculated VIF value. According to table 6, it can be found that the variance expansion factor VIF is $9.235 < 10$, indicating that there

is no serious multicollinearity problem in the model. So, this model can be suitable for application in this article.

5.1.2 Panel data mixed effect regression

Table7 The result of Panel data mixed effect regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0307	0.0042	7.3146	0.0000
Ln (FDI)	0.0156	0.0031	5.0317	0.0000
Ln(export)	0.0595	0.0054	11.0049	0.0000
Ln(education)	0.0619	0.0347	1.7815	0.0754
Ln(consumption)	0.2287	0.0268	8.5228	0.0000
Ln(GDP(t-1))	0.4423	0.0306	14.4351	0.0000
SEZ	0.0003	0.0041	0.0842	0.9329
R-squared	0.5346	Mean dependent var		0.1296
Adjusted R-squared	0.5298	S.D. dependent var		0.0687
S.E. of regression	0.0410	Sum squared resid		0.9766
F-statistic	111.4132	Durbin-Watson stat		2.0739
Prob(F-statistic)	0.0000			

From the model of regression results of the model fitting of R-squared is 0.5349, F value is equal to 111.4132, the P value is equal to 0.000, it shows that the model is significant, and the model has statistical significance. Also, the DW value is equal to 2.0739, which is close to 2; it is indicating that there is no sequence autocorrelation. Through the analysis of the empirical results, the empirical results are summarized as follows:

(1) the regression coefficient of variable FDI on GDP per capita is equal to 0.0156, and the significance P value is equal to 0.0000, less than 0.01. The significance level of 1% indicates that FDI plays a significant role in promoting GDP per capita, that is, FDI increases by 1 percentage and GDP increases by 0.0156 percentage. This also indicates that the relationship between FDI and GDP per capita is positive.

(2) the regression coefficient of the variable export on GDP per capita is equal to 0.0595, and the significance P value is equal to 0.0000, less than 0.01. The significance level of 1% indicates that export plays a significant role in promoting GDP per capita, that is when export increases by 1 percentage, the GDP increases by 0.0595 percentage. This also indicates that the relationship between FDI and GDP per capita is positive.

(3) the regression coefficient of the variable education on GDP per capita is equal to 0.0619, and the significance P value is equal to 0.0754, less than 0.1. The significance level of 10% indicates that education plays a less significant role in promoting GDP per capita compared to others except for SEZ, that is, an increase of 1 percentage in education leads to an increase of 0.0619 percentage in GDP. This also means that there is a positive relationship between the two variables.

(4) the regression coefficient of variable consumption on GDP is equal to 0.2287, and the significance P value is equal to 0.0000, less than 0.01. Through the significance level of 1%, it indicates that consumption plays a significant role in promoting GDP per capita, that is, the consumption increases by one percentage, and the GDP increases by 0.2287 percentage. This also means that there is a positive relationship between the two variables.

(5) the regression coefficient of the lagging variable GDP(t-1) on GDP per capita is equal to 0.4423, and the significance P value is equal to 0.0000, less than 0.01. The significance level of 1% indicates that GDP(t-1) has a significant promoting effect on GDP per capita, that is, GDP(t-1) increases by one percentage and GDP increases by 0.4423 percentage. This also means that there is a positive relationship between the two variables, as well.

(6) SEZ, as the dummy variable did not pass the significance test. This indicates that the results obtained by the regression are not credible, even if the coefficient value is equal to 0.0003, it cannot be recognized that SEZ has a positive promoting effect on GDP per capita.

