STRUCTURAL CHANGE IN CHINA

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ABSTRACT

STRUCTURAL CHANGE IN CHINA

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China has sustained her high growth rate at approximately 10 percent annually during the last three decades. China is a unique case study which enables researchers to investigate the reasons behind her high growth rate. In addition to that sustaining a high growth rate over three decades, China also has maintained a relatively high share of manufacturing sector in GDP, which sets apart from the experiences of developed countries, and other developing countries which are still in transition like China. Most of the researchers associate China's high growth rate to the high saving rate of Chinese people, and thus high capital accumulation. In fact, China's high accumulation rate is not only due to high saving rate of Chinese people, but also the government's. In this thesis, we will explain the reason of Chinese high share of manufacturing output in total output with infrastructure investment of government. Since China is a developing country, China needs the infrastructure investment of the government. In this thesis, we examine the long run growth and structural change experience of the Chinese economy with and without the incorporation of government infrastructure investment by using the three sector Ramsey growth model. The contribution of this thesis into the literature is the explanation of high manufacturing share of China with infrastructure investment of government.

Keywords: China, Structural change, Infrastructure investment of government.

ÖZ

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Çin yaklaşık otuz yıldır yıllık ortalama yüzde 10 büyüme oranını sağlamıştır. Çin, araştırmacılara yüksek büyüme oranının nedeninin incelenmesi için özgün bir örnek çalışma alanı oluşturmaktadır. Çin son 30 yılda yüksek büyüme oranını sürdürmesine ek olarak, milli gelir içerisinde oldukça yüksek imalat sanayi oranını da sürdürmüştür, bu durum Çin'i gelişmiş ülkeler ve Çin gibi gelişmekte olan ülkelerin deneyimlerinden ayırmaktadır. Çoğu araştırmacı, Çin'in yüksek büyüme oranını Çin halkının yüksek tasarruf oranıyla ve böylelikle yüksek sermaye birikimiyle ilişkilendirir. Çin'in yüksek büyüme oranı sadece Çin halkının yüksek tasarruf oranına değil, aynı zamanda Çin devletinin de yüksek tasarruf oranına bağlıdır. Bu tezde, biz Çin'in toplam üretim içinde yüksek imalat sanayi üretimi oranını hükümetin altyapı yatırımıyla açıklayacağız. Çin gelişmekte olan bir ülke olduğu için, Çin, devletin altyapı yatırımına ihtiyaç duymaktadır. Biz bu tezde Çin'in uzun dönem yapısal değişimini üç sektörlü Ramsey büyüme modeline devletin alt yapı yatırımlarını dahil ederek ve etmeyerek iki şekilde göstereceğiz. Bu tezin literatüre katkısı Çin'in yüksek imalat sanayi oranını devletin yapmış olduğu altyapı yatırımıyla açıklamasıdır.

Anahtar kelimeler: Çin, Yapısal Değişim, Hükümetin Altyapı Yatırımı

To My Family

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CHAPTER 1

INTRODUCTION

China has attracted the attention of the world roughly in the last three decades with high growth rate. Formerly, China has had a command economy. With the reform process, China introduced the market economy rules. In general, countries which implemented command economy introduced market economy rules rapidly, whereas China introduced the market economy rules gradually. Formerly, China has had a closed economy, whereas now China is a member of World Trade Organization. China's trade with the world shows an increasing trend. Invest in China is profitable because of low level of rental rate of labor and capital. So, China attracts more foreign direct investment relative to developed countries. We believe that the importance of China will increase more and more in the near future in the world economy. Since China is a developing country, we intend to examine the reform process, structural change of the economy and growth dynamics of China.

Data shows that China experiences structural change in the mid-1980s. The thing which observed in the structurally transformed countries is the decrease in the share of agricultural and manufactured goods production sectors and increase in the share of services goods production sector. China experienced structural change as the decrease in the share of agricultural goods production sector, increase in the share of services goods production sector while the share of manufacturing goods production sector stays quite stable. In China, manufacturing goods production share is quite high because of the infrastructure investment of government.

To examine the growth dynamics of China, we used the three sector Ramsey growth model. In the Ramsey type growth modeling framework, there are agricultural,

manufacturing, and services sectors. All sectors use labor and capital in the production process. In addition to labor and capital, in the production of agricultural goods, land is also used. Labor and capital are mobile between the sectors and immobile between the countries. Agricultural and manufacturing sectors are open to trade whereas there is no international trade in the services sector. In the model, firms operate in a competitively environment. Households maximize their intertemporal utility with respect to their budget constraint. Also, labor and capital markets clear in the modeling framework.

Since China is a developing country, she needs infrastructure investment. In general, infrastructure investment is attributed to government. In the literature, there are articles which attribute China's high growth rate to government's infrastructure investment. By originating from the literature, we incorporated government's infrastructure investment into the three sector Ramsey growth model. In the extended model, the role of the government is the collection of taxes from manufacturing sector. Government uses tax revenues in infrastructure investment. Public capital which is used in infrastructure investment is introduced into the model as a factor of production in manufacturing goods production function. Incorporation of government necessitates the division of capital either public or private. Since infrastructure investment is a part of manufacturing goods production, public or private capital divisions are realized only in the manufacturing sector. Formerly, in the production of manufactured goods labor and capital is used. With the incorporation of public capital, manufactured goods is produced by labor, private and public capital. With the introduction of government into the model, profit occurs in the manufactured good production. By assumption, infrastructure services are used without any charge by the agents of the model. In the extended model, manufacturing profit is retained by the government as taxable profit and in return, government invests in infrastructure. In the extended model, government implements a balanced budget policy. There is no change in the role of services and agricultural sectors. In the extended model, firms again operate in a competitive environment and household solves utility maximization problem. In the factor markets, labor and private capital

markets clear. Since infrastructure investment is a public good, it is not priced in the model. So, there is no need to clearance of public capital market.

This thesis consists of six chapters. In the first chapter I introduced the importance of this subject in a general framework. In the second chapter, I examine the reform process of China. Reform process examined in two periods. In the 1978 – 1992 period, China implements relatively more individual market (micro)-based reforms. Second reform period begins in 1993 and it still continues. In the second phase of reform, China implements more macro-based reforms. Third chapter consists of literature review on structural change and the Chinese experience. In the fourth chapter, I evaluated the literature review on the role of government in the economy. In the fifth chapter, I introduce the three sector Ramsey growth model and then I introduce the extended three sector Ramsey growth model by incorporating public infrastructure investment and lastly the results of both the basic and extended model are summarized. The contribution of this thesis into the literature is the introduction of infrastructure investment into the three sector Ramsey growth model. Sixth chapter concludes this thesis.

CHAPTER 2

CHINA & REFORM PROCESS AS A TRANSITIONAL ECONOMY

China has attracted the attention of researchers since she is one of the most populous countries in the world, with a big landmass, a high growth rate, a high saving rate and unique institutions. There are two misperceptions concerning China's economic success; one of them is that China owes her high growth rate to foreign direct investment and exports, the other misperception is related to the success of agricultural reform in the early 1980s. Foreign direct investment (FDI) in China has accelerated only after 1993. During the 1981-1990 interval, FDI was less than 1 percent of GDP. China became a member of WTO in 2001, and only after 2001 her growth rate of exports has increased. China's first reform success nevertheless occurred in the agricultural sector. Concerning these two misperceptions, FDI, export and agricultural reform contributed to growth of China but these factors are not enough to explain the growth success of China (Qian, 2002).

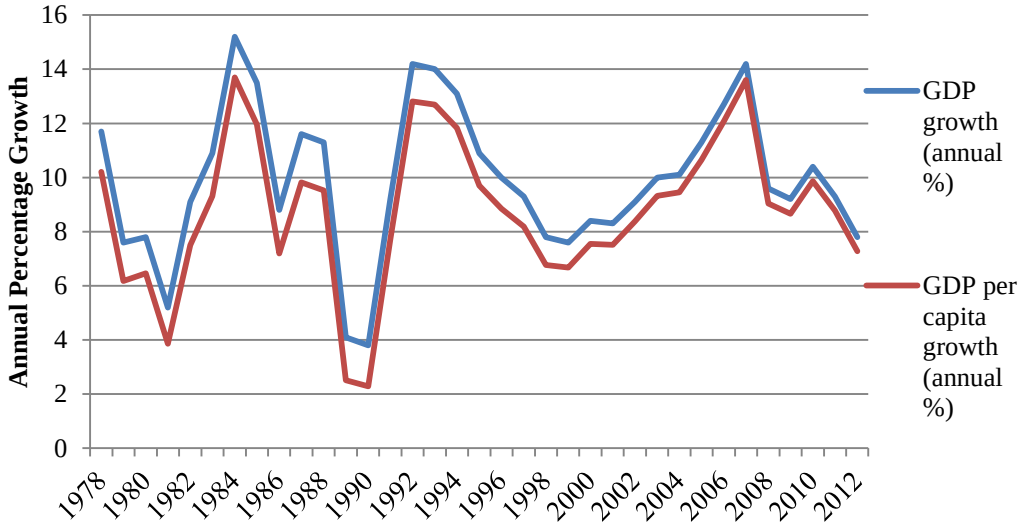

Figure 1: Growth Rate of GDP & GDP per Capita

Source: World Bank, World Development Indicators, 2013

Figure 1 shows the growth rate of GDP and GDP per capita since the first phase of reforms that started in December 1978. From 1978 to 2012, average per capita GDP growth is about 8.8 percent, average GDP growth is about 9.9 percent. During the same period, growth rate of GDP and GDP per capita were respectively 5.8 and 3.9 percent for India, 2.3 and 2 percent for Japan, 6 and 5.8 percent for South Korea. Growth rate of GDP and GDP per capita for Europe and Central Asia were 2 and 1.6 percent respectively during the same period. In comparison to India, Japan and South Korea, China's growth rate is remarkable. World average GDP growth rate is 2.9 percent and world average GDP per capita growth is 1.4 percent for the same time interval. China's growth has been called as a growth miracle since her growth rate is greater than the world average growth rate.

