# Impact of Trade and FDI Openness on Wages in the Manufacturing Sector in China

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A Thesis Submitted in Partial Fulfillment of the Requirements
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# ผลกระทบของการเปิดเสรีทางการค้าและการลงทุนโดยตรงจากต่างประเทศที่มีต่อค่าจ้างแรงงานในภาคอุตสาหกรรมการผลิตของประเทศจีน

น.ส.เฉียนยี่ เฉิน



วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
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เฉียนยี่ เฉิน : ผลกระทบของการเปิดเสรีทางการค้าและการลงทุนโดยตรงจากต่างประเทศที่มีต่อค่าจ้างแรงงานในภาคอุตสาหกรรมการผลิตของประเทศจีน. ( Impact of Trade and FDI Openness on Wages in the Manufacturing Sector in China) อ.ที่ปรึกษาหลัก : ผศพิธุวรรณ ปรมาพจน์, อ.ที่ปรึกษาร่วม : ศ.ไพฑูรย์ วิบูลชุติกุล

งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบของการเปิดการค้าเสรี (Trade Openness) และการลงทุนโดยตรงจากต่างประเทศ (FDI) ต่อค่าจ้างแรงงานในประเทศจีน โดยใช้การวิเคราะห์แบบข้อมูลภาคตัดขวางร่วมกับข้อมูลอนุกรมเวลา (Panel Data) ครอบคลุมข้อมูลจากภาคอุตสาหกรรมทั้งหมด 27 อุตสาหกรรม ระหว่างปี 2544 ถึง 2559 การศึกษาผลกระทบแบ่งเป็น 3 กลุ่ม ได้แก่ ภาคอุตสาหกรรมโดยรวม ภาคอุตสาหกรรมที่ใช้ทุนเข้มข้น (Capital-Intensive Industries) และภาคอุตสาหกรรมที่ใช้แรงงานเข้มข้น (Labor-Intensive Industries)

(1) ในการเปรียบเทียบผลการศึกษาทั้ง 3 กลุ่ม ผลการศึกษาพบว่า การเปิดการค้าเสรี (Trade Openness) ส่งผลทางบวกต่อค่าจ้างแรงงานอย่างมีนัยสำคัญในภาคอุตสาหกรรมที่ใช้แรงงานเข้มข้น (Labor-Intensive Industries) เท่านั้น ในขณะที่การลงทุนโดยตรงจากต่างประเทศ (FDI) ส่งผลทางบวกต่อค่าแรงอย่างมีนัยสำคัญทั้งในภาคอุตสาหกรรมที่ใช้ทุนเข้มข้น (Capital-Intensive Industries) และภาคอุตสาหกรรมที่ใช้แรงงานเข้มข้น (Labor-Intensive Industries) (2) สำหรับภาคอุตสาหกรรมโดยรวม ผลการศึกษาพบว่า การเปิดการค้าเสรี (Trade Openness) และการลงทุนโดยตรงจากต่างประเทศ (FDI) ไม่ส่งผลอย่างมีนัยสำคัญต่อค่าจ้างแรงงาน ส่วนผลิตภาพแรงงาน ค่าใช้จ่ายในการวิจัยและพัฒนา สัดส่วนของแรงงานที่มีทักษะต่อจำนวนแรงงานทั้งที่มีและไม่มีทักษะ ส่งผลทางบวกอย่างมีนัยสำคัญต่อค่าจ้างแรงงาน ในทางตรงข้าม สัดส่วนของแรงงานหญิงต่อการจ้างงานทั้งหมดและสัดส่วนของรัฐวิสาหกิจต่อจำนวนผู้ประกอบการทั้งหมดส่งผลทางลบต่อค่าจ้างแรงงานอย่างมีนัยสำคัญ (3) สำหรับภาคอุตสาหกรรมที่ใช้ทุนเข้มข้น (Capital-Intensive Industries) ผลการศึกษาพบว่า การเปิดการค้าเสรี (Trade Openness) ไม่ส่งผลต่อค่าจ้างแรงงาน แต่การลงทุนโดยตรงจากต่างประเทศ (FDI) กลับส่งผลทางบวกอย่างมีนัยสำคัญ นอกจากนี้ ผลิตภาพแรงงาน ค่าใช้จ่ายในการวิจัยและพัฒนา และสัดส่วนของแรงงานที่มีทักษะต่อจำนวนแรงงานทั้งที่มีและไม่มีทักษะนั้น ส่งผลทางบวกต่อค่าจ้างแรงงานอย่างมีนัยสำคัญ (4) สำหรับอุตสาหกรรมที่ใช้แรงงานเข้มข้น ผลการศึกษาพบว่า ทั้งการเปิดการค้าเสรี (Trade Openness) และการลงทุนโดยตรงจากต่างประเทศ (FDI) ส่งผลทางบวกต่อค่าจ้างแรงงานอย่างมีนัยสำคัญ นอกจากนี้ ผลิตภาพแรงงาน ค่าใช้จ่ายในการวิจัยและพัฒนา และสัดส่วนของแรงงานที่มีทักษะต่อจำนวนแรงงานทั้งที่มีและไม่มีทักษะ ส่งผลทางบวกต่อค่าจ้างแรงงานอย่างมีนัยสำคัญเช่นกัน แต่อย่างไรก็ตาม สัดส่วนของแรงงานหญิงต่อการจ้างงานทั้งหมด และสัดส่วนของรัฐวิสาหกิจต่อจำนวนผู้ประกอบการทั้งหมดส่งผลทางลบอย่างมีนัยสำคัญต่อค่าจ้างแรงงาน

ในท้ายที่สุดนี้ ผลการศึกษาแสดงให้เห็นว่า ภาครัฐควรดำเนินนโยบายทางด้านการค้าและการลงทุนที่ก่อประโยชน์ต่อการเพิ่มขึ้นของค่าจ้างแรงงานในทุกภาคอุตสาหกรรมทั้งภาคอุตสาหกรรมที่ใช้ทุนเข้มข้น (Capital-Intensive Industries) และภาคอุตสาหกรรมที่ใช้แรงงานเข้มข้น (Labor-Intensive Industries)



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| สาขาวิชา | เศรษฐศาสตร์และการเงินระหว่างประเทศ | ลายมือชื่อนิสิต ..... |
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KEYWORD: Trade Openness, Foreign Direct Investment, Wage Determinants
Qianyi Chen : Impact of Trade and FDI Openness on Wages in the Manufacturing Sector in China. Advisor: Asst. Prof. PITUWAN PORAMAPOJN, Ph.D. Co-advisor: Prof. PAITOON WIBOONCHUTIKULA, Ph.D.

The purpose of this study is to examine the impact of trade openness and foreign direct investment (FDI) on wages in China using a panel data set of 27 manufacturing sectors over the period of 2001 to 2016. The effects are separated into three groups: total industries, capital-intensive industries and labor-intensive industries.

First, by comparing the determinants of three groups of industries, it shows that the impact of trade openness on wages only significant and positive in labor-intensive industries while the impact of FDI on wages is significantly positive in both capital-intensive industries and labor-intensive industries. Second, in the case of total industries, trade openness and FDI are insignificant to wages. Labor productivity, research and development (R&D) expenditure, the proportion of skilled workers to total skilled and unskilled worker are significantly positive to wages. In contrast, the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises are significantly negative to wages. Third, for capital-intensive industries, the impact of trade openness on wages is insignificant while the impact of FDI is significantly positive on wages. Moreover, labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers are significantly positive to wages. Finally, for labor-intensive industries, the impact of trade openness and FDI are both significantly positive to wages. Furthermore, labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers are significantly positive to wages. However, the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises are significantly negative to wages.

Last but not least, the results imply that the benefits of trade and investment policies of China on industrial wages should be made more inclusive to all types of industries, either capital or labor-intensive industries.



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Qianyi Chen

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# Chapter 1
# Introduction

## 1.1 Background

Trade liberalization has a crucial influence on countries' economic growth and social development. The variation of international trade and foreign investment reflect the world economic development. Looking at the world economy, any government that achieves its own development and enhances its own national wealth tries to exploit foreign trade to develop its economy.

Compared with the United States (U.S.), Japan and other developed countries, China is a typically abundant labor resources country. In 2001, China accessed to the World Trade Organization (WTO). Its tariff level has experienced substantial reduction. According to Ministry of Commerce of the People's Republic of China, China's tariff level fell from 15% to 9% during the period of 2001 to 2010, representing the WTO's tax reduction commitment has been fulfilled. The right to trade is open to all enterprises, and the investment environment and market access conditions for agriculture, industries, and services have greatly improved. Under the Economic Reform and Open up policy, China has become the world's largest export country and the second largest import country in 2013. According to the World Bank, China's GDP per capita has soared from 1,053 U.S. dollars in 2001 to 8,826 U.S. dollars in 2017.

What is more, the utilization of foreign capital is one of the considerable parts of Economic Reform and Open up policy in China. So far, China has become the largest developing country in the world that attracts foreign direct investment (FDI), with the total amount of 119 billion U.S. dollars in 2014. Moreover, foreign direct investment is particularly prominent in outsourcing, research and development (R&D) and high-tech manufacturing investment. With the promote of industrial structure of the home country and the rapid development of the domestic industries, FDI has become a new trend in the new round of industrial revolution. Since 1960, the "Newly Industrial Economics[1]" has started to boom, those developing countries undertook the production and manufacturing of labor-intensive industries from western developed countries. Those developing countries absorbed advanced foreign capital and technology to development, making them become the "leaders" in Southeast Asia and in East Asia. Nowadays, the global manufacturing industry has gradually shifted from Japan, Europe and others developed countries to some developing countries in Asia which have lower labor costs, such as China, Vietnam and the Philippines. The shift of manufacturing industry not only provides new development opportunities for developing countries, but also changes wages among labor in various countries.

[1] "Newly Industrial Economics": Refer to South Korea, Singapore, Taiwan (China) and Hongkong (China).

Although China has succeeded in both trade openness and FDI, ultimately, we need to discuss whether the gains from trade and FDI openness benefit workers in terms of increasing wages. This study designs to explore the determinants of wages in China, and to investigate the impact of trade and FDI openness on wages in the manufacturing sector in China and to give the policy advice from the study results.

## 1.2 Objectives

In order to find the relationship between trade openness, foreign direct investment (FDI) and wages. There are four main objectives in this research paper.

(1) To describe the wage condition and policies in China.
(2) To describe the trade, FDI and trade and FDI policies in China.
(3) To find the impact of trade and FDI openness on wages in the manufacturing sector in China.
(4) To draw policy implications from the study results.

## 1.3 Scope

The research uses panel data to analyze the impact of trade and FDI openness on wages in the manufacturing sector in China. There are 27 sectors and the data are annually from 2001 to 2016. All the data come from China Labor Statistical Yearbook, China Science and Technology Statistical Yearbook and the website of global economy.

## 1.4 Research purpose and contributions

Most previous studies were used micro-level (firm level data) and provincial-level (province level data) data to analyze the determinants of wages. This research paper uses national-level data to study the wage determinants and finds the relationship between trade and FDI openness on wages in China.

Different from others studies, this paper compares the determinants of different kinds of industries. It has divided into three equations to explore: total industries, capital-intensive industries and labor-intensive industries.

# Chapter 2
# Overview of wages, trade and FDI policies in China

## 2.1 Wages and wage policies in China

### 2.1.1 Wage policies

Before 1977, China has implemented a planned economic policy. In the urban area, state labor agencies absolutely monopolizes the allocation of labor, which means that governmental planning determined the supply and demand of labor, rather than the market Yueh (2004). As a result, the majority of employed population has become the employee of state-owned enterprises (SOEs) or government departments. In 1957, the state council stipulated that employees working in state-owned enterprises or government departments cannot be dismissed at will. Therefore, employees in those sectors do not have to worry about losing their jobs, which is called "iron rice bowl" (Yueh, 2004).

At that time, the country basically executed "Low Wages, More Jobs" wage distributive policy (Yueh, 2004). Their wages are given based on a unified national wage system. The wage policy was patterned after the Soviet model, but it only applied to SOEs and government departments, not to private or foreign-owned enterprises, and the wages of private and foreign-owned enterprises can be set freely within the requirements of Labor Laws (Yueh, 2004). According to Yueh (2004), under this wage system, government officers and employees in the SOEs began to receive their wages centrally supervised according to different standards. For example, regions (urban or rural areas), sectors (state or collective-owned enterprises), industries (heavy or light industries; capital intensive or labor-intensive industries), enterprise management level (central or local government), occupations (white collar workers or blue collar workers) and the characteristics of the workplace (workplace for white collar workers or blue collar workers) etc. This wage system is a complex structure with more than 300 different job classifications. Importantly, employees of SOEs or government departments can enjoy a good welfare system, such as, the low house rent, the public expense medical treatment, good retirement benefits and so on.

In order to change the absolute egalitarianism formed and the unreasonable payment in the past, the labor market began to reform in the 1980s. According to Yueh (2004), at that time, a more decentralized labor allocation system was implemented in the labor market. And by the 1990s, SOEs and government departments were allowed to choose their own employees because the recruitment quotas were cancelled (Yueh, 2004). What is more, China's Economic Reform and Open up policy was implemented in 1978, the market economy system began to spring up. In 1992, in the 14th National Congress of the Communist Party of China, the “Socialist Market Economy System” (SME) has been established in the form of law. Since then, the basic principle of China's wage policy was “distribution according to one's

performance". The division of labor was mainly determined by the market, as well as its wages.

The basic components of a worker's wages include basic wage, performance related wage and allowance. The wages components are shown in *Table 2.1*. The principle of "distribution according to one's performance" in wages policy is mainly embodied in "Performance related wage"

*Table 2.1: Explanations of wage components*

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| **Basic wage** | This is the wage standard under the normal working conditions. No matter which position you are in, everyone's basic wage is the same in the same enterprise. The amount of basic wage is set by the enterprise. It is the main part of labor compensation and is different from the minimum wage[2]. Normally, the basic wage is higher than the minimum wage. |
| **Performance related wage** | This determines the wage level based on worker performance and labor efficiency. To understand better, for instance, the predecessor of performance related wage is Piece-rate wage, which is calculated according to the quantity produced by the worker and the unit price. There is no doubt that if you produce more, you can earn more.<br><br>Three ways to evaluate performance assessment of employees are as follows:<br>(1) Effect-oriented, focusing on "what is done" by employees, concentrating on the results;<br>(2) Quality-oriented, focusing on "how it does" by employees, concentrating on the quality of the work;<br>(3) Behavior-oriented, focusing on "how to do" and "what to do" by employees, concentrating on the work process. |
| **Allowance** | It is mainly granted to employees, such as housing subsidies, medical subsidies, transportation subsidies, overtime subsidies or an extra payment received as a reward for doing job well. |

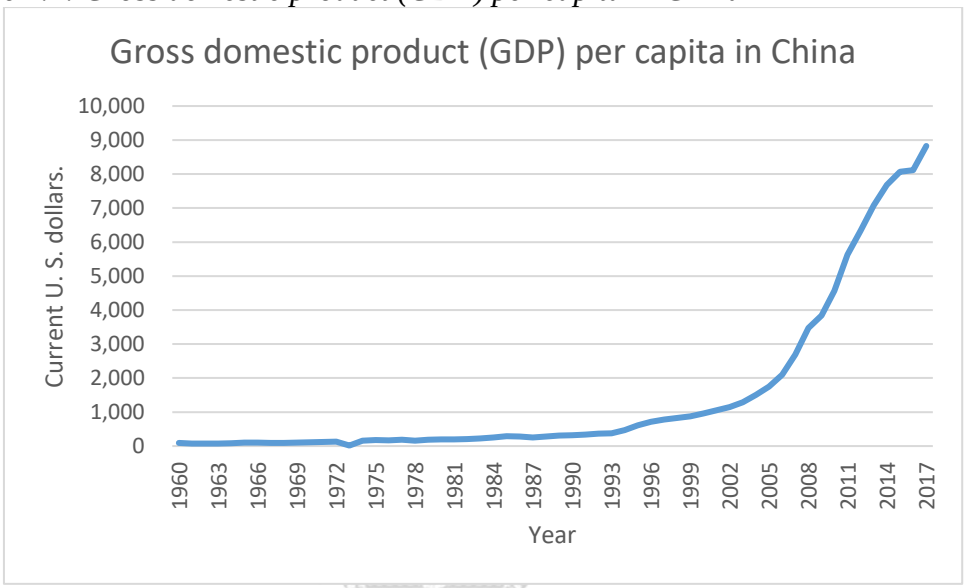
To conclude, the change in labor market division has changed the wages of workers respectively. The biggest flaw of "wages determined by the government" is that workers cannot be encouraged to increase their enthusiasm in work. Their wages are fixed and kept at a relatively low level. But the policy of "wages distribution according to one's performance" is overcome egalitarianism and mobilize the enthusiasm of the labor. This is a relatively fair approach that directly links individuals' wages to their job performance.