5.1.3 Endogenous test

Table 8 Davidson-MacKinnon test (endogenous test)


```

Fixed-effects (within) IV regression
Group variable: idl

Number of obs   =      558
Number of groups =      31

R-sq:
  within = 0.9950
  between = 0.9924
  overall = 0.9915

Obs per group:
  min =      18
  avg =     18.0
  max =      18

Wald chi2(5) = 2.06e+07
Prob > chi2 = 0.0000

corr(u_i, Xb) = -0.4706

```

lmgdppc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnfdi	.011068	.0064165	1.72	0.085	-.0015082	.0236442
lmgdpl	.7988601	.0285555	27.98	0.000	.7428923	.8548279
lnexport	.0524632	.0061682	8.51	0.000	.0403737	.0645527
lneducation	.1548239	.0580635	2.67	0.008	.0410215	.2686262
lnconsumption	.1223556	.0299333	4.09	0.000	.0636873	.1810239
dumy	0	(omitted)				
_cons	.2133959	.0766677	2.78	0.005	.0631299	.3636619
sigma_u	.06833538					
sigma_e	.05164918					
rho	.63643101	(fraction of variance due to u_i)				

```

F test that all u_i=0:      F(30,522) =      5.05      Prob > F      = 0.0000

```

```

Instrumented:  lnfdi lmgdpl
Instruments:  lnexport lneducation lnconsumption dumy L.lnfdi L.lmgdpl
              L2.lnfdi L2.lmgdpl

```

```
.      dmexogxt
```

```
Davidson-MacKinnon test of exogeneity:  2.441032  F( 1,521)  P-value =  .1188
```

Furthermore, if the model has endogeneity problems, spurious regression may occur. Since the core variable FDI and the control variable GDP (t-1) are the key variables to be concerned, and most likely the potential endogenous variables, this paper takes the later terms of order 1-2 of GDP(t-1) and FDI as the instrumental variables of these two variables, conducts IV regression estimation and conducts Davidson-MacKinnon test (endogenous test) on this basis. The above figure shows that the statistics value of Davidson-MacKinnon test (endogeneity test) is 2.441032, and the corresponding P value is 0.1188, which indicates that the null hypothesis that the tested variables are exogenous variables is accepted at the statistical levels of 10%, 5%, and 1%, indicating that the model does not suffer endogeneity problem.

5.1.4 Robustness test

According to the Durlauf (2001), in order to test the robustness, there are two main methods to test the robustness of the regression. The first is mainly carried out by changing the model measurement method, and the second is changing related variables.

In this paper, the first method is adopted, the author also conducts random effect and mixed effect regression, respectively for the model. Table 9 & 10 shows the result of random effect and mixed effect regression.

Table 9 The result of Panel data random effect regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0301***	0.0047	6.4132	0.0000
Ln (FDI)	0.0408***	0.0052	7.8571	0.0000
Ln(export)	0.0164***	0.0037	4.4048	0.0000
Ln(education)	0.0242***	0.0425	0.5707	0.5684
Ln(consumption)	0.2425***	0.0305	7.9397	0.0000
Ln(GDP(t-1))	0.4562***	0.0343	13.3138	0.0000
SEZ	0.0024	0.0052	-0.4588	0.6465
R-squared	0.4781	Mean dependent var		0.1158
Adjusted R-squared	0.4728	S.D. dependent var		0.0571
S.E. of regression	0.0414	Sum squared resid		0.9989
F-statistic	88.8713	Durbin-Watson stat		2.0672
Prob(F-statistic)	0.0000			

Table 10 The result of Panel data Fixed effect regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0322	0.0047	6.8626	0.0000
Ln (FDI)	0.0408	0.0052	7.8224	0.0000
Ln(export)	0.0163	0.0037	4.3467	0.0000
Ln(education)	0.0231	0.0426	0.5420	0.5880
Ln(consumption)	0.2449	0.0308	7.9530	0.0000
Ln(GDP(t-1))	0.4338	0.0350	12.3792	0.0000
SEZ	0.0039	0.0032	-0.3563	0.6456
R-squared	0.4906	Mean dependent var		0.1158
Adjusted R-squared	0.4583	S.D. dependent var		0.0571
S.E. of regression	0.0420	Akaike info criterion		-3.4435
Sum squared resid	0.9751	Schwarz criterion		-3.1759
Log likelihood	1050.1230	Hannan-Quinn criter.		-3.3393
F-statistic	15.2143	Durbin-Watson stat		2.0709
Prob(F-statistic)	0.0000			

By comparing the regression results of three panel regression methods, which are mixed effect (Table7), random effect (Table9) and fixed effect (Table10), it was found that the

direction and size of regression coefficient of each variable did not change significantly, so the robustness of the comparison figure was verified.