In 1988-1989 time periods, China experienced a political crisis and this was known as Tiananmen Interlude[1] in the history. This has led to the decrease in GDP growth in the late 1980s. Because of the global financial crisis, growth rate of GDP also decreased in 2007 and 2008.

[1] Because of the high inflation and corruption, people poured out into the streets at Tiananmen Square (Lai, 2006).

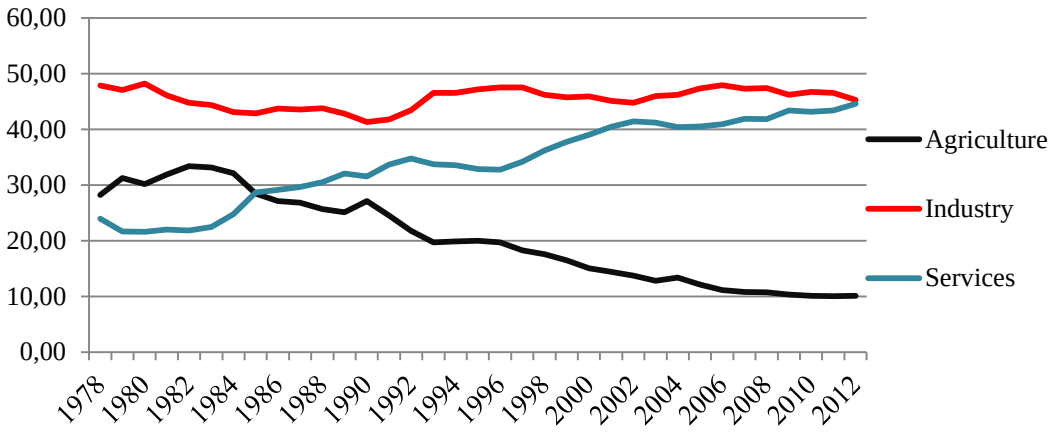

Figure 2: Sectoral Distribution of GDP

Source: World Bank, World Development Indicators, 2013

Figure 2 shows the sectoral distribution of GDP. In 1978, the share of industry sector was about 48 percent of GDP, whereas the shares of agriculture and services sectors were about 28 percent and 24 percent of GDP respectively. When we look at the whole period, we observe a steady decrease in the share of agriculture sector, an increase in the share of services sector and a quite stable industry share.

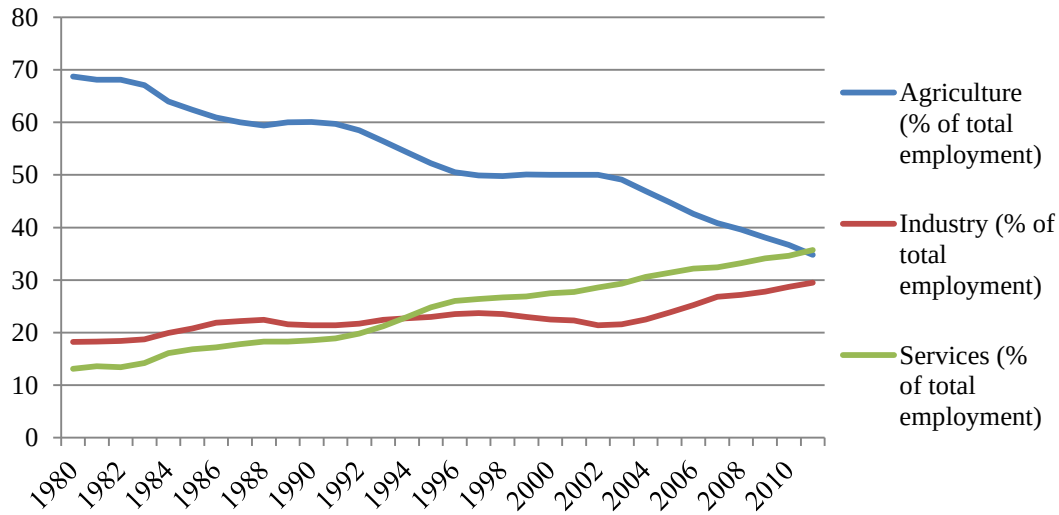

Figure 3: Employment Share

Source: World Bank, World Development Indicators, 2013

Figure 3 shows the sectoral employment share in China. In 1980 employment in agriculture sector was about 69 percent, employment in industry sector was about 18 percent and employment in services sector was about 13 percent of total employment. Employment in agriculture sector decreased, whereas employment in industry and services sectors increased during the whole period.

The People's Republic of China was established in 1949 and in 1950 Agrarian Reform Law was enforced. The main aim of Agrarian Reform Law was the redistribution of cultivated land to farmers from local governments; formerly land belonged to central government. As indicated in Naughton (2007), after 1949, government followed heavy industrialization strategy (for example heavy industry comprised approximately 80 percent of investment) and importance was given to construction of new factories. Because of the planned economic system, government had an authority to control the resources and incentive to direct the resources into investment.

China implemented the first five year plan in 1953. In a planned economy, central planning authority decides on the production amount, distribution of the production, investment and capital accumulation. Material balance system is a process which necessitates the adjustment of equalization of production and demand of each input (Chow, 2007). In China, central planning authority is the Economic Planning Commission in the State Council. Economic Planning Commission determines wages, prices and production targets. It controls all enterprises and all sources of supply of inputs. Also, it decides the laborers to work in factories or farms. Central planning authority has a difficulty in determining the price of a product, collecting information about production and demand, and setting incentive mechanism (Chow, 2007). It was hard for central planning authority to determine the price of a product because in China, there were millions of consumers and producers and determining the price of a product necessitates the consideration of the production cost and desirability of consumption by consumers simultaneously. Local governments could have been misinformed about the extent of production because farmers could declare the production amount to planning authority mistakenly. Since China had been one

of the most populous countries, it was hard for central planning authority collect information on demand. In China, corruption was widespread. The organizations or corporations which had close ties with central planning authority could have become more advantageous compared to other corporations. Therefore, it was hard for central planning authority to establish an incentive mechanism.

In the first plan, farmers were organized as collectives and farmers had to satisfy the procurement targets which were determined by the government. The period 1953-1961, was known as the Great Leap Forward movement. The main motive of this movement was to increase the growth of output immediately. As stated in Chai (2011), the main aim of the Mao who was the founder of China Communist Party was to catch up and surpass Great Britain and United States. To reach this aim, Soviet style command economic system implemented and the importance was given to heavy industry. Farmers were organized as communes[2] and approximately 99 percent of farmers participated in communes. However, food production decreased because of the bad weather and misguided policies which diverted resources away from agriculture to heavy industrialization projects. Result of the decrease in food production and implementation of heavy industrialization policy was the death of approximately 30 million people. (Lin, 2012).

In 1962-1965 time period, after the failure of Great Leap Forward movement, the government's aim was to achieve modernization in industry, agriculture, defense and science and technology fields. Also, procurement targets which were formerly high were lowered. However in 1966 – 1976, China experienced a political turmoil which was known as Cultural Revolution[3] (Chow, 2007) and the modernization attempts came to a halt.

[2] "A commune was a large scale combination of governmental and economic functions. It was used to mobilize labor for construction projects, provide social services and develop rural small-scale industries" (Naughton, 2007, p.69).

[3] In the period of Cultural Revolution, Mao wanted to eliminate the bureaucracy of the Communist Party and toppled the government. For this aim, he appealed to Chinese youth. Many people were killed and universities were closed because of this movement.