[2] Minimum Wage: the lowest wage allowed by law that may be paid to employees.

### 2.1.2 Industry wages status

After China had implemented Economic Reform and Open up policy in 1978, it can be seen that Gross domestic product (GDP) per capita was on a slow upward trend. After China accessed to the WTO in 2001, the sharp increase of GDP per capita was very noticeable. According to *Figure 2.1*, GDP per capita had increased from 1,053 U.S. dollars in 2001 to 8,826 U.S. dollars in 2017, which was nearly 8 times increased.

*Figure 2.1: Gross domestic product (GDP) per capita in China*

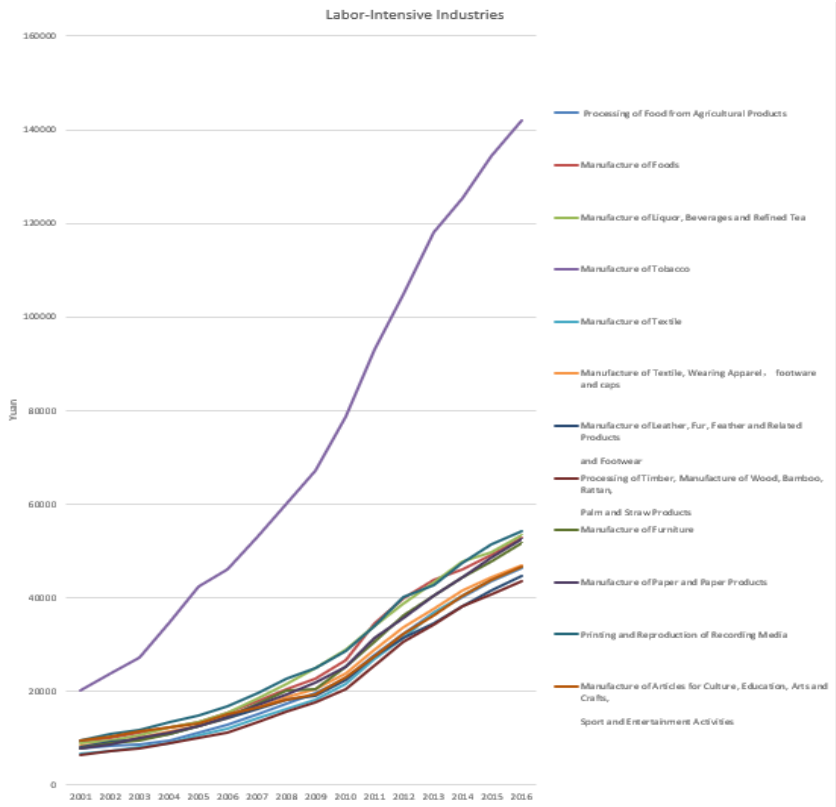



Source: World Bank

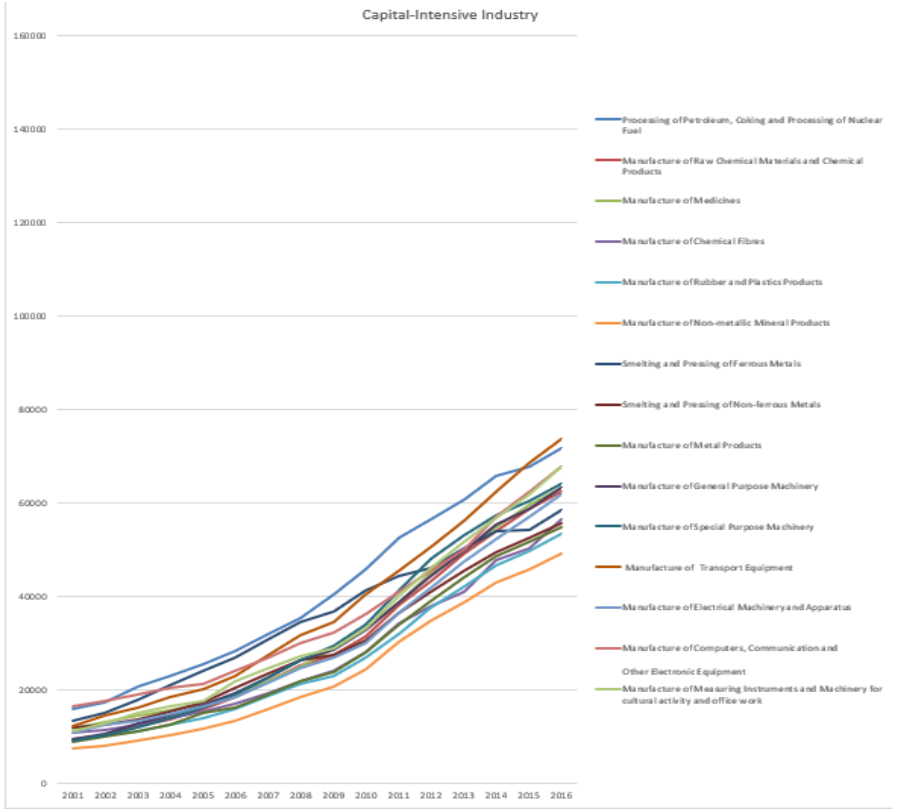
If we look at the specific manufacturing sector (*Figure 2.2*), real wages of each sectors are increasing as time goes by. The figure on the left is labor-intensive industries and the figure on the right is capital-intensive industries. Obviously, capital-intensive industries have higher average wage level than that of the labor-intensive industries. Among them, the manufacture of tobacco has the highest wage because it is monopolized by the government.

*Figure 2.2: Real wages in 27 sectors*

Labor-intensive industries




Capital-intensive industries



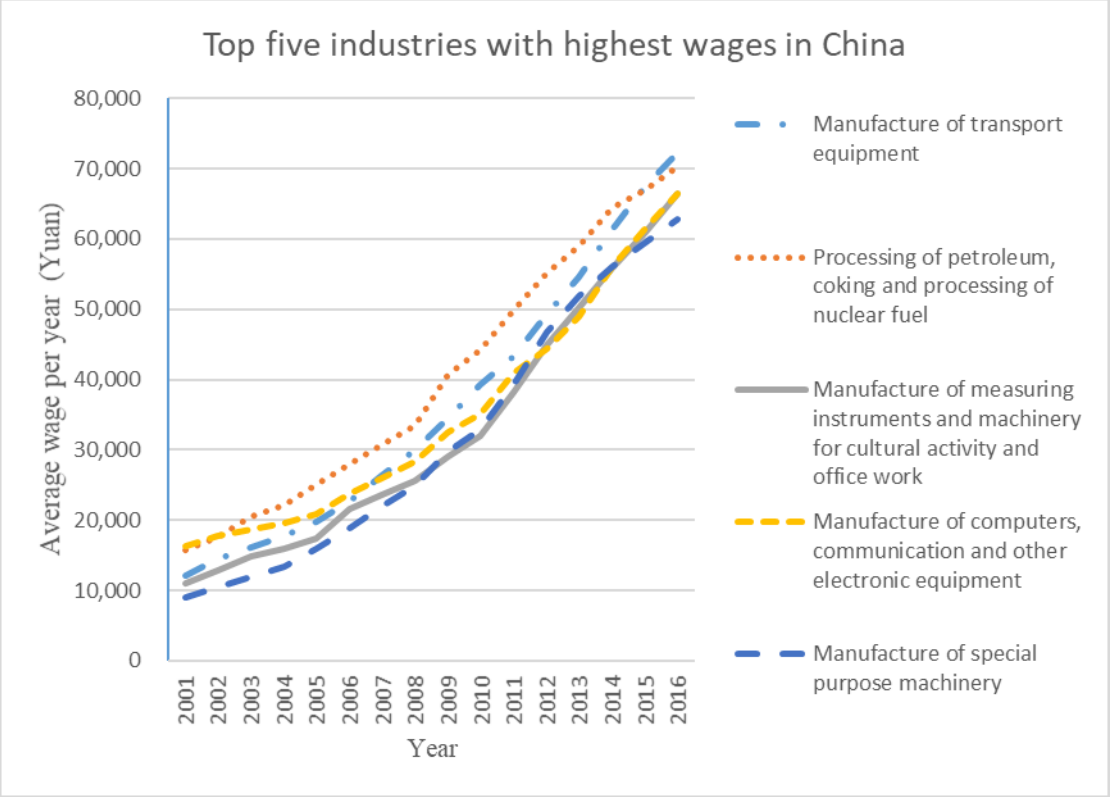

Source: China Statistic Year Book

As shown in *Figure 2.3*, if the manufacture of tobacco were not included among the specific manufacturing sectors, the top five industries with the highest wages would be (1) manufacture of transport equipment, (2) processing of petroleum, coking and processing of nuclear fuel, (3) manufacture of measuring instruments and machinery for cultural activity and office work, (4) manufacture of computers, communication and other electronic equipment, (5) manufacture of special purpose machinery.

Moreover, following the information of Nation Bureau of Statistics of China and measuring by production size, five of the major industries in China in 2016 are (1) manufacture of transport equipment, (2) manufacture of raw chemical materials and chemical products, (3) manufacture of computers, communication and other electronic equipment, (4) smelting and pressing of ferrous metals, (5) manufacture of electrical machinery and apparatus.

We can see that these five industries belong to capital-intensive industries. Both of manufacture of transport equipment and manufacturing of computers, communication and other electronic equipment are the industries with the highest wages and the largest production size.

*Figure 2.3: Top five industries with highest wages in China*




Source: China Statistic Year Book

## 2.2 Trade and trade policies in China

### 2.2.1 Trade policies

During the period of 1949 to 1977, China had implemented a planned economic policy. Under the macro background of the planned economic system, China had established a highly centralized foreign trade systems, where the State Planning Commission controlled exports as well as imports (Rani & Kaur, 2018).

In 1978, China's Economic Reform and Open up policy began to establish and China has implemented the market economy policy. Firstly, China has set up four Special Economic Zones (SEZs)[3] in 1980. The SEZs is a specific region that adopted a special policy which was more open and flexible than other parts of China in foreign economic activities. Secondly, in 1989, as Shanghai Pudong was so developed that it made the market opened in the cities along the Yangtze River. At present, Shanghai has become a well-known international financial center in the world. Additionally, China established bonded areas, set up the Economic Open Zone, opened land border cities and opened all inland cities step by step in 1992. That is, China had gradually opened the mainland areas to the world. In 2001, China joined to the World Trade Organization (WTO). Based on its commitment, China provided a fair environment for trade and foreign investment, and gradually removed various forms of trade barriers as follows.

For the tariff barriers, according to the statistics of the Ministry of Finance of the People's Republic of China, China slashed import duties on more than 5,300 items in 2002 and the tariff level fell from 43% in 1992 to 15% in 2002. As of 2010, the total tariff level had further went down to 9%, which means the WTO's tax reduction commitments had all been fulfilled.

For the non-tariff barriers, China abolished quotas and licenses for eight categories of products, including grain, wool, cotton, acrylic, polyester chips, fertilizer and some kinds of tire in 2002. Moreover, in 2003, China had further canceled the quotas and licenses for some motorcycles, automobiles and their spare parts, cameras, watches and other related products.

[3] Special Economic Zones including Shenzhen city, Zhuhai city, Xiamen city and Shantou city.

### 2.2.2 Trade and trade openness

According to *Figure 2.4*, Gross Domestic Product (GDP), total amount of goods and service for export and total amount of goods and service for import have been on an adding upward trend. The total amount of goods and service for export is always higher than the total amount of goods and service for import. In 2009, the total amount of goods and service for export had reached 8,537 billion Yuan and China is by far the largest export country in the world. In 2013, the total amount of goods and service for export and import had reached 27,717 billion Yuan, China became the largest country in trade of goods and service in the world.

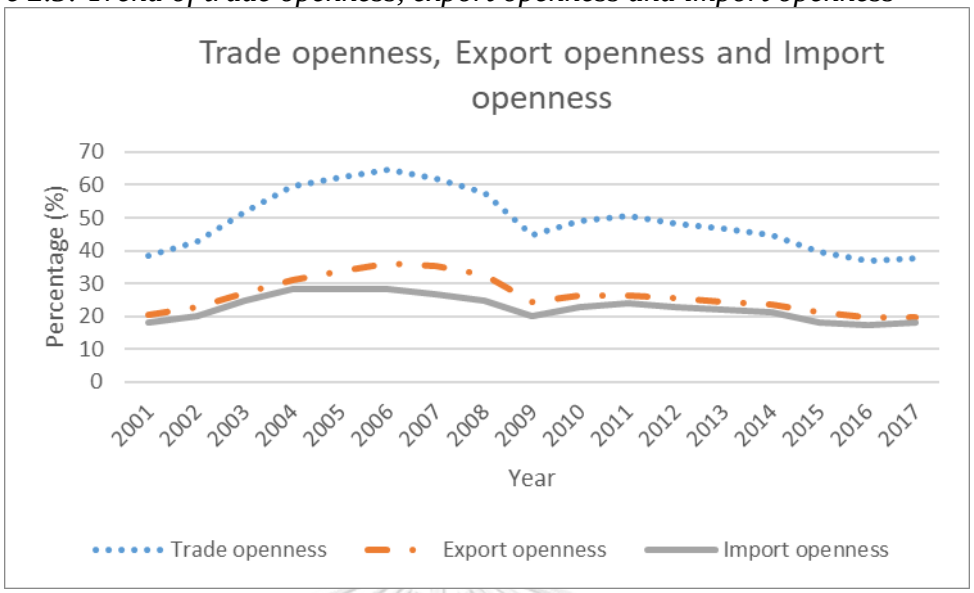
*Figure 2.4: Gross domestic product (GDP), total amount of goods and service for export and total amount of goods and service for import*


Source: World Bank



Trade openness refers to the degree of a country to open its economy to the outside world. *Figure 2.5* that shows the trade openness trend in China during the period of 2001 to 2017. Between 2001 and 2006, trade openness had been continuously increasing. The reason was that when China participated in the WTO in 2001, it had opportunities for the development of trade to other countries, and trade openness once reached the highest degree of 64.24% in 2006. However, after 2007, trade openness showed a significant decline trend, which was related to the global economic crisis in 2008. After 2009, economy in China had entered a period of rapid development, but at the same time, China adjusted its economic policies and slowed down the speed of import and export trade, which caused a downward trend continuously of trade openness. Importantly, the changing trend of import openness and export openness were consistent with trade openness, and export openness was slightly higher than import openness, indicating that export trade has a leading function in economic development in China during 2001 to 2017.