5.2 Discussion

First of all, the coefficients of FDI and GDP per capita conform to most theoretical views. Compared with other control variables, FDI has the weakest impact on GDP per capita. Therefore, Chowdhury & Mavrotas (2006) and Li & Liu (2005) agree with the experimental results and believe that the contribution of FDI to China's economy shall be positive. In this case, the relationship between FDI and China's economy is not as irrelevant as Zhang (2005), and Alfaro et al. (2004) stated. Li & Liu (2005) states that what FDI brings shall be not only the investment of capital, but also the FDI spillover effect, and the effect will attract more FDI inflows when it leads the development of other industries, That is, more money flows into the spillover effect.

5.2.1 Export-GDP per capita, FDI-Export

According to table 6, the results are consistent with the views of Jarreau & Poncet (2012) and Christmann & Taylor (2001). It is true that exports have a positive impact on China's GDP per capita, and its impact is in the mean value compared with the coefficients of other variables. The correlation coefficient between exports and FDI is 0.8058, and the significance level is 99.9%, indicating that the relationship between these two variables is positive in 99.9% of the cases. Although Zhang (2005) 's conclusion does not match the coefficients of FDI and GDP per capita well, her view is also worthy of reference. She believes that the most important impact of FDI on China is that on exports because the type of labour force in China and the support from the government make FDI spillover effect particularly important in this aspect. In 2007, the export rate of foreign enterprises in China increased to 33.5 percent, higher than the average export rate of domestic enterprises, which further proves the spillover effect of FDI on exports (Cheung & Ping, 2004). According to Shan (2002), FDI is not necessarily the key factor affecting export, and export and FDI should be complementary. As China's exports grow, more FDI will be attracted; As FDI increases, the amount of export will increase. This indicates that China should increase the preferential degree of FDI so that FDI could play a greater role in GDP. Meanwhile, FDI spillover effect can promote export growth. China's export is one of the main modes of China's economy, so when FDI has a positive impact on export, China should pay more attention to maintaining the stability and sufficiency of FDI, avoiding the

unnecessary impact of unstable and unsafe FDI on China's export, and firmly grasping China's development goals or approaches.

5.2.2 Edu-GDP per capita, FDI-Edu

The resulting accord with the views of Hanushek & Woessmann (2010), who emphasized the strong relationship between economic development and the quality of education and called on the government to focus on the teaching quality over teaching time. The correlation between FDI and Edu is 0.6879***, which indicates that there is a 99.9 percent chance that education and FDI are positively correlated.

Alfaro et al. (2004) also believe that China will get a return from the spillover effects of FDI higher than the actual amount of investment benefits. Research from Cheung & Ping (2004) indicates that in 2008, foreign-invested enterprises created 300 million jobs in the market and provided above-average wages. Chen et al. (2013) argue that foreign enterprises have very high requirements on the education of employees, which passively leads to the improvement of Chinese education because the higher wages and occupations are connected to higher degrees, some who did not attach importance to education will willingly focus on investing in education. Although the conclusions of Chen et al. (2013) and Zhao & Du (2007) do not match the values in the chart, their focuses are also on whether China can accept the spillover effect of high technology. This indirectly indicates the importance of education. In addition, among these variables, education has a relatively strong impact on economic growth, so Chinese government should pay more attention to education and strengthen investment guidance of FDI, so that FDI spillover effect can more correctly and positively affect China's economic environment. In terms of education, Chinese government can lower certain taxes for foreign companies, offer them preferential policies, reduce the cost of training positions, and encourage foreign companies to recruit Chinese interns for training so that trainees can enhance profit of knowledge brought by FDI spillover effect, and apply the knowledge into domestic enterprises so as to accelerate promote the development of China. As Borensztein et al., (1998) pointed out, education is always a harsh object for countries whether with high or with the low level of development. Only with a high enough education, can the country absorb the benefits of FDI spillover effect, otherwise it will waste the opportunity of achieving accelerated development.