Table 1: Sectoral Share of Investment in Capital Construction: 1952-1975 (%)

	Agriculture	Light Industries	Heavy Industries	Other
1st Five Year Plan (1953-1957)	7.1	6.4	36.2	50.3
2nd Five Year Plan (1958-1962)	11.3	6.4	54.0	28.3
1963-1965	17.6	3.9	45.0	32.6
3rd Five Year Plan (1966-1970)	10.7	4.4	51.1	33.8
4th Five Year Plan (1971-1975)	9.8	5.8	49.6	34.8

Source: Lin, (2012).

Table 1 shows the sectoral share of investment in capital construction. In the first two plans, the share of heavy industry investment in capital construction was higher relative to the share of agriculture and light industry. At the end of the Great Leap Forward movement, death of approximately 30 million people necessitated the investment in agriculture. In 1963 – 1965 time frame, investment in agriculture sector increased approximately 56 percent relative to the second five year plan period. Before the reform period, the share of heavy industry investment in capital construction was approximately 50 percent in 1952 – 1975 timeframe.

Chinese economy could be examined mainly in two parts; rural and urban areas. Firms which operated in urban areas were state owned enterprises, collective enterprises, private firms and other firms. Firms which operated in rural areas were township and village enterprises[4] and private firms. State owned enterprises (SOEs) were usually used to refer the state enterprises and non – state sector refers to other type of enterprises except for SOEs (Qian, 1999).

China was a poor country in the pre-reform period. Almost two-thirds of the Chinese population was living in rural areas. Urban population had a permanent job whereas for rural population that was not the case. China was a labor surplus country. Migration from rural parts of the country to urban parts was banned. In China there

[4] Township and village enterprises (TVEs) are organizations which are running either private households or collective units. TVEs will be explained in later pages.

was no labor market and after the beginning of Cultural Revolution wages were frozen (Naughton, 1995). In the pre-reform period, the main properties of China can be summarized as privileged heavy industry sector, command economic system, poor and labor surplus country and immobility of labor.

Reforms in China started in 1978, and with the reform process China began to apply market economy rules. Reform process could be examined mainly in two parts; the first phase of reforms comprises 1978-1992 time interval and the second phase of reforms started in 1993 and still continues. The main aim of this chapter is to provide some background about China's reform process. Importance will be given to the second phase of reforms since 1992 year was chosen as the starting point of this thesis.

The motivations of the reforms can be listed as (Naughton, 2007):

1. China Communist Party[5] and the leaders wanted to try market economy and willingness of gaining support of the people,
2. Drawbacks of the planning system,
3. The belief that the market economy works better than the planned economy.
4. The Chinese people supported the reform because of the first three motivations.

2.1. The First Phase of Reforms: 1978-1992

When we look at the basic macroeconomic indicators in Table 2, during the first phase of the reforms average growth rate of GDP was 9.6 and average GDP per capita growth was 8.1 percent. In China, domestic savings were quite high and on average domestic savings were 36.3 percent of GDP during the first reform period. The saving rate is high in China due to both private and public savings. Gross fixed capital formation is used as a proxy for capital construction. During the whole period, average gross fixed capital formation was about 29 percent of GDP. Gross

[5] China Communist Party played an important role in the management of the country.

fixed capital formation generally followed the same pattern with gross domestic savings.

Table 2: Basic Macroeconomic Indicators (1978 – 1992)

Years	GDP growth(%)	GDP per capita growth(%)	Gross domestic savings (%of GDP)	Gross fixed capital formation (% of GDP)	Inflation (%)	Unemployment (%)
1978	11.7	10.2	37.3	29.5	1.9	
1979	7.6	6.2	35.5	28.4	3.6	
1980	7.8	6.5	34.8	29.1	3.8	4.9
1981	5.2	3.9	33.8	27.4	2.3	3.8
1982	9.1	7.5	35.9	28.2	-0.3	3.2
1983	10.9	9.3	35.3	28.9	1.0	2.3
1984	15.2	13.7	34.9	29.8	4.9	1.9
1985	13.5	11.9	34.3	29.6	10.2	1.8
1986	8.8	7.2	35.9	30.6	4.8	2.0
1987	11.6	9.8	37.1	31.5	5.2	2.0
1988	11.3	9.5	36.6	31.3	12.1	2.0
1989	4.1	2.5	35.8	26.0	8.5	2.6
1990	3.8	2.3	39.1	25.9	5.8	2.5
1991	9.2	7.7	39.2	27.9	6.9	2.3
1992	14.2	12.8	38.7	31.6	8.2	2.3

Source: World Bank, World Development Indicators, 2013

China had experienced an inflationary period in 1988 with the increase in supply of money. The aim of the monetary authority was to hold the inflation below 10 percent and as seen in Table 2, this target was generally realized. The reason of the high inflation in 1988 was the announcement of lifting dual track system[6]. This announcement gave rise to the expectation of inflation for households. An important reason of the inflation was the subsidization of loss – making SOEs via bank loans (Gang, 1994). Bankruptcy of SOEs would create unemployment problem at a large extent. To avoid the creation of unemployment problem, government subsidized these enterprises (Lin, 2012). In general, unemployment decreased and the reason of

[6] Dual track system was the existence of both planned and market economy system in the economy (Naughton, 2007).

the increase in the unemployment rate in 1989 and the following year was the Tiananmen Interlude.

China began to implement one child policy in 1980. The main idea of this policy was to increase GDP per capita and saving rate, reduce the unemployment of surplus worker. It was thought that capital accumulation and increase in labor productivity could be provided only by the restriction of the population growth (Grivoyannis, 2012).

In the early 1979, autonomy of the central government was decentralized. The main idea of the decentralized government was that local governments were more successful in the provision of public goods since they were more informed about the local economy relative to central government. Duties of the local governments were provision of public goods, coordination of local businesses and collecting taxes which determined by central government (Qian, 1999). During the first reform phase, the Central government had decided on the amount of output in terms of quota and it transmitted the procurement target to the local government. Households had to obey the procurement targets of the government otherwise they were sent to the labor camps. Prices were determined by the government and wages were organized according to the number of hours worked in the production process.

Before the reform period, in the agriculture sector there were some problems. These problems were listed as (Lin, 2012);

- Low level of procurement prices decreased the motivation of farmers.
- Communes consisted of approximately 5.000 households for small ones and 20.000 households for large ones. Wages were determined by the number of hours worked in the production not by the efficiency of workers. In this mechanism, there was no incentive for workers to work more.
- In general skilled labor worked in the state sector and unskilled labor worked in the agriculture sector. Agriculture sector was inefficient sector relative to state sector.

Because of the problems which were stated, initial reforms began in the agricultural sector. To overcome the drawbacks of the old system, procurement prices were increased, the size of the communes was scaled – down, household responsibility system began to be implemented and market system was introduced via dual – track system (Lin, 2012).

Initially China implemented reforms in the pilot zones as an experiment. If they proved to be successful, then reforms were generalized to the country-wide. In the reform process, importance was given to gradual[7] transformation of the economy instead of shock therapy which was applied by Former Soviet Union countries. Dual-track system consists of two tracks, one of them is plan track and the other one is market track. This system was used as a transition device from planned economy to market economy. In this system there were two-pricing mechanisms; one of them was the planned prices and the other one was the market prices. In general, market determined prices were higher than the government determined prices. Dual-track mechanism allowed excess production over and above the procurement target. The price of the output by the amount of the procurement target was determined by the government and it was sold to local government at planned prices. The excess amount of the target could be sold in the market at market determined prices (Brandt and Rawski, 2008).

Success of dual track system was depending on the market track. If growth rate of market track is higher relative to plan track, in the long run market track will survive and plan track will disappear (Gang, 1994). As indicated in Qian (1999), the advantage of dual – track system was no one became worse off when the economy transformed from the planned one into market economy. Because of this reason first reform process was known as reform without loser policy and it was the political implication of dual – track system. Economic implication of dual – track system was to enhance the efficiency. As stated in Qian (2002), in planned track there was no inefficiency and production above the procurement target implemented efficiently.

[7] As indicated in Gang (1994), gradualism was better in an under – developed country since China was a labor surplus country. If market economy grows fast, it would create employment and decrease the unemployment.

Dual – track system was more visible in raw materials and intermediate good production. Industrial (such as steel industry, coal) sector, agricultural sector and labor market could be given as an example to dual – track implementation (Naughton, 1996).

As stated in Lin (2012), if farmers had a power of control some resources, they would invest more profitable sectors. This would give rise to the rent – seeking behavior and arbitrage. To get rid of these attitudes, dual track became a single track. Dual track was an important transition device for a country like China. The first success of Chinese reform occurred in the agriculture sector via dual – track system. As growth rate of economy increased and as market track started to dominate the economy, the importance of plan decreased, and this can be seen in Table 3. As indicated in Table 3, 94.4 percent of agricultural products were priced at planned prices in 1978 whereas in 2001, only 2.7 percent of agricultural products were priced at planned prices. In other words, in 1978 most of the agricultural goods were priced at planned prices, in 2001 the share of the planned prices in agricultural products decreased and the share of the market price in agricultural products increased. This was also true for industrial goods and total retail sales. Until the mid-1980s, farmers had to obey the procurement target. After the mid-1980s, procurement targets were used only as a guide. Farmers didn't have to obey these targets strictly.