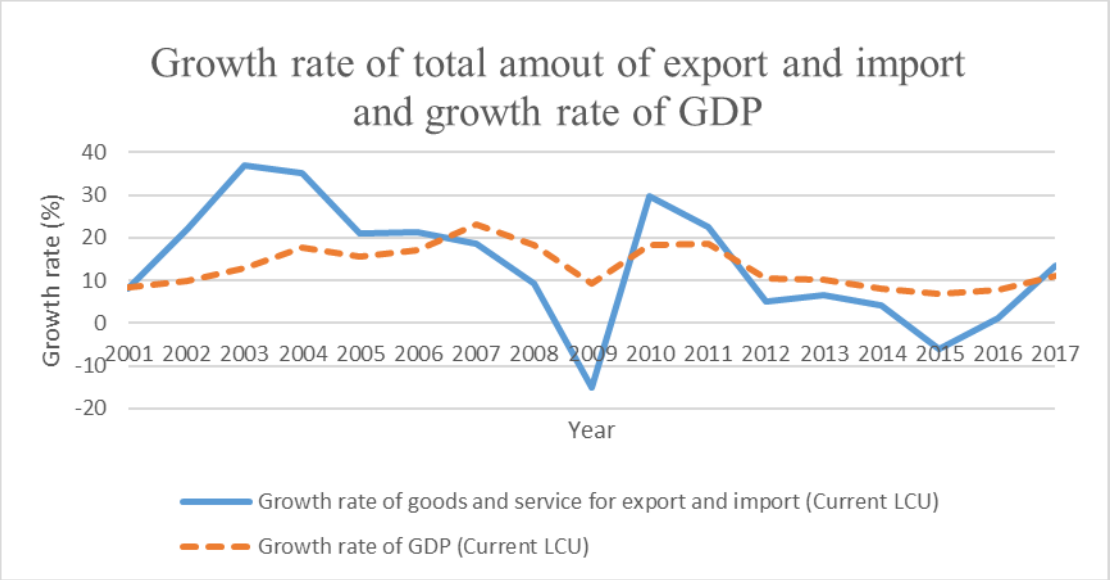
*Figure 2.5: Trend of trade openness, export openness and import openness*




Source: World Bank

As shown in *Figure 2.6*, the downward trend of trade openness was may be due to China's GDP growth rate which was faster than the growth rate of the total amount of goods and service for export and import after 2007. However, in 2010, the growth rate of goods and service for export and import was slowly recovering, but still less than the previous speed. After 2012, the growth rate of GDP continued faster than the growth rate of total amount of goods and service for export and import.

*Figure 2.6: The growth rate of the total amount of export and import and growth rate of GDP*




Source: World Bank

Moreover, Xinyi (2017) explains why trade openness in China has faced a downward trend. Three reasons for downward trend in trade openness, due to the decreasing value of total amount of goods and service for export and import in China are as follows.

(1) The comparative advantage of producing labor-intensive goods is gradually weakening in China. China has a large population, and the biggest benefit brought by a large population is low labor cost, namely the advantage of demographic dividend[4]. Data from National Bureau of Statistics of China shows that the population of aged over 60 years old accounted for 12% of the total population, reaching 1.6 billion in 2009. In the context of China's aging population[5], the trend of demographic dividend had lost gradually. According to the background of rising wages and prices in the Chinese market, FDI has gradually shifted to the lower-cost countries, such as the other Southeast Asian countries, ultimately leading to a decline in exports and affecting the degree of trade openness in China.

(2) The proportion of FDI's processing trade[6] had decreased. Processing trade had been regarded as a major contributor to the total amount of goods and service for export and import in China in the 1990s. However, after 2007, China's foreign trade policy tended to reduce the proportion of processing trade and increased the proportion of general trade[7]. From 1981 to 2006, the total amount of goods and services for export and import of processing trade increased from 2.6 U.S. billion dollars to $909 U.S. billion dollars, and the total amount of goods and service for export and import of processing trade accounted for 5.9% to 53.4% of the total amount of goods and services for export and import in this respectively year. By 2015, the total amount of goods and services for export and import of processing trade reached 1,244 U.S. billion dollars, but its share of the total amount of goods and service for export and import has dropped to 45%. The decrease in the proportion of processing trade will decline the total amount of goods and services for export and import at the meantime, which will decrease the degree of trade openness. The decline in the share of processing trade means some traditional industries, such as manufacturing industries, are shifting to Vietnam, the Philippines and others countries where the labor cost is lower.

(3) China has been affected by industrial transformation and upgrading policies. At the Third Plenary Session of the 18th Central Committee of the communist party of China in 2013, the central government proposed to guide the industrial transformation and develop the tertiary industry. Before the Economic Reform and Open up policy, China was an agricultural country. After 1978, the proportion of manufacturing industry[8] continued to develop, and the proportion of tertiary industry also slowly increased. As can be seen in *Figure 2.7*, since 2012, the

---

[4] Demographic dividend occurs when the ratio of $\frac{Under\ aged\ 14+Over\ aged\ 65}{aged\ between\ 15\sim64}$ less than fifty percent (50%).

[5] According to the standards of the United Nations, the population aged 60 and above in a region reach 10% of the total population, the region is regarded as entering an aging society.

[6] Processing trade: Enterprises import raw materials, parts of components or packaging materials and re-exports the finished products after processing or assembling.

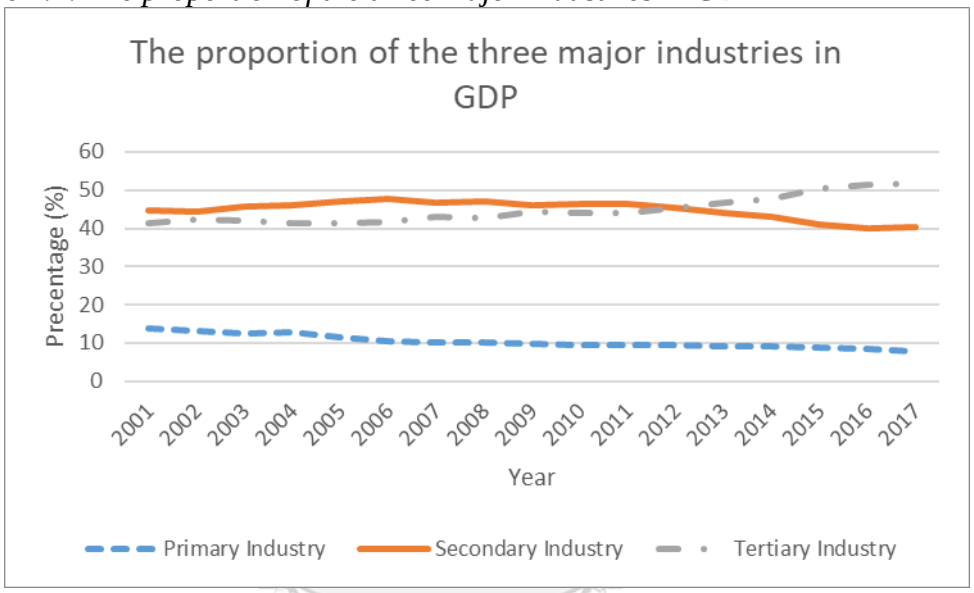
[7] General trade: Meanings unilateral import or export.

[8] For a breakdown of the three main industries please as shown in Appendix.

proportion of the tertiary industry has exceeded the secondary industry. In the following years, the proportion of the tertiary industry continued to rise because the trade openness is related to the proportion of the secondary industry closely.

The higher the proportion of the tertiary industry, the lower the proportion of the secondary industry. And the secondary industry is related to the manufacturing goods, which means that lower the proportion of secondary industry will decrease in the total amount of goods and service for export and import, which declines the degree of trade openness.

*Figure 2.7: The proportion of the three major industries in GDP*



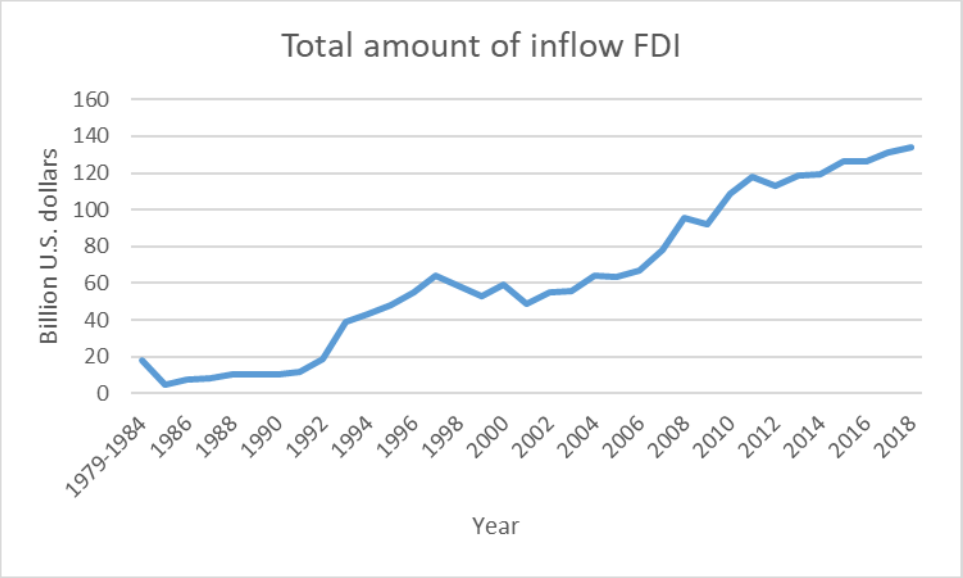

Source: China Statistic Yearbook

## 2.3 Inflow of foreign direct investment (FDI) and FDI policies in China

### 2.3.1 Policies to encourage inflow FDI

Foreign direct investment (FDI) trend is based on the change in Economic Reform and Open up policy in China. The starting point of China's use of FDI was in 1978 to establish four Special Economic Zones (SEZs) in the eastern area, where allowed foreign investors to invest. As shown in *Figure 2.8*, throughout the 1980s, the total amount of inflow FDI was small. Since the early 1990s, the amount of inflow FDI has increased remarkably. In 2014, the total amount of inflow FDI reached 119 billion U.S. dollars, and at the same time, the total amount of inflow FDI in China had in second place in the worldwide and become the first among developing countries. In 2018, the total amount of inflow FDI reached 134 billion U.S. dollars.

*Figure 2.8: Total amount of inflow foreign direct investment (FDI)*




Source: China labor statistical yearbook



There are two reasons for China's rapid attraction of FDI after the 1990s. The first reason is that China's Economic Reform and Open up policy has continued to deepen, as China's economy continues to develop and foreign investors are interested in the Chinese market. The second reason is that China has expanded the scope of foreign investment and eased restrictions on foreign investment. All in all, foreign investment policies in China are more open and attractive.

According to China Foreign Investment Report 2018[9], the preferential policies for foreign direct investment has the following aspects, shown in *Table 2.2*.

*Table 2.2: Some preferential policies for foreign investment*

| | |
|---|---|
| "Notice of the State Council on Measures to Expand Foreign Opening and Active Use of Foreign Capital" | Expand FDI opening and encourage foreign investment:<br>(1) Reduce the investment restrictions on in the secondary industry and in the tertiary industry;<br>(2) Encourage investment in high-value-added manufacturing, transform and upgrade the traditional industries;<br>(3) Support foreign investor to establish R&D centers, and carry out R&D work with domestic enterprises and scientific research institutions. |
| "Notice of the State Council on Several Measures to Promote Foreign Investment Growth" | Reduce withholding income tax:<br>The profit distributed by the enterprise shall be subject to a 10% withholding income tax. If these enterprises continue to invest in China within the next year and meet certain conditions, this tax may be temporarily exempted.<br><br>Relax visa restrictions:<br>The validity period for work visas for foreigners is extended from 1 to 2 years to 5 to 10 years for multiple round-trip visas, and their spouses and minor children also get the same treatment. |



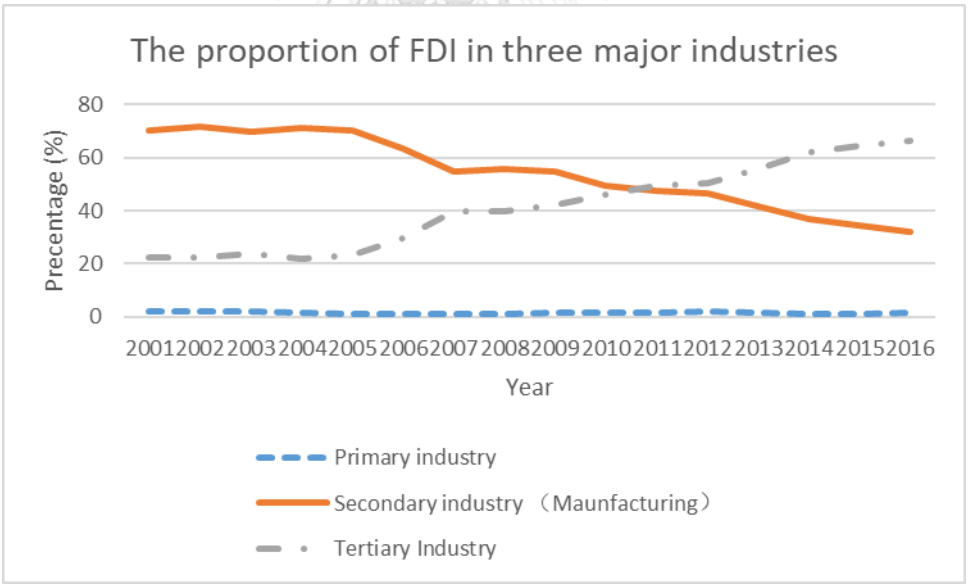
[9] China Foreign Investment Report 2018, reference from the People's Republic of China Ministry of Commerce.

### 2.3.2 Inflow of FDI

**(1) Distribution of foreign direct investment (FDI)**

As shown in *Figure 2.9*, the primary industry accounts for the smallest proportion of inflow FDI. During the period of 2001 to 2016, the proportion of inflow FDI in the secondary industry decline continuedly, and the proportion of inflow FDI in the tertiary industry increased. The percentage of FDI in the tertiary industry remained low, around 30 percent, from 2001 to 2006. According to the World Trade Organization (WTO) agreements, when the tertiary industry was opened up after 2007, the percentage of the tertiary industry began to rise dramatically. In 2011, the proportion of inflow FDI in the tertiary industry was exceed the secondary industry. According to Yongjian and Jiechang (2012) from China Daily, the first reason was the increasing amount of R&D sector in China. Foreign investment in science, technology and geological explorations in China increase from 340 U.S. million dollars in 2005 to 1.97 U.S. billion dollars in 2010. Similarly, the foreign investments in retail and the realty market increased more than four times from 2001 to 2007. Besides, more multinationals entered into China through mergers and acquisitions after 2007, thus changing the total industry chain.