5.2.3 Consumption-GDP per capita

According to diagram 6, the results are consistent with Palley's (2010) point of view.

To some extent, consumption is equivalent to the growth of GDP. The correlation between FDI and consumption is 0.7397***, indicating that FDI is positively correlated to consumption to a large extent, and consumption is positively correlated with GDP per capita. Although there is not enough evidence to prove the relationship between FDI spillover effect and consumption in the literature, some conclusions can be drawn from this paper. Through the comparison between the above variables, it can be concluded that FDI spillover effect can bring a certain positive influence on consumption to some extent. Moreover, after the positive impact of FDI spillover effect on education, the improvement of the education level will increase individual income, and then it will have a positive impact on consumption. Therefore, FDI spillover effect indirectly leads to the increase in consumption.

5.2.4 GDP(t-1)-GDP per capita

A lag variable is a quantity that prevents an observed quantity from producing a lag effect. According to the results, GDP (t-1) is the variable with a value of 0.4423, which has the strongest relationship with GDP among all variables. Combined with the survey data, the author found the possible reason for this phenomenon. When collecting FDI data of each province, the author found that FDI had two values. One is the amount of FDI contracts, and the other is the actual amount of FDI used, and their difference is usually 2-3 times (FDI contracts: the actual amount of FDI used = 3:1). Therefore, the author believes the reason why GDP (t-1) and GDP per capita have a close relationship is that the GDP in the second year may contain the money in the FDI contract in the first year, and the money in the contract may also affect the economy for a longer time. For example, the actual number of FDI contracts in 2000 was \$30 million and the actual amount used was \$10 million. In 2001 the contract was worth \$1 million, so there's \$10 million left. The remaining 10 million may not return at 2002 or even 2003, so the impact could be much longer.

5.2.5 SEZ-GDP per capita, FDI-SEZ

It is obvious that the results do not conform to the views of Yeung et al. (2009), Wang (2013) and Graham (2004). According to Wang (2013) and Yeung et al. (2009), special economic zones are important areas to attract FDI and play an important role in promoting regional economic development. Or from Graham (2004)'s point of view, FDI plays a significant role in the economic development of coastal areas in China, where their infrastructures also meet the needs of FDI. However, the significance test did not pass, indicating that the results obtained by regression have no credibility. Therefore, based on the existing data, it cannot be recognized that there

is a positive promoting relationship between SEZ and GDP per capita. The author suggests there may be two reasons. The first reason is that Wang (2013) tested special economic zones and economic development through municipal data, and this paper has been completed through provincial significance test so that accuracy of Wang's is relatively high. Moreover, the data used in this paper is based on the provincial level, and Shenzhen, Zhuhai, Shantou and Xiamen are actually cities among special economic zones. So the scope of special economic zones in this paper is larger than the actual one, resulting in relative imprecision of the data. Furthermore, it also proves the income inequality between regions mentioned by Cheng & Yum (2000) and (Buckley, 2010). Obviously, SEZ supposed to bring positive effect to the Chinese economy, but when every province is counted as SEZ, the answer obtained cannot prove that SEZ is related to the improvement of the Chinese economy. This shows that in addition to the real SEZ, the income gap between cities in other provinces and SEZ is quite large. The second point is the regulations of special economic zones. In the article of Graham (2004), the definition of special economic zones is extended to coastal cities, and cities like those in Zhejiang are also regarded as special economic zones because there are 14 coastal open cities in China that fall into the category of SEZ to some extent. So, that creates the bias of the result. However, this proves the conclusion of Cheng and Yum (2000) and Nee and Oppen's (2014) from the side that FDI has a certain impact on the imbalance of economic development in China. Although the data used are not accurate enough for the whole province, China's special economic zones have been proved to be beneficial to China's economy in previous articles. This also shows that the special economic zones and other cities in the same province have big economic development difference. Otherwise, it will clear to see the influence of SEZ to GDP per capita. It further illustrates the imbalance of China's development, not only in the west and east, coastal and non-coastal areas, but also in the same province.