Table 3: Pricing Tracks Whether Determined by Plan, Guide or Market Prices (% of Total)

	1978	**1985**	**1991**	**1993**	**1995**	**1998**	**1999**	**2001**
Agricultural Products								
Plan price	94.4	37.0	22.2	10.4	17.0	9.1	6.7	2.7
Guide price	0.0	23.0	20.0	2.1	4.4	7.1	2.9	3.4
Market price	5.6	40.0	57.8	87.5	78.6	83.8	90.4	93.9
Industrial Goods								
Plan price	100.	64.0	44.6	13.8	15.6	9.6	9.6	9.5
Guide price	0.0	23.0	19.0	5.1	6.5	4.4	4.8	2.9
Market price	0.0	13.0	36.4	81.1	77.9	86.0	85.6	87.6

Table 3: (cont'd)

	1978	1985	1991	1993	1995	1998	1999	2001
Total Retail Sales								
Plan price	97.0	47.0	30.0	4.8	8.8	4.1	3.7	2.7
Guide price	0.0	19.0	25.0	1.4	2.4	1.2	1.5	1.3
Market price	3.0	34.0	45.0	93.8	88.8	94.7	94.8	96.0

Source: Brandt and Rawski (2008).

In China, in the planned economy period, wages were determined by work – points instead of efficiency of workers. Incentive mechanism was absent in the determination of wages. To refrain from this drawback, material rewards system was applied. Precondition of this system was to give some autonomy to managers. After the introduction of autonomy to micro agents, it was expected that resource allocation was determined in the market framework (Lin, 2012). As an example, reform in SOEs could be given. As stated in Chow (2007), reforms in SOEs began by giving some autonomy to these enterprises. Thus SOEs could keep profit after they paid taxes to the government. After a while, price of SOEs products began to be determined at the market. In the case of producing loss by SOE, government would subsidize the enterprise. The reason of the subsidization of SOEs was to avoid from unemployment problem since SOEs employed the major part of the population.

Giving autonomy to enterprises via profit retention gave rise to abuse of the autonomy. For example SOEs could show their profit at low or they could show their operation in a loss whereas it was not the case. To avoid the misuse problem, contract responsibility system was introduced to all SOEs in 1985 (Lin, 2012).

Formerly, land belonged to the collectives. Later, introduction of Agrarian Law Reform enabled the distribution of land to farmers. Under the household responsibility system land was contracted to households. In return for land, households had to fulfill the procurement targets and tax payments. The only obligation was the fulfillment of procurement targets and tax payments. After the satisfaction of these targets, households could chose to production and sales decision

(Krusekoph, 2002). As stated in Li (2012), in 1978 – 1984 timeframe, the most contributors to high growth in agriculture were household responsibility system. As time passes, the contribution of this system decreased and township and village enterprises had emerged.

Township and village enterprises (TVEs) are local government owned organizations which were run either by local government or collective units. Progress of privately owned TVEs was fast and most of the collectively owned TVEs were transformed into private ownership. TVEs had operated in almost all sectors (Brandt & Rawski, 2008). The profits of TVEs were used either re – investment or provision of public goods. TVEs were encouraged by the central government as they established a new competition to the SOEs and encouraged the formation of the free market system (Qian, 1999).

When we come to the reforms in the banking sector case, The People's Bank which was founded in 1948 was the only bank in China. In 1983, The People's Bank was turned into central bank of China. Specialized banks[8] were founded and they were given some autonomy for provision of credit in the early 1980s. The result of this autonomy was an increase in money supply and inflation (Chow, 2007). The attitude of the central government in the case of inflation was to decrease investment projects. In general as inflation decreased, output of China decreased. To increase the output, government gave incentives (Lin, 2012).

China was a rather closed economy before the reform era with an almost balanced trade[9] having same international trade with other communist states like the Soviet Union. With the reform process, foreign trade and investment increased. China

[8] Four specialized banks were the Industrial and Commercial Bank, the Agricultural Bank, the People's Construction Bank and the Bank of China. The first three specialized banks had the autonomy to provide credit to the SOEs. The last specialized bank was dealt with foreign transactions.

[9] According to world development indicators, in 1970 – 1977 interval, China's exports and imports as a percent of GDP were respectively 4 and 3.9 percent.

maintained high investment partly by foreign investment and partly by high savings of the households and private sector (Chow, 2007).

Reforms in foreign trade and investment started with the implementation of the open-door policy via Special Economic Zones (SEZs) in 1978. As indicated in Wang (2013), SEZs are geographic regions which are used to encourage exports and they have more liberal laws relative to the countrywide. Firstly, the SEZs began as an experiment. The expectation from the establishment of the SEZs was to help the economy by internalizing foreign technology, attracting FDI and increasing exports. Enterprises in these zones could make their own investment and production decisions without the intervention of the government (Grivoyannis, 2012). Reform in foreign trade began by foundation of foreign trade companies of provinces and municipalities (Lin, 2012).

First phase of reforms can be summarized as the transition to the market economy via dual-track system[10], implementation of one-child policy, reforms in SOEs, reforms in the banking sector and China's open door policy.

China adopted gradual transformation of the economy in the reform period. New policies and institutions firstly implemented as an experiment. Reforms were realized in a politically stable environment. Because of the drawbacks of planned economy, Chinese people and government supported reform policies.(Chow, 2007). First reform success occurred in agriculture sector. First phase of reforms were in fact micro – based reforms that led to the restructuring of markets. First phase of reforms prepared the ground for macro – based reforms which was the second phase of reforms.

2.2. Second Phase of Reforms: 1993 – Present

Table 4 shows the basic macroeconomic indicators of China during the second phase of reforms. Average GDP growth was 10.2 percent and average per capita GDP growth was 9.3 percent during the whole period. As it is mentioned before, in the

[10] Dual – track system was phased out in 1993.

first phase of reform process China implemented one child policy. Due to this legislation, there was no remarkable difference between GDP and GDP per capita growth. Average gross domestic savings was 45.4 percent of GDP and average gross fixed capital formation was 38.6 percent of GDP during this period.

During the second phase of reform process, the lowest GDP growth was in 1998 because of the Asian Financial Crisis. In 2008, there was a decrease in GDP growth due to the Global Financial Crisis. In general, inflation exhibits a decreasing trend. In 1998, 1999 and 2009, China in fact experienced deflation.

China was successful in controlling the unemployment and as seen in Table 4 the highest unemployment rate was 4.3 percent in 2003. In 1993 – 2007 timeframe, unemployment rates (as a percent of total labor force) was on average 3.6 percent in Republic of Korea, 4.1 percent in Japan, 2.6 percent in China and 9.3 percent in Europe and Central Asia. In comparison to Japan and Republic of Korea, unemployment rate was low in China. The reasons of this low unemployment rate were government's infrastructure investment which created employment, laid – off workers could find a job in the services sector (Chow, 2007).

Table 4: Basic Macroeconomic Indicators (1993 - 2012)

Years	GDP growth (%)	GDP per capita growth (%)	Gross domestic savings (%of GDP)	Gross fixed capital formation (%of GDP)	Inflation (%)	Unemployment (%)
1993	14	12,7	41,8	37,7	15,1	2,6
1994	13,1	11,8	43,5	35,9	20,6	2,8
1995	10,9	9,7	43,5	34,4	13,7	2,9
1996	10	8,9	42,5	33,8	6,4	3
1997	9,3	8,2	42,4	32,9	1,5	3,1
1998	7,8	6,8	41,4	33,8	-0,9	3,1
1999	7,6	6,7	39,4	34,0	-1,3	3,1

Table 4: (cont'd)

Years	GDP growth (%)	GDP per capita growth (%)	Gross domestic savings (%of GDP)	Gross fixed capital formation (%of GDP)	Inflation (%)	Unemployment (%)
2000	8,4	7,5	37,5	34,1	2,1	3,1
2001	8,3	7,5	38,4	34,4	2,1	3,6
2002	9,1	8,4	40,4	36,3	0,6	4
2003	10	9,3	43,4	39,4	2,6	4,3
2004	10,1	9,4	45,8	40,7	6,9	4,2
2005	11,3	10,6	47,6	40,1	3,9	4,2
2006	12,7	12,1	50,7	40,7	3,8	4,1
2007	14,2	13,6	50,5	39,1	7,6	4
2008	9,6	9,0	51,8	40,8	7,8	NA
2009	9,2	8,7	52,7	46,0	-0,6	NA
2010	10,4	9,9	52,0	45,7	6,7	NA
2011	9,3	8,8	50,7	45,6	7,8	NA
2012	7,8	7,3	51,6	46,8	1,8	NA

Source: World Bank, World Development Indicators (2013)

Before the evaluation of second phase of reforms, I want to show the composition of China's national gross savings as a percent of GDP. Distribution of China's national gross savings as a percent of GDP can be seen in Table 5. During 1992 – 2008 period, national gross savings of China increases in general and on average it is 41.8 percent of GDP. Average corporate savings, household savings and government savings as a percent of GDP are respectively 16.6 percent, 19.9 percent and 5.2 percent in GDP during 1992 -2008 period. Household, corporate and government savings in GDP increase in general during the whole period. In 1992, government savings was 4.4 percent of GDP while in 2008 it increased to 11 percent of GDP. According to Ma and Yi (2010), marginal propensity to save of Chinese government was 20 percent in 1990s whereas it exceeds 50 percent in 2000s. So, we can say that

high accumulation of China depends not only due to corporates and households but also government. In the fifth chapter we evaluate the role of government in the three sector Ramsey growth model framework.