*Figure 2.9: The proportion of foreign direct investment (FDI) in three major industries*



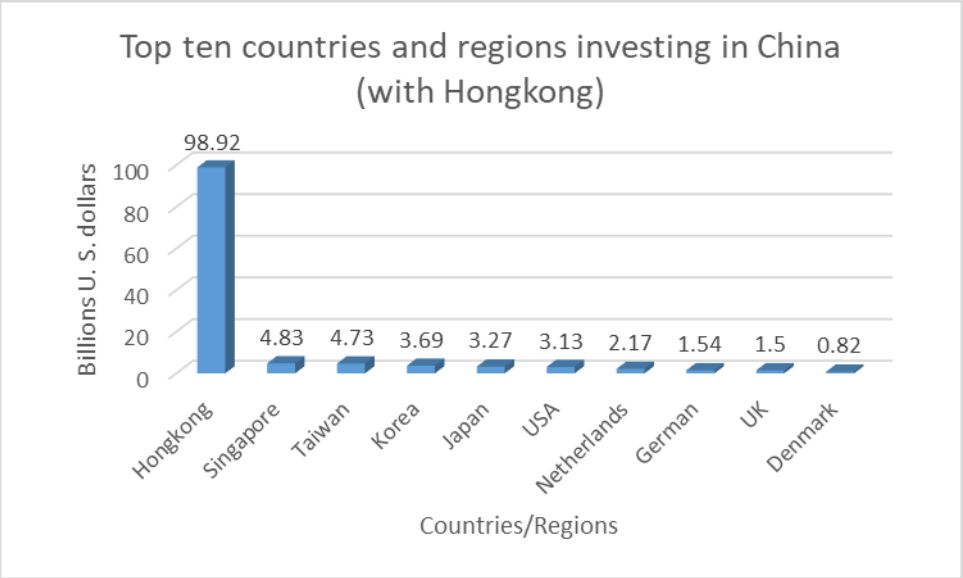

Source: Statistics of the Ministry of Commerce of the People's Republic of China

**(2) Sources of foreign direct investment (FDI)**

Ministry of Commerce of the People's Republic of China showed that the sources of foreign capital mainly came from Hongkong, Macao and Taiwan before the 1990s, accounting for 80% of the total investment in China. In the early 1990s, the number of multinationals from other developed countries investing in China has increased markedly. The proportion of funds from Macao, Hongkong and Taiwan had decreased year in year out, but the accumulative proportion still accounted almost 79% in 2017. Among FDI, funds from Macao, Hongkong and Taiwan still account for a great part. This is because investors have natural closeness with mainland China, in terms of blood relationship, language and culture. But the proportion has gradually declined due to the swift growth of large multinational companies invested in China, which come from Singapore, Japan, Korea, the United States and Europe.

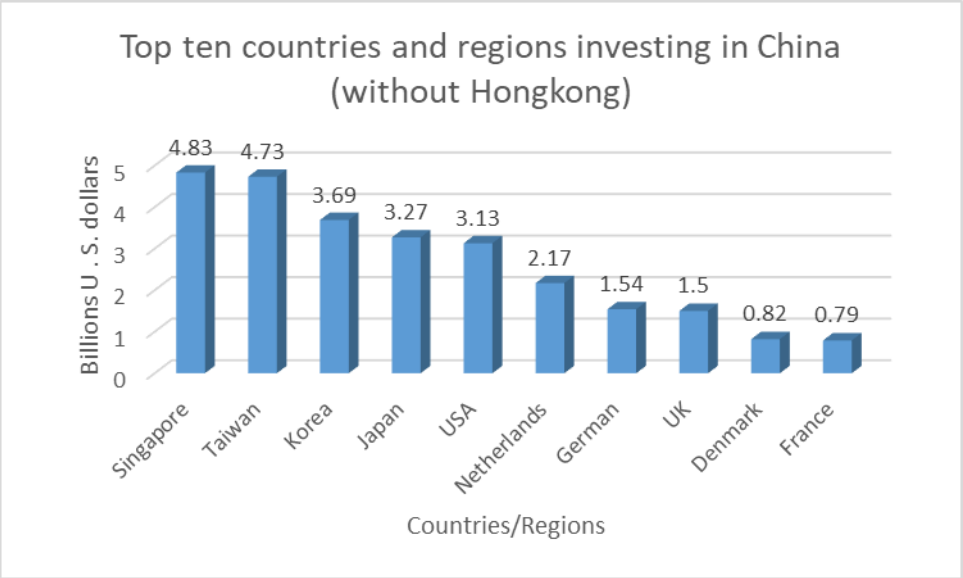
According to the latest data, China totally received 131 billion U.S. dollars in foreign investment in 2017, while the total amount of the top ten countries and regions totally invested 125 billion U.S. dollars. As Hongkong accounted for the majority of inflow foreign investment in China. The top ten countries and regions with Hongkong investing in China as shown in *Figure 2.10*, and the top ten countries and regions without Hongkong investing in China as shown in *Figure 2.11*.

*Figure 2.10: Top ten countries and regions investing in China in 2017 (with Hongkong)*




Source: Ministry of Commerce of the People's Republic of China

*Figure 2.11: Top ten countries and regions investing in China in 2017 (without Hongkong)*



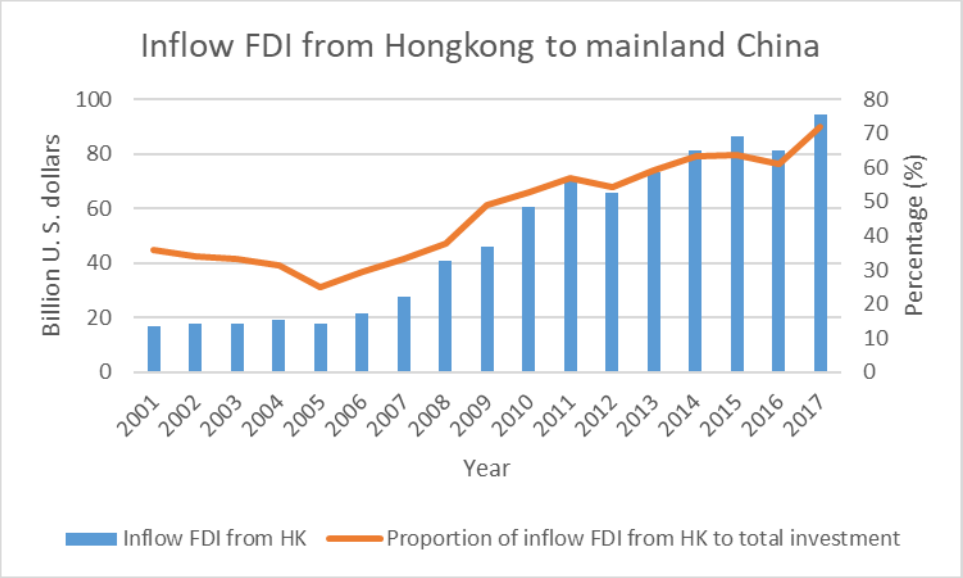

Source: Ministry of Commerce of the People's Republic of China

We can see that Hongkong was the most considerable source of foreign investment for the mainland China (*Figure 2.12*). According to Ministry of Commerce of the People's Republic of China, in 2017, there were 18,066 new Hongkong-owned enterprises set up in the mainland China. Compared with the previous year, it increased by 41.7%, and accounted for 50.7% of the total enterprises.

The most common economic activities of Hong Kong-invested enterprises in the mainland include import and export trade, wholesale and retail, real estate investment, manufacturing and services. In the early years of China Economy Reform and Open up policy, Guangdong, a province in mainland, developed a special economic relationship with Hongkong, which is called "Front Shop, Back Factory." The mainland China is plenary in natural resources and the labor force is cheap while Hongkong and Macao have abundant advanced technology, capital assets and management experience. Therefore, many Hongkong enterprises are willing to build factories and invest in mainland China, and then sell products to Europe, America and other areas through Hongkong as a transit point.

Importantly, Hongkong is a free trade port with low taxation and Hongkong adopts the offshore RMB exchange rate mechanism. Many mainland enterprises or international investment institutions choose to invest a large amount of RMB assets in Hongkong, and then invest in the mainland China through Hong Kong Banks. These assets will become FDI inflow to mainland China, and those enterprises can enjoy various preferential policies when they have economic activities in mainland China.

*Figure 2.12*: *Inflow FDI from Hongkong to mainland China*




Source: Ministry of Commerce of the People's Republic of China

# Chapter 3
# Conceptual framework

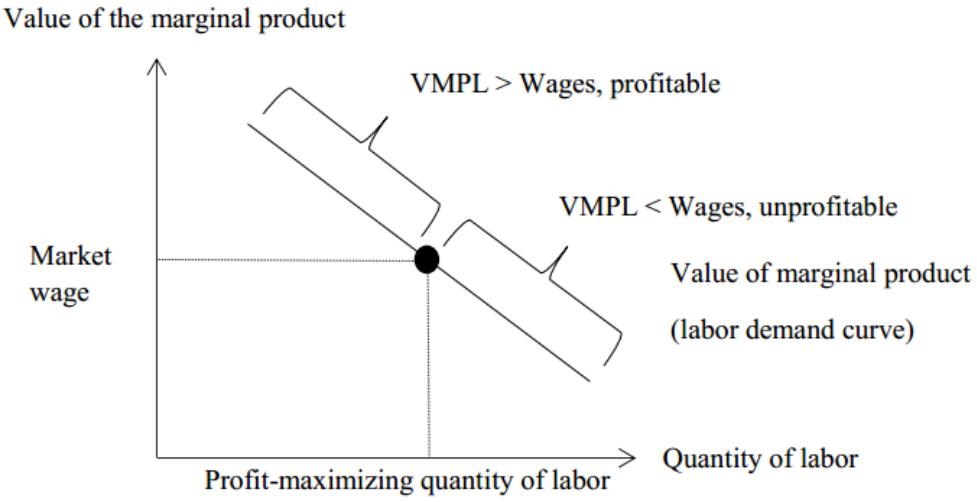
## 3.1 Wage determinations

The manufacturing industry wages can be explained by the framework of labor demand and supply (Mankiw, 2015).

### 3.1.1 Labor demand and wages

The labor demand is a function of D=f ($X_1$,$X_2$,$X_3$,...,$X_n$), where D is labor demand, and ($X_1$,$X_2$,$X_3$,...,$X_n$) are the determinant factors. Figure 3.1 shows how the value of the marginal product (VMPL) relies on the quantity of labors. According to Mankiw (2015), the curve has a downward slope because the marginal product of labor (MPL) decreases as the quantity of labor increases. In order to profit maximization, the firm hires laborers and pay corresponding wages when the labor demand curve and the labor supply curve cross and reach equilibrium. Because below this level of quantity of labor, the VMPL surpasses the market wages, so hiring another labor will increase profit. Above this level of quantity of labor, the VMPL is under the market wages, so the marginal labor in unprofitable (Mankiw, 2015).

*Figure 3.1: Labor demand curve*



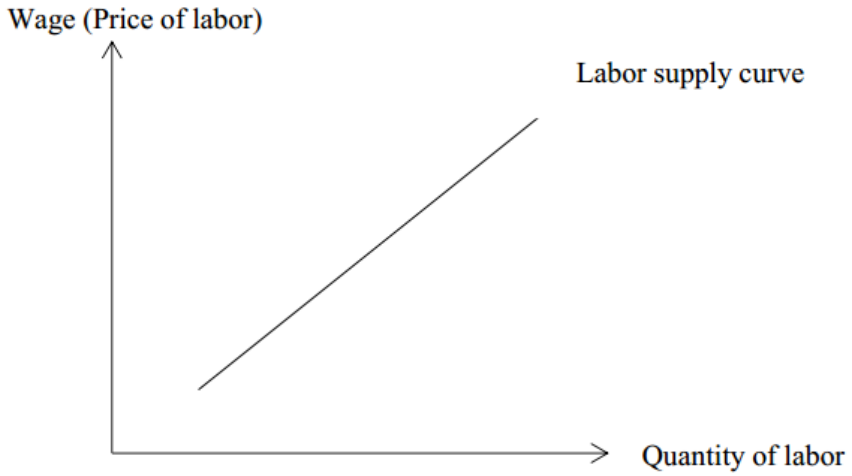
The relationship between wages and labor demand curve is negative. Wages change affects labor demand through the impact of production scale. When the wages rise, the cost of the enterprise rises. To absorb the rising cost, the enterprise tends to increase the product price, which in turn causes consumers to reduce the consumption. In order to survive, enterprises will reduce the level of labor demand, that is to lay off laborers. On the other hand, when the wages decline, the level of labor demand of enterprises increase, because enterprises can hire more laborers at a lower cost and expand production in order to earn more (Mankiw, 2015).

### 3.1.2 Labor supply and wages

The labor supply function is represented by S= f ($X_1$,$X_2$,$X_3$,...,$X_n$), where S is labor supply, and ($X_1$,$X_2$,$X_3$,...,$X_n$) are the determinant factors.

Following Mankiw (2015), the labor supply curve reflects the response of workers to the change of opportunity cost in the labor - leisure trade off. Figure 3.2 shows the labor supply curve has an upward slope because wages increase causes an increase of quantity of labor. Laborer's time is limited, more working hours means that laborers enjoy less leisure time. In other words, laborer's wages are equivalent to the opportunity cost to acquire leisure, which becomes the "price" of leisure (Mankiw, 2015).

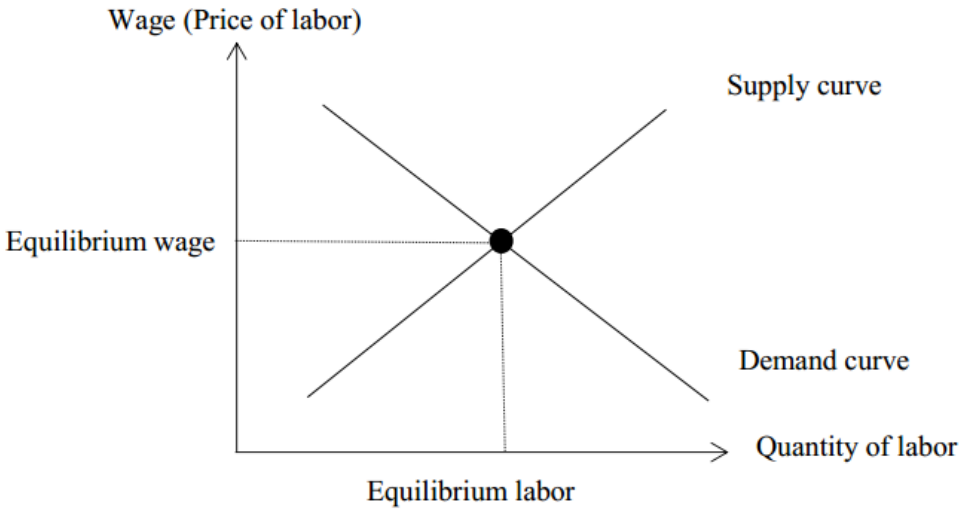
*Figure 3.2: Labor supply curve*



### 3.1.3 Equilibrium wages

*Figure 3.3* shows that the labor demand and labor supply can determine the wages and quantity of labor. Each firm hires as many laborers as it finds profitable at the equilibrium wage when the market is in this equilibrium. So changes in labor demand and labor supply can affect wages and the quantity of labor (Mankiw, 2015).

*Figure 3.3: Equilibrium wages*






### 3.1.4 Factors that lead to a change in the labor demand curve

**(1) Trade openness**

Trade openness increase indeed enhances the demand of labor in a country. An export-oriented country will increase production and export more in order to obtain profits. If this country is also a labor-intensive country, export trade needs more workers and labor demand will increase, which also increase the wages of labor (Chor-ching & Javorcik, 2005; Revenga, 1997)

**(2) Foreign direct investment**

Compared with domestic producers, foreign investors have a production advantage because they have advanced technology. As increasing the amount of inflow FDI in the invested country will be associated with higher levels of productivity, increasing the proportion of factors such as capital, technology or even experience and organization method. In order to get more profits, enterprises will hire more laborers thereby moving the labor demand curve upward (Vijaya & Kaltani, 2007). Moreover,

the inflow of FDI will set up new enterprises in the invested country, so new enterprises will increase the employment opportunities in domestic market, which means they will increase labor demand of the whole industry, moving the labor demand curve upward (Faggio, 2001).

**(3) Labor productivity**

The worker's productivity level (MPL) can determine the value of the marginal product (VMPL) because of VMPL=MPL×P. With the constant amount of labor, workers who have higher productivity level can produce more goods without increasing the production cost. In order to get more profits, enterprise will expand production and increase labor demand, which will increase workers' wage.