6. Conclusion

Special economic zones in China, which have been set up since 1978, did indeed reverse the downward trend in Chinese economic. This paper uses the data of Chinese provinces from 1996 to 2016 to study whether the spillover effect of FDI has an impact on China's economy. In order to better understand the spillover effect of FDI in China, a sub-research question is coming out, that is whether the establishment of special economic zones in China since 1978 have an impact on China's economic development and whether it can boost the economy of surrounding cities. Unfortunately, the data in this paper are not enough to support the positive relationship between special economic zones and economic development and fail to provide readers with an early understanding on the establishment of special economic zones by Chinese leaders. Luckily, it can prove that the economic gap between SEZ and surrounding cities are huge, not like the opinion from Madariaga & Poncet (2007). In their article, they

described that the income growth caused by the growth of FDI in receiving cities would lead to the income growth of their neighboring cities, which could not be agreed in this article. However, there is sufficient evidence to prove whether the spillover effect of FDI has an impact on China's economy. In general, compared with that of other variables, the weak coefficient of FDI can be explained. The index of FDI reflects not only the input of foreign investors, but also its spillover effect, which will affect exports, consumption and education and these three variables have a positive impact on GDP per capita and are stronger than that of FDI on GDP per capita, which to some extent shows that the spillover effect of FDI does bring some other positive impact indirectly on China. Therefore, it can be concluded that the spillover effect of FDI does have an effect on China's economy, and it is positive. Moreover, FDI itself has a positive impact on China's economy, but it is not apparent. In the author's opinion, the spillover effect of FDI will become smaller and smaller for China. In the four decades since the reform and opening up, China has changed from a developing country to a very popular emerging economy. The technology gap between China and other developed countries gradually narrowed; China's economic growth will continue to slow down to a certain extent. The author believes that the contribution of this paper is to prove that the spillover effect of FDI has a certain positive effect on consumption because there is little evidence to prove this in previous literature. The second is the importance of education, not only connect to the spillover effect of FDI. More specifically, the impact of education on the whole economic development. Only when the education level is enough can the "high-tech knowledge" from developed countries be learned, applied and developed through the spillover effect of FDI.

7. Self-Reflection

The most regrettable thing in this article is that the relationship between special economic zones and the Chinese economy cannot be analysed with the existing data, which will be an exciting topic. According to Wang (2013)'s experience, the use of city-level data can effectively calculate the relationship between special economic zones and China's economy, and the author will considering use city-level data to test the relationship between special economic zones and economic growth in the next article on the Chinese economy.

As for the selection of variables, the author believes that if there is an opportunity to add more variables in the next study or increase the length of time of variables, the veracity, and accuracy of the article will be slightly improved. The data of Chinese provinces are hard to find even in the statistical yearbooks of the province, Therefore, in the next article on China's economy, more variables should be used as backup data to avoid some data causing the collapse of the model. The relationship between the index of education and GDP per capita is not prominent in other variables. The author

thinks that it may be that the calculation method of education index lags behind of professional economists. According to the calculation method of Borensztein et al. (1998) and Wang & Wong (2011), education is prominent in its contribution to the economy. Therefore, when it comes to algorithms in later papers, the algorithm of other authors should be studied more carefully to ensure the practicability of data.

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