Table 5: Distribution of China's National Gross Savings, by Sector (as a percent of GDP)

Years	Total	Corporate	Household	Government
1992	36.4	11.7	20.3	4.4
1993	38.0	15.7	18.2	4.1
1994	39.4	14.5	21.7	3.2
1995	38.1	16.0	19.6	2.5
1996	37.1	13.5	19.9	3.7
1997	38.4	13.0	21.4	4.0
1998	37.7	13.3	21.1	3.3
1999	37.1	14.6	19.9	2.6
2000	37.3	16.5	17.5	3.3
2001	38.2	17.4	16.6	4.2
2002	40.3	18.0	17.2	5.1
2003	43.6	18.3	18.3	7.0
2004	46.6	23.5	18.5	4.6
2005	48.2	20.4	21.5	6.4
2006	49.5	18.8	21.7	8.9
2007	51.8	18.8	22.2	10.8
2008	53.2	18.8	23.4	11.0

Source: Ma G. & Yi W.,(2010).

When we return to 2nd phase of reforms, the main elements of this reform process can be listed as (Naughton, 2007):

a. Privatization and enterprise reform
b. Fiscal policy and tax system
c. Banking and financial system
d. Membership to the World Trade Organization (WTO).

Now, I will explain these main elements in detail.

2.2.1. Privatization and Enterprise Reform

Formerly, privatization was thought as an exploitation of the resources and labor in China. For example in the 1950s, China was under the effect of nationalism and due to this reason private firms were nationalized. With the aim of creating employment, China ensured the foundation of private businesses in 1978 – 1982 time period. In 1983 – 1986 period, state had a neutral attitude towards the private firms and in this period private firms could employ maximum 5 labors and this implies that private firms were small sized enterprises. In 1987 – 1988 timeframe, private firms were established as large sized enterprises. Towards the end of the first phase of reforms, private enterprises[11] were seen as the complementary component of the economy (Lai, 2006).

Table 6: Gross Industrial Output Value and Share by Ownership (%)

Year	Total (Current Price) (billion yuan)	State-owned or state-controlling shareholding (%)	Collectively owned (%)	Individuals or private-owned (%)	Other types of ownership (%)[12]
1978	424	78	22	0	0
1980	515	76	24	0	0
1985	972	65	32	2	1
1990	2392	55	36	5	4
1991	2663	56	33	5	6
1992	3460	52	35	6	8
1993	4840	47	34	8	11
1994	7018	37	38	10	15
1995	9189	34	37	13	17
1996	10741	34	37	14	15

[11] Today, in China there are three types of private enterprises. These enterprises are individual household business, private enterprises and private economy that has stock holding.

[12] Other types of ownership include foreign and mixed ownership.

Table 6: (cont'd)

Year	Total (Current Price) (billion yuan)	State-owned or state-controlling shareholding (%)	Collectively owned (%)	Individuals or private-owned (%)	Other types of ownership (%)
1997	12067	30	36	17	17
1998	12699	26	36	16	21
1999	13607	26	33	17	24
2000	8567	47	17	6	30
2001	9545	44	14	9	36
2002	11077	41	12	12	35
2003	14227	38	7	15	41
2004	18722	35	6	17	43

Source: Lai (2006).

Table 6 shows the gross industrial output value and share by ownership as a percent. In China, non – state sectors are collectively owned enterprises, foreign owned enterprises, private firms and mixed sectors (Lai, 2006). In 1978, state owned enterprises comprised 78 percent of gross industrial output, whereas the non – state sector comprised 22 percent of gross industrial output. When we look at the 1978 – 2004 period, we observe a decrease in the share of state sector. Share of collectively owned enterprises in gross industrial output was higher in the early of 2000s, and after 2000 its share decreased. The share of the private enterprises and other types of ownership increased in 1978 – 2004 period. In 2004, 66 percent of gross industrial output was provided by non – state sectors. Briefly, in the first phase of reform state sector was dominating the private sector, whereas in the second phase of reform the importance of the private enterprises increased.

In the early 1980s, China began an experiment which ensures SOEs to retain 3 percent of profit. Expectation from this experiment was to increase in efficiency and productivity of the SOEs. Undesirable result of this policy was the decline in

government tax revenue[13]. Then, government began to implement two precautions: one of them was priority given to payment of taxes and the other one was that funding of the SOEs implemented with bank loans instead of using government financial resources. (Sun & Tong, 2003).

In China, government introduced the contracting system for SOEs due to decline in the government tax revenues. In this system director of the SOEs, had to meet the targets which determined by government i.e. targets for profits and rate of investment. This method improved the productivity of SOEs in 1980s. This system rewarded the successful SOEs; whereas there was no enforcement for failure which was the drawback of the contracting system in SOEs. (Brandt & Rawski, 2008).

As stated in Sun & Tong (2003),

> In 1994 27.6 percent of the SOEs had total debts higher than their total asset values. Another 21.5 percent of the SOEs had total debts equal to total equities. The result was that SOEs took in 70 percent to 80 percent of all bank credit in China and saddled financial institutions with as much as $200 billion in uncollectible debt. The bad debt was 24 percent of all outstanding bank loans, according to Standard & Poor's estimates. (p.187).

China began a rapid privatization process in the mid-1990s because of debt and loss production of the SOEs. Top – down privatization approach was applied in Former Soviet States and Eastern Europe, but bottom – up privatization approach was applied in China (Guo & Yao, 2005). In bottom – up privatization strategy, non – state agents aim to reach their own targets whereas in top – down privatization strategy, state plays an important role and it initiates the privatization (Marx, 2007).

In 1995, the central government decided to recover the debts of the large SOEs and put the small SOEs up for sale. Under the policy of "retain the large, release the small", government retained the largest 300 SOEs. Privatization methods could be divided into two parts: privatization with explicit changes in ownership which

[13] SOEs gave priority to payment of interest rate instead of payment taxes to the government. As stated in Sun & Tang (2003), "in Chinese accounting, interests are paid before operating income. Furthermore they now had an incentive to declare no profit or low profits." (p.187).

includes management buy – outs[14] and selling to outsiders[15] and, privatization without explicit changes in ownership which includes share issue privatization[16] and leasing, joint venture and others [17](Gan, 2008).

2.2.2. Fiscal Policy and Tax System

In the early 1980s, China's fiscal system was centralized in terms of revenue collection and fiscal transfers. All taxes and profits were collected in central government budget and then some part of revenues transferred to provinces with the aim of provision for basic social needs which approved by the central government. In 1980, fiscal system was replaced with the decentralized revenue sharing system. In decentralized revenue sharing system, local governments could retain a part of revenues which was collected by local governments and they could use the revenues in the provision of basic social needs. This system was known as fiscal contract system (Ma, 1995).

Fiscal decentralization could affect the growth in two ways. One of them is that fiscal decentralization could increase the investment in provincial level and so does economic growth. The other one is that fiscal decentralization could provide the effective resource distribution. Since local governments had a limited budget, they would prefer to invest in more productive areas. Together with the spillover effect, investment in productive sectors could affect the other sectors in a positive way. Lin and Liu (2000) have found that fiscal decentralization affected economic growth positively and rural reform, capital accumulation and development of non – state sector were the key elements of China's high economic growth rate.

[14] Management buy – outs was the most popular method which comprises 47 percent of total privatization process.

[15] Selling to outsiders comprised 22 percent of total privatization process.

[16] Share issue privatization includes 1 percent of all privatization process.

17 Joint ventures was 2 percent, leasing was 8 percent and employee holding was 10 percent of all privatization process.

In fiscal contract system, a lump sum remittance determined between central and local government from each province and these remittances would be increased at an agreed rate per annum. In return, provinces were obliged to fulfillment of responsibilities for example education, health care. Fiscal contract system enabled the self-sufficiency to local governments for the first time since they had a budget by the amount of remittance and they carried out expenditures from their budget. Central government tax revenue began to decrease since local governments could have retained almost all tax revenues. The reason of the decline in tax revenue was not only implementation of fiscal contract system but also SOEs' low level of profitability. (Brandt & Rawski, 2008).