**(4) Technology change**

Advanced technology raises up labor productivity, which can increase the demand of labor and shift the labor demand curve up (Mankiw, 2015). This is because the enterprise with advanced technology can expand production and earn more, therefore wages increase accordingly. However, technological can also reduce labor demand. With the invention of an industrial cheap robot, enterprises are more willing to use capital instead of labor, and convincingly weaken the demand of labor, moving the labor demand curve to downward and decreasing wages (Mankiw, 2015).

### 3.1.5 Factors that lead to a change in the labor supply curve

**(1) The size of the working population**

According to Mankiw (2015), the working population refers to the number of people who are above 15-year-old and willing and able to work. It depends on birth and death rates, school leaving age, retirement and immigration and so on. Increase in the size of the working population can increase the supply of labor, and hence decrease wages and vice versa (Mankiw, 2015).

## 3.2 The relationship between trade openness and wages

### 3.2.1 Ricardian theory[10]

Based on the Ricardian models assumptions[11], it says that each country and the world as a whole will achieve maximum welfare if each country engages in free trade and completely specializes produce goods which has a comparative advantage (Dornbusch, Fischer, & Samuelson, 1977). In addition, the pattern of trade is determined by each country's relative labor productivity in combination with its relative wage rates (Paitoon, 2012).

Following Paitoon (2012), for an arbitrary good *z* produced and consumed in country H, the price of good *z* is cheaper than import it from country F. The equations are as follows and the notation is shown in Appendix.

$$p(z) < p^*(z)$$

$$wa\ (z) < w^*a^*(z)$$

$$\frac{a(z)}{a^*(z)} < \frac{w^*}{w}$$

Therefore, we can get the following equation.

$$A(z) > \frac{w}{w^*}$$

Then under perfect competition, the relative labor productivity of good *z* of Home needs to be greater than the relative wage rate of H to F.

As shown in *Figure 3.4*, we can see that
(1) $z < Z_1$, good *z* will be produced in Country H;
(2) $z > Z_1$, good *z* will be produced in Country F.



What is more, the determination of relative wages $(\frac{w}{w^*})$ is an increasing function of *z*. That is, the more goods produced by Home country (high *z*), the higher demand for Home labor which leads to higher real wages in the Home country. By finding the intersection point of the relative wage rate, $(\frac{W}{W^*})_1$ and the relative labor productivity, $z_1$, we can find the equilibrium of relative wage rates and the pattern of trade, which is shown in *Figure 3.4*. At equilibrium, the Home country produces goods up to the $z_1$ and the wage rate of Home relative to foreign is $(\frac{W}{W^*})_1$. Home

[10] Ricardian theory and Stolpter-samuelson theorem are reference from the lecture note written by Prof. Paitoon wibooncnutikula. Ph.D.

[11] Ricardian theory assumed that (1) There are 2 countries (Country F and Country H), (2) Infinitely many goods indexed by a continuous variables, (3) One factor of production-labor, (4) Labor is mobile within the country but immobile between countries, (5) Perfect competition in product and labor markets, (6) Full employment, (7) Free trade, (8) No transportation costs.

country produces and exports goods with index less than $z_1$. The foreign country produces goods with index greater than $z_1$ and exports these goods to the Home country. That is, for the Home country that produces $z_1$ and gains the most from international trade, the following condition should hold: A($z$) > $\frac{w}{w^*}$. However, if A($z$) < $\frac{w}{w^*}$, the Home country should import good $z$ instead of making it herself.

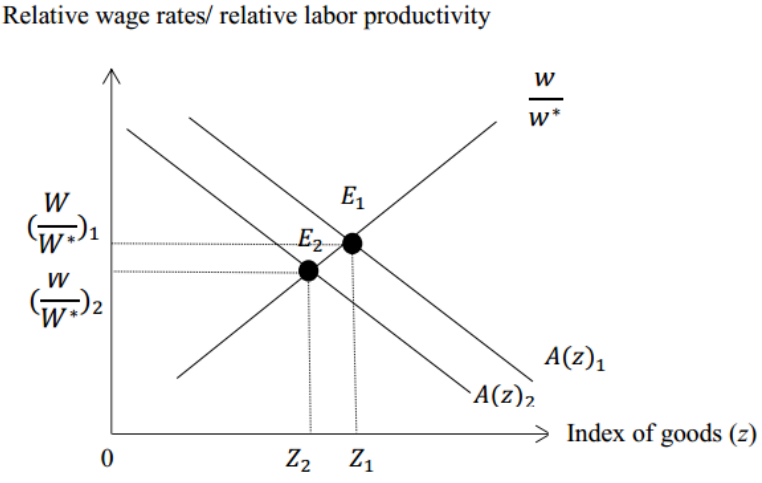
Notice that the above conditions meet the criteria for determining the pattern of trade or pattern of specialization. Since the criteria for gaining from trade is the same as the criteria for determining the pattern of trade in each country, we can conclude that international trade based on the Ricardian patterns lead each country to gain the most from trade.

What is more, productivity growth in the Foreign country leads to welfare improvement of both the Home and the Foreign countries. Increase the labor productivity in Foreign country, $A(z)_1$ will shift to $A(z)_2$, and the Home country wages increase can be separated into 3 groups:

(1) z < $Z_2$, Home country continues to produce these goods and the real wage remains constant. (2) $Z_2$ < z < $Z_1$, goods formerly produced in Home, but imported from Foreign country after the productivity growth. After the productivity growth, Home consumers find prices of imported goods in this group lower than prices of goods produced in Home, real wage in Home country in terms of prices of imported goods is greater than Home country's real wage before importing these goods. Therefore, real wage in Home country in term of transitional goods also increases. (3) z > $Z_1$, Home consumers continue import these goods from Foreign, because the relative wage has less than the relative productivity, so the real wages in Home country still increases. In conclusion, after productivity growth, the purchasing power of Home country's worker rises if they choose to consume goods in Groups 2 and 3; remain constant if consuming goods in Group 1. Home country's workers are definitely not worse off despite the change of the trade pattern after Foreign increases her productivity.



*Figure 3.4: Ricardian model with many goods (with increase productivity in Foreign country)*



### 3.2.2 Stolper-Samuelson theorem[12]

Stolper and Samuelson (1941) created a 2X2X2 model[13]. Stolper-Samuelson theorem demonstrates that an increase in the good's relative price results in an increase the return of factor that intensive use of production, and vice versa (Looi, 2016; Stolper & Samuelson, 1941)

The equations are as follows and the notation is shown in Appendix. Following Paitoon (2012), let the Home country be the labor-abundant country and the Foreign country is the capital-intensive country. After opening up to free trade, the domestic relative product prices increase to the world price level, and cause $\widehat{\text{Px}} - \widehat{\text{Py}} > 0$. The relationship between relative prices of goods and relative factor prices is:

$$|\theta|(\widehat{w} - \hat{r}) = \widehat{Px} - \widehat{Py}$$

We find that if X is labor intensive and $|\theta| > 0$, opening to trade with $\widehat{\text{Px}} - \widehat{\text{Py}} > 0$ will result $\widehat{\text{w}} - \hat{\text{r}} > 0$. The liberalization of the trade regime will allow the wage-rental ratio to rise. Furthermore, the result of the liberalization real wage rate increases but real rental rate declines.

After opening to trade, $\frac{\text{Px}}{\text{Py}}$ increase or $\widehat{\text{Px}} - \widehat{\text{Py}} > 0$. If X is labor intensive and $|\theta| > 0$, we obtain $\hat{\text{w}} - \widehat{\text{Px}} > 0$ or $\hat{\text{w}} > \widehat{\text{Px}}$, That is, real wage of good X ($\frac{\text{w}}{\text{Px}}$) increase. In return, solving for $\hat{r}$ we get, free trade allows $\widehat{Py} - \widehat{Px} < 0$, and $\hat{r} - \widehat{Py} < 0$ or $\hat{r} < \widehat{Py}$. That is, real wage of good Y ($\frac{\text{r}}{\text{Py}}$) declines.

As a result of trade liberalization, $\widehat{w} > \widehat{Px} > \widehat{Py} > \hat{r}$, real wage increases while real rental rate declines in terms of either good X or good Y. So, in conclusion, when trade increases, real wage will increase of an LDC.



[12] Ricardian theory and Stolpter-samuelson theorem are reference from the lecture note written by Prof. Paitoon wibooncnutikula. Ph.D.

[13] 2X2X2 model: according to Stolper and Samuelson (1941), there are 2 countries (Home country and Foreign country, and Home country is labor abundant country and Foreign country is capital abundant country), 2 goods (X and Y, and X is labor intensive good and Y is capital intensive good), 2 factors of productions (labor and capital).

## 3.3 The relationship between foreign direct investment (FDI) and wages

### 3.3.1 Neoclassical approach: technology spillovers

In the standard neoclassical theory, under equilibrium condition, the equation of W = P × MPL represents the nominal wage formula. The notations are: W for the nominal wage, P for final goods price, and MPL for the marginal product of the labor. The real wages can be written as $\frac{W}{P} = MPL$, meaning that the labor pay-off rests directly with its marginal product (Mankiw, 2015). Therefore, any action that can result in higher MPL is related to increase in wages (Tintin, 2012).

The impact of FDI on wages can be classified into two categories: direct and indirect impacts. The direct impact on an increase in labor productivity is related to capital accumulation from FDI activities (Vijaya & Kaltani, 2007). However, FDI is considered to have an indirect impact on wages through the technology spillover effect (Tintin, 2012). The multinational corporations bring in many intangible assets, namely knowledge and organizational skills to the invested country and due to having advanced experience, new organization and production methods of local enterprises will indirectly increase their labor productivity and thus increase wages in the whole economy (De Mello & Luiz, 1997; Tintin, 2012).

# Chapter 4
# Literature review and hypothesis

In order to find what factors can determine wage, the literature reviews has given empirical evidences on the relationship between wages and other control variables, which are trade openness, foreign direct investment (FDI), labor productivity, R&D expenditure, the proportion of skilled workers to total skilled and unskilled workers, the proportion of female workers to total employment and the proportion of stated-owned enterprises to total enterprises. And this paper will use this to represent the estimation model.

## 4.1 The relationship between trade openness and wages

Firstly, due to trade openness through importing advanced technological products and encouraging capital accumulation, developing countries can constantly simulate and learn to improve their technology level in order to increase wages. Kim (2011) discovers that trade openness has a positive impact on high-income countries than low-income countries. Because they have better ability in knowledge accumulation and implement advanced technology, which can increase their labor productivity and increase their wages.

Secondly, trade openness indeed increases the demand for abundant factor (labor) in a country, which causes a positive impact on wages (Chor-ching & Javorcik, 2005). International trade can promote technological progress and raise up the demand and wages of skilled labor. Because technological progress mainly occurs in capital-intensive industries, which leads to raise up the demand of skilled labor and leads to a surplus of unskilled labor. In the case of China, Rui (2009) shows that the proportion of multinational corporation increases in export trade through outsourcing, leading to an raise in total employment, especially can promote the export of high value-added products which can increase the wages of specialized technical personnel. Furthermore, Egger and Stehrer (2003) find that as demand for unskilled workers increased, workers' wages rose significantly.



In the same way, according to the experience of many countries, it confirms that trade openness conducive to the improvement of a country's per capita income level through promoting economic growth (Ruiping, 2016). Economic growth will make industrial restructuring, which will affect the income of different industries and will affect the labor structure. Sakyi, Villaverde, and Maza (2015) use the Granger non-causality test to consider whether it has a long run relationship between trade openness and real wages. The answer suggests that the country’s initial level of income is relating to trade, and countries that are more integrating into the world economy tend to benefit more from trade.

In spite of that, other researchers argue that the relationship between trade openness and wages is negative in developing countries. According to Majid (2004), trade openness shift employment opportunities across sectors and leads to a temporary fall

in wages. While Wood (1997) finds that the developing countries have a high content of unskilled laborers, increasing the supply of labor-intensive goods has changed the commodity structure in the world market. This will reduce the price of labor-intensive goods and the wages of labor.

Although some say trade hinder the worker's wages in developing countries, the positive relationship between trade openness and wages is account for a large proportion. All in all, we have Hypothesis1: increase in trade openness will lead to an increase in wages.

### 4.2 The relationship between foreign direct investment (FDI) and wages

Some researchers argue that FDI has a negative impact on wages. Brian Aitken, Harrison, and Lipsey (1996) confirm that foreign-invested enterprises enter into domestic market can improve the market competitiveness. In order to seize more product markets, local enterprises tend to reduce production costs and thus reduce the wages of employees. B Aitken and Harrison (1999) find that foreign-invested enterprises leads to outflow of skilled workers in domestic enterprises, and the productivity of domestic enterprises decline, thereby reducing the overall level of wages. However, the positive impact of FDI on wages is the mainstream that has been confirmed by many authors as following.

Foreign-invested enterprises give higher wages in home country because they have higher labor productivity, capital intensity and advanced technology. According to the report from Development (2000), it finds that FDI enterprises pay higher wages in China because they have higher labor productivity and capital intensity than local competitors through bring new capital assets. Onaran and Stockhammer (2008) also show that FDI has a positive effect on wages. The effect of FDI puts on productivity growth, which is mainly driven by capital-intensive industries.

FDI can increase wages by influencing labor demand. Faggio (2001) concludes that higher FDI is links to higher average wages in the local labor market. One of the reasons is that the entry of foreign companies has increased the labor demand of the whole industry, moving the labor demand curve upwards. Hale and Long (2011) find skilled workers can receive higher pay because foreign-invested enterprises need high-quality employees in Chinese market. In addition, Driffield and Girma (2003) show that inward FDI raises up the wages in the invested countries through learning advanced technologies and keeping key staff. It suggests that importing advanced technology and hiring skilled labor are complemented. As a result, an increase in labor demand of skilled workers must increase their wages.

In addition, foreign investor offers higher wages because it helps minimize worker turnover and reduce monitoring costs in the invested country. Hijzen and Swaim (2008) conclude that multinational companies (MNEs) pay more wages than domestic

companies and offer better working conditions. Since foreign companies are not accustomed with the local labor market and thus, they have higher search costs than domestic companies. MNEs offer higher pay help them minimize worker turnover and reduce monitoring costs. Further, Tintin (2012) shows that FDI has a positive relationship to wages because the accumulative impact of FDI on labor income increases all the time, due to FDI needs time to fully absorb the labor force. Thus, foreign investors are willing to pay higher wages to reduce labor turnover.

All in all, we can get Hypothesis 2: increase in FDI will lead to an increase in wages.

### 4.3 The relationship between labor productivity on wages

Increase in labor productivity can increase worker's wages. Goh and Wong (2010) analyze the relationship between labor productivity and wages in Malaysia during the period of 1970 to 2005. The main finding shows that labor productivity is a long-term factor to determine wages. Kumar, Webber, and Perry (2012) find the relationship between labor productivity and wages in Australia from 1965 to 2007. It finds that a 1% increase in labor productivity led to a 0.8% increase in real wages in manufacturing sector. Due to increase labor productivity by stimulating the capital stock and advanced technology can increase the skilled workers demand and raise up their wages.

What is more, Rycx, Saks, and Tojerow (2015) say that workers are paid at their marginal productivity and the response of behavior to productivity will increase their output, which requires more investments (or intermediate inputs) and hence raises up their wages. Lee-Peng and Yap (2001) investigate the dynamics relationship of increasing labor productivity that affects real wages in Malaysia. They find the relationship between real wages and labor productivity is positive, indicates that the increase in real wages is associated to greater skill or effort by promoting productivity. Also, Wakeford (2004) uses macroeconomic level data to discover the relationship between real wages and labor productivity in South Africa. It finds that a 1% increase in productivity is relate to wages increase of about 0.58% in the long term. The union will bargain the real wages if wages are determined by an individual's contribution. That is, strong unions increase productivity by replacing labor with capital base on increasing productivity of skilled workers.

All in all, we can get Hypothesis 3: increase in labor productivity will lead to an increase in wages.

### 4.4 The relationship between R&D expenditure on wages

Trade openness and FDI openness can lead to a larger market, which in turn induce greater research and development (R&D) and technological knowledge (Donald Robbins & Gindling, 1999). Tokutsu and Saito (2006) says that a typical skill-intensive intermediate input is R&D, and the less-skilled intensive intermediate inputs are machinery and equipment. In general, if the R&D investment to GDP ratio is high, the level of science and technology and innovation will be high, and the country's (or industrial) competitiveness will be strong, and the country's (or industrial) wages will be high, and vice versa.

In addition, Donald Robbins (1996) finds that if technology change is sector-biased toward skill-intensive sectors, it can raise up the average industry wages. Advanced technology can increase productivity during R&D activities and it can raise up the demand for skilled workers and their wages levels. Faggio (2001) explores the relationship between wages and R&D in Central and Eastern Europe from 1994 to 1997. It shows that higher the R&D expenditure can lead to higher wages because labor force has higher skills level, or, they can get better technology to increase productivity. Of course, the impact of R&D on wages may vary from ownership to ownership. The results find that compare to others enterprises, the higher the level of R&D activities of foreign-invested enterprises can lead to higher wages.

What is more, J. Arbache (2001) tries to seek and prove the impact of R&D expenditure on wages in the Netherlands. It shows that an increase in R&D expenditure lead to an increase in R&D employment in the short-run, because the education system takes a long time to adapt the requirement of highly skilled workers in R&D activities. An increase in the supply of workers in the R&D activities can increase their wages.

Finally, it finds that the R&D expenditure is actually the wage expense of R&D personnel. Goolsbee (1998) observes that federal R&D spending has a crucial role in determining real wages of R&D workers in the U.S. The labor supply of R&D sector is very inelastic, so when the government subsidizes R&D, a large part of increasing expenditures is directly transfer to higher wages. The R&D spending goes directly into higher wages and enhance in the price of goods rather than the number of invention activities.

All in all, we can get Hypothesis 4: increase in R&D investment will lead to an increase in wages.

### 4.5 The relationship between skilled workers and unskilled workers on wages.

Skilled workers have higher wages relative to unskilled workers because they have a higher skilled level. Brinkman (2014) uses a spatial equilibrium model to characterize the distribution of workers between 1980 and 2010 in the USA. The estimate result implies that both demand and supply for high-skilled labor have increased over time. He finds that high-skilled workers are overrepresented and paid higher wages than less-skilled workers. Moreover, Rycx et al. (2015) estimates the impact of education on wages and finds that wages of workers increase with the level of education.

High-skilled workers are paid higher wages because of the increasing demand of the skilled worker compare to less-skilled workers. Donald Robbins and Gindling (1999) use the time series technique to find the effects of wages between different groups of workers in Costa Rica. It argues that trade openness can change the demand of skilled workers and increase the demand of skilled workers can improve their wages. Goldin and Katz (1998) also find that the demand for skilled workers follows the technological cycle. The introduced of new technologies and machinery lead to increase in the demand for skilled workers and thus raise up their wages. However, J. S. Arbache, Dickerson, and Green (2004) believe that in Brazil, taking into account education and experience, the education levels have improved after trade openness, but the average wages level has barely changed. Because of the relative demand of skilled labor grows faster than its supply.

All in all, we can get Hypothesis 5: increase the proportion of skilled workers can lead to higher wages.

### 4.6 The relationship between the proportion of female worker on wages

The proportion of female workers will affect wages because of the motherhood. Oesch, Lipps, and McDonald (2017) find that motherhood can hinder the wage level because having children increases a woman's likelihood of interrupting her career. As a result, they have less tenure and work experience compare to those who had no children. Dickens and Katz (1986) also find that employers are less willing to invest in those fewer stable workers, that cause lower wages.

The proportion of female workers will affect wages because they are risk aversion and fail to negotiate with employers. Gneezy, Niederle, and Rustichini (2003) observe that women may not be as effective as men because they are risk aversion. There may have many businesses that need to be investigated for risk, which will reduce women's chance of success in competing for new jobs, promotion, etc., resulting in lower wages than men. What is more, as mentioned in the book "Women don't ask," Babcock and Laschever (2009) say that women may indeed be victims of external. Women fail when they do negotiate to their employer, compare to men, men ask, demand, negotiate and fight for more.

The proportion of female workers will affect wages because of job nature. Macpherson and Hirsch (1995) examine the relationship between gender occupation and wages during the period of 1973 to 1993. The conclusion showed that wages are significantly lower in some industries which have higher proportion of women. Low-paid jobs will attract a high percentage of women because women face barriers to get into highly paid jobs. And over time, if workers are mainly female, both average productivity and wages are low. For instance, Feliciano (2001) finds that most of the employment in the major reformed industries comes from labor-intensive industries where workers are less educated and women account for a large proportion. And of course, wages in those industries are much lower than those capital-intensive industries.

The proportion of female workers will affect wages because of gender discrimination. Zhigang and Shunfeng (2006) and Yueh (2004) study the determinants of wages in the late 1980s in China. The studies find that in the labor force samples, while keeping other things constants, the coefficient on the female is negative with wages which means that female workers earn less compare to men. It indicates that there is wages discrimination in the labor market in China. Yueh (2004) argues that wages are largely equalized in the administered labor system. However, as the management has more and more power to make decisions on wage level, the discrimination on gender wages is increasingly. Moreover, Haworth and Reuther (1978) use multiple regression analysis to test inter-industry wage determinations in 566 manufacturing industries. Studies show that "non-discriminatory" employers will be willing to hire women at lower wages if the degree of discrimination reduces the opportunity cost of female workers. Oesch et al. (2017) believes that there are some non-economic factors can affect workers' wages, such as such as power resources, cultural beliefs and social norms, which are leaving room for gender discrimination.

All in all, we can get Hypothesis 6: increase the proportion of female workers can lead to lower wages.

### 4.7 The relationship between state-owned enterprises on wages

Hongju (2017) argues that the degree of monopoly power has a crucial effect on industry wages. They use the number of workers in the state-owned enterprises to total number of workers in the industry to represent the monopoly power. The higher monopolistic an industry is, the higher its wages will be compared with the average wage level of other industries.

According to Yuan (2017), the stated-owned enterprises can earn higher wages compare to those private sectors because the role of the government plays an important part in workers' wages. The author gives two reasons. First, state-owned enterprises have better ability to obtain advanced equipment and technology than private enterprises because the government has enough funds to support enterprises to carry out economic activities. Importantly, there are some preferential policies that are mainly inclined to state-owned enterprises. Second, due to the government's protective policies, state-owned enterprises can avoid the competition brought by foreign-owned enterprises, so as to continuously obtain monopoly profits and expand their production scale. Therefore, with the expansion of enterprise scale and the increase of profits, the average level of wages in stated-owned enterprise rises.

There is no doubt that higher monopoly power can lead to higher average wage level. The relationship between stated-owned enterprises on wages is positive as literatures above expected. In our study, this variable (the proportion of stated-owned enterprises to total enterprises) represents the market mechanism on wages. In order to examine the role of relaxation of the government policy on labor market. In the descriptive part (Chapter 2), China has implemented the market economy system, so the government regulation of the labor market is weakened as times goes by (as shown in *Figure A.0.1*). This paper assumes that the proportion of state-owned enterprises to total enterprises has a negative impact on wages, meaning that an increase in market mechanism will lead to an increase in real wages.

All in all, we can get Hypothesis 7: increase in market mechanism can lead to an increase in real wages (or increase state-owned enterprises to total enterprises can lead to a decrease in real wages)

# Chapter 5
# Estimation model

## 5.1 Estimation model

The estimation model is applied panel data with cross section fixed effect to analysis the impact of trade and FDI openness on wages. The effects are separated into the case of total industry, specifically on capital-intensive industries and on labor-intensive industries.

$$W_{it} = C_0 + \beta_1 Trade_t + \beta_2 FDI_{it} + \beta_3 Trade_t \times FDI_{it} + \beta_4 LP_{it} + \beta_5 R\&D_{it} + \beta_6 \frac{S}{(S+US)_t} + \beta_7 \frac{F}{Emp_{it}} + \beta_8 SOEs_{it} + \varepsilon_{it}$$

Where

W: Average industry wage

Trade: Trade openness

FDI: Total amount of inflow foreign direct investment

Trade × $FDI$: Interaction term of trade openness and FDI

LP: Labor productivity

R&D: R&D expenditure

$\frac{S}{(S+US)}$: Proportion of skilled workers to total skilled and unskilled workers

$\frac{F}{Emp}$: Proportion of female workers to total employment

SOEs: Proportion of state-owned enterprises to total enterprises. Representing the market mechanism and the role of relaxation of government policy on labor market.

i: Subscript indicating manufacturing sector, i=1, 2, 3, …, 27, where 15 of them are capital-intensive sectors and 12 labor-intensive sectors as shown at Appendix in *Table A.0.2*

t: Subscript indicating time period, t=2001, 2002, 2003, …, 2016

### 5.2 Hypotheses

From conceptual framework and literature review, we can form the following hypotheses:

**Hypothesis 1:** Increase in trade openness will lead to an increase in real wages.

**Hypothesis 2:** Increase in FDI will lead to an increase in real wages.

**Hypothesis 3:** Increase in labor productivity will lead to an increase in real wages.

**Hypothesis 4:** Increase in R&D expenditure will lead to an increase in real wages.

**Hypothesis 5:** Increase in skilled workers to total skilled and unskilled workers will lead to an increase in real wages.

**Hypothesis 6:** Increase proportion of female worker to total employment will lead to a decrease in real wages.

**Hypothesis 7:** Increase in market mechanism will lead to an increase in real wages (or increase state-owned enterprises to total enterprises will lead to a decrease in real wages).

### 5.3 Data description

The research uses panel data to analyze the impact of trade and FDI openness on wages in the manufacturing sector in China. There are 27 subsectors (and 15 of them are capital-intensive industries and 12 of them are labor-intensive industries) and the data are annually from 2001 to 2016. From *Table 5.1*, we can see that the average level of wages, foreign direct investment (FDI), interaction term of trade openness and FDI, labor productivity, R&D expenditure and proportion of skilled workers to total skilled and unskilled workers are higher in capital-intensive industries than in labor-intensive industries. However, the average proportion level of female workers to total employment and proportion of state-owned enterprises to total enterprises are higher in labor-intensive industries than in capital-intensive industries.

*Table 5.1: Data description*

| | | Observations | Mean | Median | Maximum | Minimum | Std. Dev. |
|---|---|---|---|---|---|---|---|
| Total industries | W | 432 | 10.0951 | 10.0988 | 11.8445 | 8.7441 | 0.6321 |
| | Trade | 432 | 48.6856 | 47.3400 | 64.4800 | 37.0300 | 8.2198 |
| | FDI | 432 | 7.5863 | 7.7241 | 10.5723 | 0.4637 | 1.4451 |
| | Trade X FDI | 432 | 368.2713 | 373.4863 | 618.3084 | 22.3102 | 88.2765 |
| | LP | 432 | 64.2358 | 44.8087 | 476.2206 | 8.0638 | 62.8398 |
| | R&D | 432 | 13.4067 | 13.4502 | 16.7119 | 8.4973 | 1.5412 |
| | $\frac{S}{S+US}$ | 432 | 9.7937 | 8.2000 | 16.6000 | 6.4000 | 3.5205 |
| | $\frac{F}{Emp}$ | 432 | 41.4216 | 39.6332 | 72.2920 | 18.9067 | 12.1232 |
| | SOEs | 432 | 8.2225 | 4.9814 | 46.3087 | 0.2460 | 9.4060 |
| Capital-intensive industries | W | 240 | 10.1812 | 10.2042 | 11.1876 | 8.8967 | 0.5804 |
| | Trade | 240 | 48.6856 | 47.3400 | 64.4800 | 37.0300 | 8.2274 |
| | FDI | 240 | 8.1173 | 8.1433 | 10.5723 | 5.7302 | 1.0619 |
| | Trade X FDI | 240 | 393.9861 | 394.1275 | 618.3084 | 220.7857 | 76.3557 |
| | LP | 240 | 72.3448 | 58.0088 | 302.5012 | 19.0179 | 49.6043 |
| | R&D | 240 | 14.2648 | 14.3698 | 16.7119 | 11.5149 | 1.1802 |
| | $\frac{S}{S+US}$ | 240 | 5.3574 | 5.4093 | 5.4856 | 5.1740 | 0.1030 |
| | $\frac{F}{Emp}$ | 240 | 35.7764 | 32.0934 | 58.1736 | 18.9067 | 9.1026 |
| | SOEs | 240 | 7.7120 | 5.9265 | 27.7697 | 1.3957 | 5.6570 |
| Labor-intensive industries | W | 192 | 9.9876 | 9.9466 | 11.8445 | 8.7441 | 0.6777 |
| | Trade | 192 | 48.6856 | 47.3400 | 64.4800 | 37.0300 | 8.2317 |
| | FDI | 192 | 6.9227 | 7.1641 | 8.7218 | 0.4637 | 1.5826 |
| | Trade X FDI | 192 | 336.1279 | 345.0836 | 522.5661 | 22.3102 | 91.7594 |
| | LP | 192 | 54.0996 | 31.8924 | 476.2206 | 8.0683 | 75.1391 |
| | R&D | 192 | 12.3342 | 12.4257 | 14.7306 | 8.4973 | 1.2391 |
| | $\frac{S}{S+US}$ | 192 | 1.6194 | 1.2963 | 2.5672 | 1.1332 | 0.5156 |
| | $\frac{F}{Emp}$ | 192 | 48.4780 | 43.5879 | 72.2920 | 33.1753 | 11.7418 |
| | SOEs | 192 | 8.8608 | 3.6348 | 46.3087 | 0.2460 | 12.6041 |

# Chapter 6
# Empirical results

The estimate results are shown in *Table 6.1*. The effects are separated into the cases of total industries, capital-intensive industries and labor-intensive industries.

*Table 6.1: Fixed effect results*

| Dependent Variables | Expected Sign | (1) Total industries | (2) Capital-intensive industries | (3) Labor-intensive industries |
|---|---|---|---|---|
| Independent Variables | | | | |
| Trade | Positive | **-0.0041** | **0.0097** | **0.0129** ** |
| | | (-1.1687) | (1.1008) | (2.5592) |
| FDI | Positive | **0.0071** | **0.2336** *** | **0.1740** *** |
| | | (0.2528) | (3.1105) | (3.5984) |
| Trade X FDI | Positive | **0.0005** | **-0.0023** ** | **-0.0017** ** |
| | | (1.0838) | (-2.1294) | (-2.3903) |
| LP | Positive | **0.0009** *** | **0.0021** *** | **0.0017** *** |
| | | (4.4447) | (4.7821) | (5.7110) |
| R&D | Positive | **0.1349** *** | **0.3472** *** | **0.0934** *** |
| | | (8.8161) | (12.6813) | (4.4528) |
| $\frac{S}{S+US}$ | Positive | **0.0881** *** | **0.5104** * | **0.0918** * |
| | | (21.7035) | (1.8732) | (14.4825) |
| $\frac{F}{Emp}$ | Negative | **-0.0113** *** | **-0.0042** | **-0.0236** *** |
| | | (-3.3484) | (-0.6844) | (-4.6614) |
| SOEs | Negative | **-0.0250** *** | **-0.0075** | **-0.0209** *** |
| | | (-13.7048) | (-1.4761) | (-8.9947) |
| $R^2$ | | 0.9765 | 0.9594 | 0.9774 |
| Adjusted $R^2$ | | 0.9745 | 0.9553 | 0.9749 |
| F-statistic | | 485.8610 | 233.2047 | 392.6525 |
| Prob | | 0.0000 | 0.0000 | 0.0000 |
| Observations | | 432 | 240 | 192 |

Note: The parentheses below the estimated coefficients are **t** statistic, *** p<0.01, ** p<0.05, * p<0.1

From *Table 6.1*, the wage determinant variables in total industries show unexpected results. That is, trade openness and FDI have an insignificant relationship on wages. However, the estimated results become as expected when we separate the industries into two groups: capital-intensive industries and labor-intensive industries. That is, trade openness positively determines wages in labor-intensive industries and FDI has a positive relationship to wages in both capital-intensive and labor-intensive industries.