In 1984, China levied an income tax on to SOEs instead of the profit remittance since profit remittance gave rise to the decline in government budget revenue. Income tax resisted by SOEs and in 1985 the income tax was replaced by the contract system for all SOEs. In contract system, enterprises signed multi-year contracts. (Brandt & Rawski, 2008). According to Lin (2012), central government signed a contract with the manager of SOEs and they had to satisfy the fixed contract fee to central government. If profits were above the contract fee, difference between profit and contract fee was shared between enterprises and central government.

In 1994, fiscal reform began to be recentralized. This reform resembled the Western fiscal system since enterprises began to compete with each other in the provision of equal footing, decreased the government intervention in productive sector and government began to focus more on provision of public goods. (Naughton, 2007).

With the new fiscal reform national and local tax bureaus were founded and each one was responsible for its own tax collection. Formerly, there was no clear distinction between the national and local tax collection and this gave rise to the decrease in national tax revenues. New fiscal reform aimed to refrain from this drawback (Qian, 1999).

New fiscal reform had three important elements and these were tax sharing, tax modernization and tax administration. Tax sharing enabled the assignment of taxes to

central government, local government or sharing taxes between central and local government. Formerly, there was a fiscal contract system and the new reform policy enabled the mix sharing of taxes and tax assignments. Tax modernization implied that simplification of tax structure, elimination of distortionary taxes and increased transparency. Formerly, there was complex multi - tiered system of turnover taxes which created distortions. Now, value – added tax (VAT) was replaced with the complex turnover taxes and VAT levied on all manufacture sectors at a single rate which was 17 percent. In addition to VAT, excise tax implemented at different rates in the consumption of alcohol, tobacco and luxury goods. Business tax applied to corporations which operated in financial, trade and entertainment sectors. Tax administration enabled the collection of central and shared taxes at national tax administration offices and local taxes at local tax administration offices (Brandt & Rawski, 2008).

According to Naughton (2007), Chinese fiscal policy accommodate to macroeconomic conditions and it is not aim to shape the economic conditions. In general, budget deficit of government was approximately 1 percent of GDP in 1980s. China implemented passive fiscal policy in 1979 – 1996 interval because of the decentralization policy decreased central government revenue. Due to Asian Financial Crisis and downsizing of state sector, in 1998 unemployment increased and expansionary fiscal policy implemented. In contract responsibility system below quota profits taxed at a fixed rate and above quota profits were taxed at a lower rate relative to below quota tax rate or non – taxed. In contract responsibility system, local governments had to meet revenue by predetermined level in contract to central government and they could retain the remaining part. As output increased, revenue of local governments increased and central government revenue stayed almost same. Because of these reasons central government's revenue decreased (Chai, 2011).

2.2.3. Banking and Financial System

As stated before, China emphasized the gradual transition of the economy in the reform process. Dual – track system was used in transition of the agricultural sector

and industrial sector from planned economy to market economy. Also, in financial system dual – track approach implemented. Previously, People's Bank of China was the only bank in China and its responsibilities were acceptance of deposits, coinage and extension of credits to state enterprises. In 1983 People's Bank of China was transformed to central bank. Since there was no commercial bank, central bank obliged to responsibilities of commercial banks and it wasn't operate a central bank as in modern times. In the beginning of the first phase of reforms, the Industrial and Commercial Bank, Construction Bank, Agricultural Bank and Bank of China were founded as state owned commercial bank. The first three banks had autonomy to extend credit to state enterprises. Since government played a dominant role in the financial sector, it directed the extension of credits to state enterprises (Chow, 2007). Subsidization of loss – making SOEs and increased credit expansion resulted in inflation in 1985, 1988 and 1993. As stated in Naughton (2007), employment in the four new banks were too much, unskilled labor consisted of large parts of the employment and business orientation was absent in these banks. As a non – bank financial institutions, insurance companies, trust investment companies and leasing companies were founded. The main target of the foundation of new banks and non – bank financial institutions was to increase the efficiency of these institutions, to enhance their management and increase competition (Chai, 2011). Financial sector was under the control of government. Government controlled the entry of new banks into financial system, interest rates on the savings and loans and market played a limited role because of the dominance of government in the financial system (Lin, 2012).

To decrease the pressure on four state banks new three banks were established in 1994 and these banks were also known as policy banks. These three banks were State Development Bank, the Agriculture Development Bank and the Import and Export Bank. These banks followed the economic development targets (Chow, 2007). These three banks have targets different from each other. Aim of the Agriculture Development Bank was to deal with all banking operations in rural parts of the

country. State Development Bank gives credit to large scale infrastructure projects. Import and Export Bank aims to encourage the exports.

In China, four state banks played a dominant role in banking sector. Many enterprises received loan from state banking system and the probability of repayment of loans were too low. This gave rise to the increase in non – performing loans (NPLs). Another reason of the increase in NPLs was the domination of government in financial system. In fact, the domination of government in financial system destroys the resource allocation in a negative way. For example inefficient investment projects were financed by extension of credits by the direction of government. International comparison indicates that a healthy economy could have maximum 5 percent of total lending as NPLs. But in the early 2000s, NPLs as a percent of total lending was approximately 40 percent in China. Also, NPLs of four state banks was approximately 20 – 25 percent of total loans. For the aim of decrease the negative effects of NPLs, local bank managers were appointed without the intervention of local governments, four state banks could use credits without the intervention of government and state banks financed the government projects. Asian Financial Crisis remembered to take precautions for NPLs; otherwise China could have faced a financial crisis. In the late 1990s, measures were in tendency to strengthen the financial system (Naughton, 2007).

According to Basel criteria, banks have to owned equity capital ratio to 8 percent of risk – adjusted assets. Four state banks satisfied the capital adequacy ratio. In the beginning of 1998, government tried to increase the capital adequacy ratios of four state banks and issued special bonds for this aim. In 1999, four state – run asset management companies were established. The state – run assets management companies bought the NPLs at face value from four state banks and in return state – run management companies exchanged its debt. Main aim was to enhance the balance sheet of banks (Chow, 2007).

In 1995, with the introduction of Budget Law, government borrowing from central bank was prohibited. Local governments had to implement balanced budget policy. As stated in Qian (1999), approximately 70 percent of central bank's loans were used

by state banks. In 1995, Central Bank Law enforced and central bank became more autonomous in the monetary policy without the effect of local governments on central bank and it was aimed to operate as a modern central bank. In the beginning of 1998, foreign banks began to be established formerly only in SEZs and then they generalized into nationwide. Since 1998, state banks began to operate as commercial banks.

2.2.4. Membership to the World Trade Organization (WTO)

Foreign trade was under the control of government in China. Government ensured the control on foreign trade by controlling money and goods. Formerly, there were twelve national foreign trade companies and they had monopoly power over the exports and imports. Chinese currency is renminbi (or Yuan) and it was set arbitrarily and inconvertible. People could exchange Yuan only in special cases. Foreign trade companies bought and sold domestic goods at planned prices and world commodities at world prices. If a good didn't produce in domestic economy, then it was allowed to import. Export was important for China since trade balance and surplus would be achieved via exports. Formerly, China implemented import substitution policy. Under this policy overvalued exchange rate was applied. In 1980s export oriented strategy implemented (Naughton, 2007).

In the late of 1970s SEZs was established in four cities formerly, in 1984 it expanded to other cities. Private property rights of firms which operated in SEZs were protected. Foreign firms paid less tax compared to domestic firms. When foreign firms invest in government priority projects, they exempt from land use fees for five years and then they will pay half of the land use fees (Wang, 2013).

China gave importance to gradual transformation of the economy. Export processing trade means that a foreign firm buys intermediate goods, intermediate goods become final goods by Chinese firms and ownership belongs to foreign firms. In this process, processing fees paid to Chinese firms and foreign firms didn't subject to any import tariff. It was expected that SEZs would expand the export processing trade. Firms

which operated in SEZs had a tax advantage. If they would use an imported good for the aim of export, they wouldn't pay import tax (Naughton, 2007).

As stated in Qian (1999), before 1994 there was dual exchange rate in which exporters outside the plan could sell their exchange incomes in a secondary exchange market. Until 1993 plan allocation of exchange rate decreased because of the rapid increase in market allocation of exchange rate. In 1994, dual exchange rate was unified to market allocation of exchange rate. Yuan became convertible in 1996. China implemented export oriented strategy. To attract exports, import liberalization, financial and fiscal incentives were introduced and exchange rate was devaluated. Import liberalization firstly implemented in special zones then it generalized to country wide. Firms which operated in SEZs could import intermediate goods, raw materials without subject to import tariff. As financial and fiscal incentives, rebate of VATs payments for exporters were introduced. As stated in Brandt & Rawski (2008), rebate of VATs concluded with disappointment because firms which didn't export claimed the rebate of export taxes. The central government in 1995 and 1996 eliminated rebate rates for exports. Yuan devalued gradually to attract the exporters (Chai, 2011).

Entrance of China to WTO includes the reduction in import tariffs, allowance for foreign firms to operate in China and telecommunication and finance sectors to open more foreign competition. China had to decrease tariff rates on agricultural and industrial goods and open the service sector to competition. Because of the decrease in tariff rates, it was expected that these goods became cheaper and quality of the goods increased (Chow, 2007).

Table 7 shows the exports and imports of China as a percent of GDP and average tariff rates. In the first phase of reforms, exports and imports were lower relative to the rest of the years which is showed in the table. There was high tariff rate to protect the domestic economy. China conducted balance trade most of the time. In the second phase of reforms, in general exports and imports increased. Relative to the first phase of reforms, there was a reduction in tariff rates. China became a member of WTO in 2001. After the WTO accession, China's exports increased more relative

to imports. Because of the WTO membership requirements there was a considerable reduction in tariff rates.

Table 7: Exports & Imports as a percent of GDP and Average Tariff Rates

Years	Exports as a percent of GDP (%)	Imports as a percent of GDP (%)	Simple Average Tariff (%)[18]
During the first phase of reform	12,34	12,32	43,00[19]
1993	19,65	22,33	39,90
1994	21,27	19,95	36,30
1995	20,23	18,58	NA
1996	20,05	18,00	23,60
1997	21,75	17,26	17,60
1998	20,35	16,05	17,50
1999	20,17	17,52	17,20
2000	23,33	20,92	17,00
2001	22,60	20,48	16,60
2002	25,13	22,56	NA
2003	29,56	27,36	10,66
2004	33,95	31,40	9,80
2005	37,08	31,55	9,22
2006	39,13	31,43	8,88
2007	38,41	29,61	8,62
2008	34,98	27,26	8,36
2009	26,71	22,30	8,18
2010	29,40	25,64	7,74
2011	28,54	26,05	7,93
2012	27,33	24,51	NA

Source: World Bank, World Development Indicators (2013)

[18]Tariff rate data between 1993 – 2001 was obtained from Fleisher, Hope & et al (2008) and the rest of the average tariff data was obtained from World Development Indicators database.

[19] According to Naughton (2007), the unweighted average tariff was 43 percent and the trade – weighted average tariff was 32 percent in the first reform period.

As indicated in Naughton (2007), 66 percent of China's imports are intermediate goods and 66 percent of China's exports are final goods. China's comparative advantage is in labor – intensive manufacturing sectors. Accession to WTO will bring significant benefits to China.

Accession to WTO affects China's economic growth rate, political and legal system. With the opening of service sector to competition, the share of the service sector in GDP is expected to increase. Investment in China is profitable for foreign investors because of the low probability of increase in wages and interest rate. Firstly, probability of increase in wages is low because of the existence of too much labor give rise to the stable wage. Secondly, probability of increase in interest rate is low due to the huge amount of capital. Because of these reasons, foreign investors prefer to invest in China. As stated, central government plays an important role when initiating economic priorities. As China becomes more integrated into the rest of the world, people want to more democratic governments. Also, investors want to stable political environment, otherwise they can withdraw their investments. Under these circumstances, government will not behave arbitrarily. Because of this reasons, China's political environment affects positively. With the accession to WTO, there are more foreign firms which operate in China. Because of the existence of foreign firms, China's legal system becomes more modern (Chow, 2007).

CHAPTER 3

STRUCTURAL CHANGE & THE CHINESE EXPERIENCE

3.1. Literature Survey on Structural Change

Structure has two meanings in economics. One of them is the relative importance of sectors, and the other one is the ratios of some economic variables, for example savings to GDP ratio. Change in the relative importance of sectors or the change in the ratios of economic variables accompanied by economic growth corresponds to the structural change or structural transformation. Rostow (1959, cited in Syrquin, 1988) defines structural change by the famous stage theory of economic growth[20]. Gerschenkron (1962, cited in Syrquin, 1988) observed several European countries and explained the reason of the change in the relative importance of the sectors by the backwardness of countries. In other words, developing countries turned their disadvantaged position in terms of low capital to GDP ratio into as an advantage: Countries with an initial low capital to GDP ratio, and thus high marginal return to capital tend to grow faster relative to developed countries. Hirschman (1958, cited in Syrquin, 1988) prefers to use production characteristics of the countries in explaining the relationship between growth and structural change. The main reason of this

[20] Rostow explains the structural change in five stages. Initially, there is a traditional society in the economy and most of the workforce is employed in the food production sector. The second stage is the preconditions for take – off. Preconditions are the progress in science and technology accompanied by innovation and widening of the market. The third stage is the take – off stage and in this stage, fast growth occurs in limited sectors and modern industrial techniques are used in these sectors. The fourth stage is the drive to maturity stage and in this stage production is made by using modern technology. In the age of high mass consumption stage, Rostow emphasizes three important elements. These elements are the increase in security and welfare by the public precaution, to ensure the extended private consumption and to search for extended power for the mature country. (Rostow, 1959).

approach is due to the exploitation of natural resources of a country which has large amount of raw materials (Syrquin, 1988).

Syrquin (1988) examines the growth patterns of the countries by using the change in the growth rates of GDP and GDP per capita. Syrquin indicates that the most important element which contributes to growth of the GDP for developed countries is the growth rate of total factor productivity. He defines accumulation as the usage of resources for the aim of increasing productive capacity of the economy. In an economy the measurements of accumulation are savings rate, physical capital investment both in R&D and human capital, and lastly public investment. Syrquin associates the reason of the shift of factor proportions with the domination of the rise in the whole factor productivity with respect to population growth. In Chinese economy, government has an important role and this is partly due to planning economy which is implemented in the reform era. In the fifth chapter, we will extend the three sector Ramsey growth model by introducing public investment. In our extended three sector Ramsey growth model, government will invest in infrastructure.

Syrquin (1988) evaluates the industrialization by the change in the structures of demand and trade. For example in the industrialization process, the share of consumption in GDP decreases and savings increases. Also the structure of the trade changes in the industrialization process. For example with the industrialization, the share of the manufacturing production in the exports increases. Chenery (1982, cited in Syrquin, 1988) states that, small semi industrial countries specialized in the light manufacturing sectors whereas the large ones varied exports according to economies of scale.

Naughton (2007) summarizes the sectoral sources of growth in three stages. In the first stage, primary production especially agriculture prevails in the economy and agricultural goods constitute an important part of the trade. Value added in the agricultural sector is lower and due to this reason income growth is slower. In the second stage, resources begin to be transformed from primary sector to the manufactured sector. The share of manufactured production in GDP increases. The

third stage is evaluated by both demand and supply side. On the demand side, the income elasticity of manufactured good decreases as well as the share of manufactured goods in domestic demand. Also, the share of manufactured goods in GDP decrease as well as the share of labor force in that sector. This negative effect is removed by the increase in exports. Because of the increase in exports, growth of the economy increases until the per capita income reaches 2400 – 4500$ level then it shows a decreasing trend. On the supply side, the contribution of capital decreases because of the slow growth rate of the economy and the relative decrease in the share of capital.

Syrquin (1988) states that in the beginning of the industrialization, productivity gap increases because of the growth rate of the agricultural sector is lower relative to the other sectors of the economy. This case contributes to sectoral differences in the economy. Sectoral differences represent the differences in production function as well as technological change. Productivity gaps between primary production and the other sectors of the economy reach the highest point in the middle income range. Capital accumulation decreases the surplus of labor. Together with the migration, relative wages increase in agricultural sector. After that point, intensity of capital in agricultural sector increases more relative to the other sectors. This process is known as catch – up process. Catch – up process decreases the productivity gap between agricultural and other sectors.

Syrquin (1988) also examined the change in prices in the transformation of the economy. If there would be a decrease in the food prices, demand for food increases and saving decreases. In the long run, the relative price of capital goods shows an increasing trend for developed countries. Due to the increase in the price of capital goods, capital formation decreases. The price of the services sector shows an increasing trend.

Approaches for the evaluation of structural change can be categorized into three parts: demand – side approach, supply – side approach and the other approaches. The supporters of other approaches try to explain in a different way from the supporters of demand and supply side approaches.

3.1.1. Demand – Side Approach to Evaluate the Structural Change

Supporters of this approach mostly benefits from Engel's Law, the change in the labor share and expenditures to explain the structural change. Laitner (2000), Cerina and Mureddu (2013), Echeverria (1997) and Foellmi and Zweimüller (2008) are the ones who use the demand – side approach.