### 6.1 Analysis based on industries

**Total industries:** Trade openness, foreign direct investment and the interaction term of trade openness and FDI are insignificant to wages. As expected, the impacts of labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers on wages is significant and positive at 1% significance level. Furthermore, the proportion of female worker to total employment and the proportion of state-owned enterprises to total enterprises negatively determine wages as expected.

**Capital-intensive industries:** Trade openness is insignificantly positive to wages. However, FDI is positive as expected at 1% significance level. The coefficient of interaction term of trade openness and FDI is significant and negative to wages. As hypothesized, the effects of labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers on wages is significantly positive. However, both of the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises are insignificant to wages.

**Labor-intensive industries:** Trade openness and FDI are significantly positive to wages as expected. However, the interaction term of trade openness and FDI indicates unexpected result of a significant and negative relationship to wages. The impacts of labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers on wages is significant and positive as expected. On the contrary, both the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises show significant and negative impacts on wages as expected.

In summary, wage determinants highly affect wages in labor-intensive industries as seven out of eight variable has significant and expected results. As hypothesized, trade openness, FDI, labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers are significantly positive to wages in labor-intensive industries while the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises are significantly negative to wages. Regarding capital-intensive industries, only four wage determinants have expected and significant results. That is, FDI, labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers are significantly positive to wages and these are the same results as in labor-intensive industries. Lastly, in contrast to capital-intensive and labor-intensive industries, wages in total industries are not affected by both trade openness and FDI. However, similar to labor-intensive industries, the results in total industries indicate the positive effects of labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers and the negative effects of the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises on wages.

### 6.2 Analysis based on variables

**Trade openness:**

For the labor-intensive industries, export trade has played a dominant role in China's economic development since 2001. China is labor abundant country that has a comparative advantage in producing labor-intensive goods. Although in recent years, China has focused on developing the level of science and technology, making its economic development level growth rapidly. However, compared with Europe and America and others developed countries, China still produces labor-intensive goods in the international division of labor. Expanding the specialization in the production of unskilled-labor-intensive goods increases trade openness and improves wages in labor-intensive industries, therefore, this conclusion is as the same as SS theorem (J. S. Arbache et al., 2004; Stolper & Samuelson, 1941).

**FDI:**

FDI is significantly positive to wages as expected in both capital-intensive industries and labor-intensive industries. As expected, there is no doubt that foreign direct investment has been crucial to increase the wages either by learning advanced technology to raise productivity or raising the labor demand to increase wages (Development, 2000; Faggio, 2001; Onaran & Stockhammer, 2008).

**The interaction term of trade openness and FDI:**

The interaction term of trade openness and FDI is negative and significant in both capital-intensive industries wages and labor-intensive industries wages. This result may closely relate to the variable "trade openness". Trade openness has a downward trend as previously discussed (Chapter 2.2.2), therefore, the variable of trade openness is insignificant on wages, affecting the relationship between the interaction term and wages.



**Labor productivity:**

Consistent with the hypothesis, in all three equations, labor productivity has a positive relationship on wages as many studies conclude (Goh & Wong, 2010; Rycx et al., 2015). As labor is the main input production factor, there is no doubt that the improvement in workers' labor productivity is the key factor to raise their wages. With increased labor productivity, workers can produce more and create more value added in both capital-intensive industries and labor-intensive industries.

**R&D expenditure:**

In all three equations, R&D expenditure shows a positive and significant impact on wages as shown in the literature reviews (J. Arbache, 2001; Faggio, 2001). R&D reflects the development level of national science and technology. The development of R&D benefits the role of scientific and technological ability and is conducive to the application and promotion of the latest scientific and technological achievements at

home and abroad market. Therefore, R&D is able to improve the economic efficiency of enterprises and raise the overall wages.

Under the situation of China, the capital-intensive industries have obvious scale effect with high coefficient of 0.3472. Increase in the R&D expenditure can improve the mechanization and automation of capital-intensive industries and accordingly, can benefit wages of the skilled workers. Additionally, although the labor-intensive industries can only participate in the processing position with low technology content, the increased R&D expenditure can upgrade the technological content and thus, increase the labor productivity of unskilled labor and wages as well.

**The proportion of skilled workers to total skilled and unskilled workers**

In all three equations, the proportion of skilled workers to total skilled and unskilled workers have shown a significantly positive relationship on wages. Workers who have higher skill level or education level are more productive than unskilled workers, therefore, skilled worker can earn higher wages. Moreover, these variables affect capital-intensive industries more than labor-intensive industries as the coefficient in capital-intensive industries (0.5104) is higher than that of labor-intensive industries (0.0918).

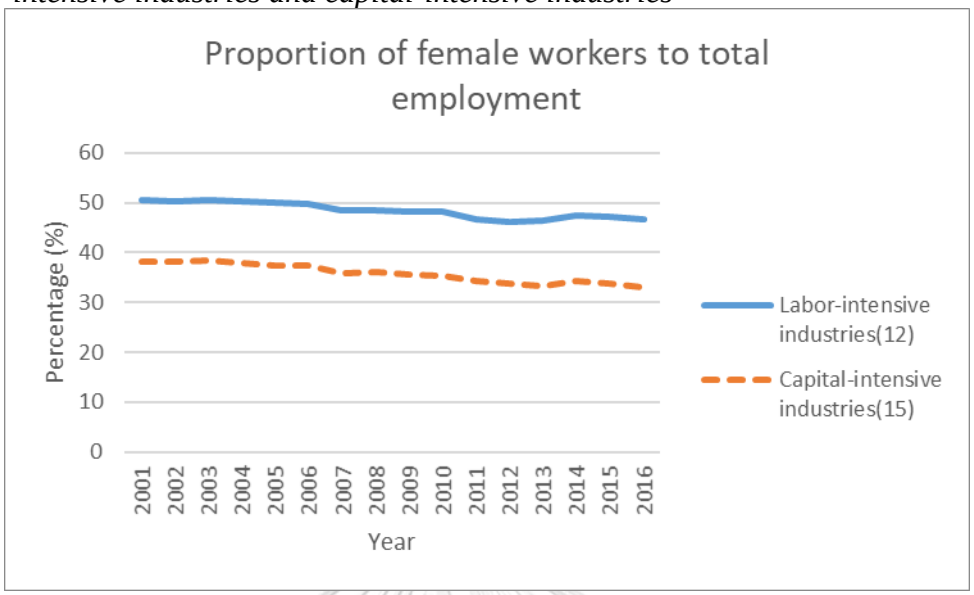
**Proportion of female worker to total employment:**

The proportion of female worker to total employment has a negative impact on wages in both total and labor-intensive industries. According to *Figure 6.1*, the proportion of women workers in labor-intensive industries is higher than that of capital-intensive industries. Compared with men, women have natural obligations such as childbirth and housework that they need to take care of their family (Oesch et al., 2017). This daily work makes it difficult for women to have enough time to enrich and invest themselves. In this regard, companies who pursue profit maximization are naturally reluctant to accept female workers (Dickens & Katz, 1986).



Under the conditions of Chinese market, some relevant laws and policies stipulate that the company should pay the maternity expenses of female employees and the wages during maternity leave. In order to maximize profit and consider the cost of employment, employers are more inclined to hire and promote men and some companies explicitly present not to hire women or suggest female workers not to be pregnant during their employment. Therefore, according to the principle of supply and demand, increase in female labor supply leads to a decline in their wages.

*Figure 6.1: Comparisons of the proportion of female workers to total employment in labor-intensive industries and capital-intensive industries*




Source: China labor statistical yearbook

**Proportion of State-owned enterprises to total enterprises**

The proportion of state-owned enterprises to total enterprises has negative relationship with wages in total industries and labor-intensive industries. This result reflects that the manufacturing sector is less monopolized and that there is an increasing role of market mechanism in China. Therefore, wages in manufacturing sector is more tended to be market-determined rather than government-determined. In other words, the higher market openness can lead to higher wages to manufacturing wages.



With respect to the main purpose of our study, trade openness is significantly positive to wages only in labor-intensive industries whereas the positive effect FDI on wages is significant in both capital-intensive industries and labor-intensive industries. Regarding other wage determinant variables, labor productivity, R&D expenditure, the proportion of skilled workers to total skilled and unskilled workers are significantly positive to wages on all three equations as expected. However, the proportion of female worker to total employment and the proportion of state-owned enterprises to total enterprises are significantly negative to wages as expected only in total industries and labor-intensive industries.

# Chapter 7
# Conclusions and policy implications

## 7.1 Conclusions

China has succeeded in both trade openness and FDI while the gains from trade and FDI openness indeed benefit workers in terms of increasing wages. Regarding the results, first, we can conclude that by comparing the determinants of different kinds of industries, the impact of trade openness on wages is only significant and positive in labor-intensive industries while the impact of FDI on wages is significantly positive in both capital-intensive industries and labor-intensive industries. Second, in the case of total industries, trade openness and FDI are insignificant to wages. Labor productivity, research and development (R&D) expenditure, the proportion of skilled workers to total skilled and unskilled worker are significantly positive to wages whereas the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises are significantly negative to wages. Third, for capital-intensive industries, the impact of trade openness on wages is insignificantly while the impact of FDI is significantly positive on wages. Moreover, labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers are significantly positive to wages. However, the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises are insignificantly to wages. Finally, for labor-intensive industries, the impact of trade openness and FDI are both significantly positive to wages. Labor productivity, R&D expenditure and the proportion of skilled workers to total skilled and unskilled workers are also significantly positive to wages. In contrast, the proportion of female workers to total employment and the proportion of state-owned enterprises to total enterprises are significantly negative to wages.

### 7.2 Policy implications

In order to improve people's quality of life and promote the country's economic development, there are several suggestions below regarding the impact of trade openness and foreign direct investment on wages in China's manufacturing sector.

(1) China should trade with other countries more actively and reduce market access barriers for foreign enterprises. Thus, China can deepen opening-up to the world and promote steady economic development.
(2) To improve the business environment for foreign investors to invest in China, the government should establish clear laws and regulations to protect their interests, and strengthen cooperation between foreign investors and local entrepreneurs.
(3) Business owners or employers should learn to how to stimulate people's enthusiasm at work. In order to improve worker's labor productivity, they can establish an employee incentive system and let employee participate more at work.
(4) The government and firms in manufacturing sectors should improve the level of science and technology in order to increase the value added of the production goods. Manufacturing sectors should promote the level of technology and develop labor productivity vigorously and realize the transformation of the industry from labor-intensive to capital-intensive.
(5) The government or enterprises should increase the investment in education and scientific research in order to train more innovative technical personnel and increase skill level of their workers
(6) Women (or unskilled workers) should learn to negotiate to their employer so that their bargaining skills enable them to set and achieve high goals and high expectations as well as men do (Babcock & Laschever, 2009). Women should learn to improve their ability to work and not focus too much on their families
(7) As the market economy becomes more open, the government should improve relevant laws to maintain the healthy development of the labor market and to create a substantially stable market environment for enterprises to improve their wages.



### 7.3 Recommendations for further study

(1) This study only finds the determinants of wages within the manufacturing industry, however, different regions, urban or rural areas, provinces or gender may have different influential factors that determine wages. To comprehensively analyze this issue, the further studies may conduct research from different dimensions in order to understand better the factors that can determine wages.

(2) Due to limitations in data measurement, this study cannot directly find the number of skilled workers in each sector. The results of wage determination may improve by including this kind of data.

(3) In the situation of China, government policy has certain impact on both trade and FDI as well as to wages. It may have an econometric problem among those variables. Because we are not sure whether the implementation of government policies leads to wage increases or the inflow of foreign direct investment (FDI)

leads to wages growth This study does not explore the government policy mechanism on wages. This may leave room for further discussion.

# APPENDIX

## 1. Explanations

Classification criteria for the three major industries according to Industrial classification for national economic activities in China as shown in *Table A.0.1*.

*Table A.0.1: . Classification criteria for the three major industries*

| | |
|---|---|
| Primary Industry | Agriculture; Forestry; Animal husbandry and fishery. |
| Secondary Industry | Mining; Manufacturing; Production and supply of electricity; Gas and water; Construction. |
| Tertiary Industry | Transport; Storage and post; Information transmission; Computer services and software; Wholesale and catering services; Financial intermediation; Real estate; Leasing and business services; Scientific research, Technical service and geologic prospecting; Management of water conservancy, Environment and public facilities; Services to households and other services; Education; Health, Social security and social welfare; Culture, Sports and entertainment; Public management and social organizations. |

**2. Explanations**

$p(z)$ : Price of good *z* in Country H

$p^*(z)$: Price of good *z* in Country F

$a$ (z): Labor input coefficient of good *z* in Country H

$a^*$ (z): Labor input coefficient of good *z* in Country F

$w$ : Wage rate in Country H

$w^*$ : Wage rate in Country F

A(z): Relative labor productivity of good *z* in Country H to Country F

z: An arbitrary good

$\frac{w}{w^*}$: Relative wage rate of Country H to Country F

$\widehat{\text{Px}}$: Rate of change of the price of good X

$\widehat{\text{Py}}$ : Rate of change of the price of good Y

$\theta_{ij}$ : Proportion of the returns on the use of the i-th input to the value of production of good j

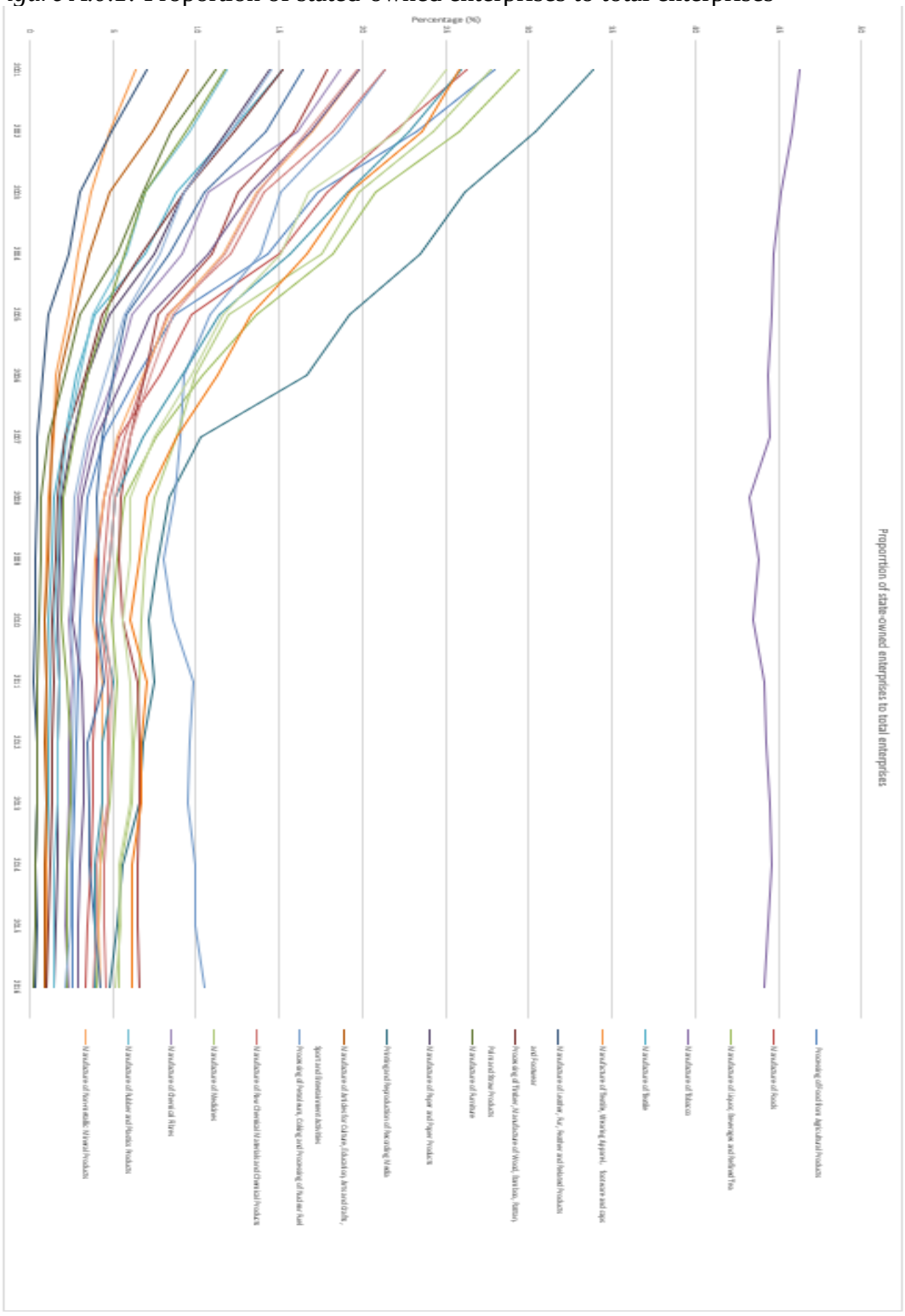
$\widehat{w}$: Rate of chang of the wage rate

$\hat{r}$: Rate of change of the rental rate

$\frac{\text{Px}}{\text{Py}}$ : Relative price of good X to good Y

**3. Trend of proportion of stated-owned enterprises to total enterprises in 27 sectors**

*Figure A.0.1:* Proportion of stated-owned enterprises to total enterprises



**4. Division of Labor-intensive industries and capital-intensive industries**

According to International Standard Industrial Classification of All Economic Activities (ISIC3), Rui (2009) classifies industrial sectors by technical level, as shown in *Table A.0.2*, and the industrial sector is separated into high-tech industry (HT), middle high-tech industry (MHT), middle low-tech industry (MLT) and low-tech industry (LT). In this paper, I have combined HT, MHT and MLT to capital-intensive industry and LT to labor-intensive industry. The classification result is the same as the study of Hongju (2017).

*Table A.0.2: Classification based on ISIC3 by technological level*

| **High-Tech industry (HT)** | **Middle high-tech industry (MHT)** | **Middle low-tech industry (MLT)** | **low-tech industry (LT)** | |
|---|---|---|---|---|
| Manufacture of medicines | Manufacture of raw chemical materials and chemical products | Processing of petroleum, coking and processing of nuclear fuel | Processing of food from agricultural products | Manufacture of leather, fur, Feather and related products |
| Manufacture of special purpose machinery | Manufacture of chemical fibers | Manufacture of rubber and plastics products | Manufacture of foods | Manufacture of wood, bamboo, rattan, palm and straw products |
| Manufacture of computers, communication equipment and other electronic equipment | V: Manufacture of general-purpose machinery | Manufacture of non-metallic mineral products | Manufacture of liquor, beverages and refined tea | Manufacture of furniture |
| Manufacture of measuring instruments and machinery for cultural activity and office work | Manufacture of transport equipment | Smelting and pressing of ferrous metals | Manufacture of tobacco | Manufacture of paper and paper products |
| | Manufacture of electrical machinery and apparatus | Smelting and pressing of non-ferrous metals | Manufacture of textile | Printing and reproduction of recording media |
| | | Manufacture of metal products; | Manufacture of textile, wearing apparel, footwear and caps | Manufacture of articles for culture, education, arts and crafts, sport and entertainment activities |

This paper has classified 27 industries sub-sector in two groups, labor-intensive industries and capital-intensive industries, as shown in *Table A.0.3*.

*Table A.0.3: Division of labor-intensive industries and capital-intensive industries in this paper*

| **Labor-intensive industries:** | **Capital-intensive industries:** |
|---|---|
| A: Processing of food from agricultural products | M: Processing of petroleum, coking and processing of nuclear fuel |
| B: Manufacture of foods | N: Manufacture of raw chemical materials and chemical products |
| C: Manufacture of liquor, beverages and refined tea | O: Manufacture of medicines |
| D: Manufacture of tobacco | P: Manufacture of chemical fibers |
| E: Manufacture of textile | Q: Manufacture of rubber and plastics products |
| F: Manufacture of textile, wearing apparel, footwear and caps | R: Manufacture of non-metallic mineral products |
| G: Manufacture of leather, fur, feather and related products | S: Smelting and pressing of ferrous metals |
| H: Manufacture of wood, bamboo, rattan, Palm and straw products | T: Smelting and pressing of non-ferrous metals |
| I: Manufacture of furniture | U: Manufacture of metal products |
| J: Manufacture of paper and paper products | V: Manufacture of general-purpose machinery |
| K: Printing and reproduction of recording media | W: Manufacture of special purpose machinery |
| L: Manufacture of articles for culture, education, arts and crafts, sport and entertainment activities | X: Manufacture of transport equipment |
| | Y: Manufacture of electrical machinery and apparatus |
| | Z: Manufacture of computers, communication equipment and other electronic equipment |
| | AA: Manufacture of measuring instruments and machinery for cultural activity and office work |

***5. Variables, measurement of variables and data sources***

*Table A.0.4: Variables, measurement of variables and data sources*

| Variables | Measurement | Date source |
|---|---|---|
| W | Average real wages of *i* industries in time *t* | China labor statistical yearbook |
| Trade | Trade openness: $\frac{Imports + Exports(of\ goods\ and\ services)}{GDP}$ in time *t* | The globe economy.com |
| FDI | Total amount of inflow foreign direct investment of *i* industries in time *t* | China labor statistical yearbook |
| Trade×FDI | Interaction term of trade openness and FDI of *i* industries in time *t* | The globe economy.com; China labor statistical yearbook |
| LP | Labor productivity: $\frac{Output\ value}{Average\ empolyed\ person}$ of *i* industries in time *t* | China labor statistical yearbook |
| R&D | R&D expenditure of *i* industries in time *t* | China science and technology statistical yearbook |
| $\frac{\boldsymbol{S}}{(\boldsymbol{S}+\boldsymbol{US})}$ | Proportion of skilled worker to total skilled and unskilled workers:<br>**Note**: The proportion of skilled worker to total skilled and unskilled workers [ $\frac{\boldsymbol{S}}{(\boldsymbol{S}+\boldsymbol{US})}$ ] only represents the ratio of skilled workers in the whole manufacturing sector. For measuring the skilled level in capital-intensive industries and labor-intensive industry, this paper use output value [$\frac{Output\ value}{Total\ output\ value}$] in each sub sector to adjust the ratio of skilled workers [ $\frac{\boldsymbol{S}}{(\boldsymbol{S}+\boldsymbol{US})}$ ]. Higher the number of skilled workers can earn higher output value in each sub sector. | China science and technology statistical yearbook; China labor statistical yearbook |

| | | |
|---|---|---|
| | The formula is shown as following:<br>**Total industries**:<br>$(\frac{S}{S+US})_t$<br>**Capital-intensive industries**:<br>$(\frac{S}{S+US})_t \times (\frac{Output\ value\ of\ K}{Total\ output\ value\ of\ L+K})_t$<br>**Labor-intensive industries**:<br>$(\frac{S}{S+US})_t \times (\frac{Output\ value\ of\ L}{Total\ output\ value\ of\ L+K})_t$ | |
| $\frac{F}{Emp}$ | Proportion of female worker to total employment of *i* industries in time *t* | China science and technology statistical yearbook |
| SOEs | Proportion of state-owned enterprises to total enterprises of *i* industries in time *t* | China labor statistical yearbook |

## 6. Result of Panel date with fixed effect: Total industries

Dependent Variable: WAGE?
Method: Pooled Least Squares
Date: 06/08/19 Time: 23:06
Sample: 2001 2016
Included observations: 16
Cross-sections included: 27
Total pool (balanced) observations: 432

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 7.997017 | 0.295856 | 27.03012 | 0.0000 |
| TRADE? | -0.004124 | 0.003529 | -1.168753 | 0.2432 |
| FDI? | 0.007181 | 0.028400 | 0.252849 | 0.8005 |
| TF? | 0.000513 | 0.000473 | 1.083824 | 0.2791 |
| LP? | 0.000920 | 0.000207 | 4.444760 | 0.0000 |
| RD? | 0.134917 | 0.015303 | 8.816168 | 0.0000 |
| S? | 0.088102 | 0.004059 | 21.70359 | 0.0000 |
| FE? | -0.011330 | 0.003384 | -3.348468 | 0.0009 |
| SOE? | -0.025029 | 0.001826 | -13.70484 | 0.0000 |
| Fixed Effects (Cross) | | | | |
| A--C | -0.231964 | | | |
| B--C | 0.090467 | | | |
| C--C | -0.020377 | | | |
| D--C | 1.957417 | | | |
| E--C | -0.228263 | | | |
| F--C | 0.128863 | | | |
| G--C | 0.114593 | | | |
| H--C | -0.174111 | | | |
| I--C | 0.008548 | | | |
| J--C | -0.271998 | | | |
| K--C | 0.416336 | | | |
| L--C | 0.174345 | | | |
| M--C | 0.313585 | | | |
| N--C | -0.336757 | | | |
| O--C | 0.130796 | | | |
| P--C | -0.061881 | | | |
| Q--C | -0.217504 | | | |
| R--C | -0.415328 | | | |
| S--C | -0.283737 | | | |
| T--C | -0.222290 | | | |
| U--C | -0.268349 | | | |
| V--C | -0.297169 | | | |
| W--C | -0.176883 | | | |
| X--C | -0.162181 | | | |
| Y--C | -0.272182 | | | |
| Z--C | 0.008448 | | | |
| AA--C | 0.297576 | | | |

Effects Specification

Cross-section fixed (dummy variables)

| | | | |
|---|---|---|---|
| R-squared | 0.976531 | Mean dependent var | 10.09519 |
| Adjusted R-squared | 0.974522 | S.D. dependent var | 0.632162 |
| S.E. of regression | 0.100905 | Akaike info criterion | -1.671718 |
| Sum squared resid | 4.042218 | Schwarz criterion | -1.342100 |
| Log likelihood | 396.0911 | Hannan-Quinn criter. | -1.541586 |
| F-statistic | 485.8610 | Durbin-Watson stat | 0.507897 |
| Prob(F-statistic) | 0.000000 | | |

## Capital-intensive industries

Dependent Variable: WAGE?
Method: Pooled Least Squares
Date: 06/08/19 Time: 23:33
Sample: 2001 2016
Included observations: 16
Cross-sections included: 15
Total pool (balanced) observations: 240

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 1.090577 | 1.596231 | 0.683220 | 0.4952 |
| TRADE? | 0.009715 | 0.008824 | 1.100899 | 0.2722 |
| FDI? | 0.233604 | 0.075101 | 3.110520 | 0.0021 |
| TF? | -0.002316 | 0.001088 | -2.129494 | 0.0343 |
| LP? | 0.002181 | 0.000456 | 4.782197 | 0.0000 |
| RD? | 0.347201 | 0.027379 | 12.68132 | 0.0000 |
| S? | 0.510424 | 0.272474 | 1.873293 | 0.0624 |
| FE? | -0.004265 | 0.006231 | -0.684493 | 0.4944 |
| SOE? | -0.007586 | 0.005139 | -1.476134 | 0.1414 |
| Fixed Effects (Cross) | | | | |
| M--C | 0.643777 | | | |
| N--C | -0.396643 | | | |
| O--C | 0.192923 | | | |
| P--C | 0.431458 | | | |
| Q--C | 0.075438 | | | |
| R--C | -0.102950 | | | |
| S--C | -0.246968 | | | |
| T--C | 0.032544 | | | |
| U--C | 0.177789 | | | |
| V--C | -0.195776 | | | |
| W--C | -0.052411 | | | |
| X--C | -0.408784 | | | |
| Y--C | -0.374757 | | | |
| Z--C | -0.404927 | | | |
| AA--C | 0.629287 | | | |

Effects Specification

Cross-section fixed (dummy variables)

| | | | |
|---|---|---|---|
| R-squared | 0.959420 | Mean dependent var | 10.18122 |
| Adjusted R-squared | 0.955306 | S.D. dependent var | 0.580433 |
| S.E. of regression | 0.122709 | Akaike info criterion | -1.267080 |
| Sum squared resid | 3.267469 | Schwarz criterion | -0.933518 |
| Log likelihood | 175.0495 | Hannan-Quinn criter. | -1.132679 |
| F-statistic | 233.2047 | Durbin-Watson stat | 0.830577 |
| Prob(F-statistic) | 0.000000 | | |

## Labor-intensive industries

Dependent Variable: WAGE?
Method: Pooled Least Squares
Date: 06/09/19 Time: 00:03
Sample: 2001 2016
Included observations: 16
Cross-sections included: 12
Total pool (balanced) observations: 192

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 7.921351 | 0.429820 | 18.42948 | 0.0000 |
| TRADE? | 0.012912 | 0.005045 | 2.559253 | 0.0114 |
| FDI? | 0.174060 | 0.048370 | 3.598489 | 0.0004 |
| TF? | -0.001745 | 0.000730 | -2.390377 | 0.0179 |
| LP? | 0.001795 | 0.000314 | 5.711094 | 0.0000 |
| RD? | 0.093448 | 0.020986 | 4.452831 | 0.0000 |
| S? | 0.091844 | 0.006342 | 14.48258 | 0.0000 |
| FE? | -0.023607 | 0.005064 | -4.661462 | 0.0000 |
| SOE? | -0.020941 | 0.002328 | -8.994770 | 0.0000 |
| Fixed Effects (Cross) | | | | |
| A--C | -0.479345 | | | |
| B--C | -0.075749 | | | |
| C--C | -0.323249 | | | |
| D--C | 1.588781 | | | |
| E--C | -0.186934 | | | |
| F--C | 0.240889 | | | |
| G--C | 0.150561 | | | |
| H--C | -0.393969 | | | |
| I--C | -0.300827 | | | |
| J--C | -0.592518 | | | |
| K--C | 0.194435 | | | |
| L--C | 0.177925 | | | |

Effects Specification

Cross-section fixed (dummy variables)

| | | | |
|---|---|---|---|
| R-squared | 0.977464 | Mean dependent var | 9.987653 |
| Adjusted R-squared | 0.974975 | S.D. dependent var | 0.677706 |
| S.E. of regression | 0.107208 | Akaike info criterion | -1.529759 |
| Sum squared resid | 1.976892 | Schwarz criterion | -1.190437 |
| Log likelihood | 166.8569 | Hannan-Quinn criter. | -1.392331 |
| F-statistic | 392.6525 | Durbin-Watson stat | 0.586240 |
| Prob(F-statistic) | 0.000000 | | |

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| | |
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