Laitner (2000) examined the relationship between structural change and economic growth by using Engel's Law. In low – income countries the share of consumption goods is high in the expenditure. As stated by Engel, in the case of an increase in income, demand for consumption goods decreases and for manufacturing goods increases. Consumption goods are agricultural goods in general and in the production process of agricultural goods land is used. Manufacturing goods are produced via reproducible capital and as income increases reproducible capital increases. Because of these reasons, national income and saving rate increases. Laitner's article concludes with the fact that after the period of large share of consumption in expenditure, average propensity to save increases endogenously.

Cerina and Mureddu (2013) define the structural change as the reallocation of labor and resources from agricultural sector to the non-agricultural sector. Authors set up a model similar to North – South model[21] and introduce the iceberg trade cost. And they examine the consequences of a decrease in trade costs on the change in labor shares and expenditures for North & South. In the case of a decrease in trade costs, trade occurs between North – South and due to decrease in agricultural good prices, demand for industrial good increases.

Echevarria (1997) examines the relationship between changes in sectoral composition and growth. Echevarria uses a three-sector Solow growth model to investigate the relationship between the change in the composition of sectors and economic growth. In her three sector model, 22 percent of growth is explained by the

[21]In the North – South model, North specialize in the manufactured goods whereas South specialize in the primary goods production. In this model there are no trade barriers. While North doesn't depend on to the South in the production process, South depends on to the imported Northern heavy machinery.

change in the sectoral composition. And she states that poor countries have the lowest growth rate and middle income countries have the highest growth rate. Growth rate of rich countries is higher than poor countries and lower than middle income countries. She indicates the development process of the economies is such that initially, poor countries have high growth rates and together with the development process, growth rate decreases. In poor countries agriculture constitutes a large share of GDP whereas in rich countries, it is the services sector. In other words there is a negative relation between the share of agriculture and GDP, and a positive relation between the share of services sector and GDP. With the development process, the share of labor in agriculture decreases and in manufacturing and services increases across time and countries. Since poor countries consume more necessity goods, their share of savings is lower. With the development process poor country experiences an increase in her income. And an increase in income is reflected as an increase in the saving rate and investment. In general, investment is carried out in the manufacturing sector. The increases in investment and productivity increase the rate of economic growth. Echevarria states that the difference between the countries lies in the starting point of development process; except for this all countries are the same. Also, she states that a positive relationship between income and services as a share of real output for low income countries, and a negative relationship for rich income countries.

Foellmi and Zweimüller (2008) explain the reason of the structural change as the change in consumer demand and income. They use hierarchic preferences to explain the non – linear Engel curve. The introduction of new goods leads to a high income elasticity of new goods, in other words new goods are luxury goods. As time passes luxury goods transform into necessity goods which have low income elasticity. Because of this argument, structural change emerges. The results of the analysis of the authors are non – linear Engel curve encompasses Kaldor's stylized facts[22], initially high employment share in manufacturing sector and low employment share

[22] In the long run, capital – output and labor shares, growth rate, interest rate stay constant in an economy.

in the agricultural sector, and as time passes employment share in manufacturing sector decreases.

3.1.2. Supply – Side Approach to Evaluate the Structural Change

Supporters of this approach mostly use the change in the total factor productivity in explaining the structural change. In the literature, Reati (2014), Fagerberg (2000), Baumol (1967) and Ngai and Pissarides (2007) use the supply – side approach.

Reati (2014) support the idea that the reason of the structural change is the change in the technology. Technological change or revolutions are mainly innovation and the diffusion of innovation. To support the innovation, government needs to provide subsidy. Since the production of technology necessitates employment, wages should be adjusted according to efficiency of wage theories. To refrain from the unemployment problem because the innovation requires skilled worker, the main mission of the government is the provision of retraining programs. Also, to increase the labor mobility countrywide, government needs to increase housing opportunities countrywide, and this necessitates infrastructure investment. To satisfy the increase in growth rate of the economy as well as in employment, labor mobility is necessary for structural change.

Fagerberg (2000) examine the effect of specialization on structural change and productivity growth in manufacturing goods for thirty nine countries. He finds that countries which specialize in high technology production grow more relative to the countries which specialized in low – technology production. By using UNIDO Industrial Statistics database, he constructs productivity growth both at the industry and country level. The main conclusion of his paper is the effect of productivity growth is higher in countries rather than industries, and structural change on average does not contribute to productivity growth.

Baumol (1967) examines the unbalanced growth by classifying economic activities in two parts. One of them is the technologically progressive sector which involves innovation and capital accumulation. The other one is the stagnant sector. According

to Baumol, the source of the differences in these two sectors is the productivity of labor. In the progressive sector productivity of labor grows cumulatively, whereas in the stagnant sector labor productivity is constant. Baumol assumes that in the two sectors wages are equal to each other. The main implication is that in the stagnant sector production cost increases indefinitely whereas in the progressive sector it is constant. Because of this reason, production of the stagnant sector decreases. As time passes output ratio of the two sectors approaches to zero. In the framework of unbalanced growth model, demand for products of stagnant sector, which is inelastic, decreases. Also, if the production ratio of two sectors is held fix, there will be transfer of labor from progressive sector to the stagnant sector. If the aim is to achieve balanced growth, there would be decrease in growth relative to the growth rate of labor force.

Ngai and Pissarides (2007) examine structural change in a multi – sector modelling framework, and they agree with the idea of Baumol. Authors define structural change as the change in labor shares in at least one sector. In their multi – sector growth model there are (*m-1*) consumption good production sectors and 1 manufacturing sector. Relative employment share in *m* sectors depend on either total factor productivity or elasticity of substitution between goods. Differences in prices in both sectors are due to the different productivity growth rates. If elasticity of substitution is less than one, then there is a transfer of labor from high productivity sector to the low productivity sector. Also, authors extend the structural change model by introducing intermediate goods and several capital goods.

3.1.3. Other Approaches that Evaluate Structural Change

The other approaches that evaluate structural change cover the approaches which are not classified in demand and/or supply side explanations. Patriarca and Vona (2013), Mcmillan and Rodrik (2011), Uy, Yi and Zhang (2013), and Grossman (2013) could be listed concerning the other approaches.

Patriarca and Vona (2013) examine the relationship between structural change and income distribution. In their article, there are two sectors; existing and new sectors.

There is a negative relationship between inequality and growth, and the negative relationship depends on the relative importance of investment in innovation in the existing and new sectors. In the case of a decrease in inequality, growth increases if most of the consumers desire an innovation which gives rise to a decrease in cost of basic goods, and poor households could consume these basic goods. When a shock occurs in the economy either coming from technology or preference, demand for new goods increases, or in other words transition begins. And investment begins to accumulate in the new sector. The share of new goods production in expenditure and aggregate demand increase. Also, employment in the existing sector decreases. Employment in the existing sector produces the same amount of good as in the initial case. This means that marginal productivity of labor increased in the existing sector. Authors find a U-shaped relation between unemployment and inequality.

Mcmillan and Rodrik (2011) examine the effect of globalization on structural change and productivity growth. Transformation of factors of production from less efficient to more efficient gives rise to economic growth, even if there is no productivity growth in overall economy. This is a kind of growth – improving structural change. With the globalization which started in the 1990s, developing countries began being more integrated into the world economy. Globalization led to a decrease in tariff rates and increase in capital flows. Also, globalization contributed to technological upgrading and efficiency of production. One of the authors' finding is that if a country's exports consisted of large amounts of natural resources, productivity-improving structural change would be less. And the other finding is that countries which sustained undervalued currencies benefited most from productivity-improving structural change. Also, they found that if a country's labor market is more flexible, they benefited most from productivity-improving structural change. McMillan and Rodrik emphasize that productivity gap between agricultural and non – agricultural goods first increases and later decreases; the ratio of agricultural to non – agricultural productivity displays a U-shaped pattern with the development process of the economy. Productivity-improving structural change occurred in Asian countries, whereas Latin America and Africa experienced productivity-decreasing structural

change. The important feature of Asian style growth model encompasses both the import competing activities subsidized by the state and export oriented strategy; as an example China could be given. Latin American and African countries pursued overvalued exchange rate policy whereas Asian countries sustained undervalued currency; the result of the different exchange rate policy implementation in Latin America and Africa is that factors of production transformed from more productive to less productive. This case resulted with a decrease in productivity-improving structural change in Latin America and Africa, whereas in Asian countries such as China, factors of production transformed from less productive one to more productive and this case resulted with the increase in productivity-improving structural change.

Uy, Yi and Zhang (2013) evaluate the structural change in an open economy and as a case study they examined the structural change in Republic of Korea's economy for 1971 – 2005. The effect of international trade on structural change has three dimensions. The first effect is related with the reduction in trade costs. Reduction in trade costs affects the specialization and labor allocation in the sectors. Second effect is related with the productivity growth which has an effect on specialization and allocation of labor. Third effect is related with the income growth which resulted from the decrease in trade costs. Authors' two country three sector model implied that a country will benefit net export surplus from the comparative advantage of it has. In the case of opening the country to international trade, labor moves from the least productive sector to the one with comparative advantage. Authors stated that Republic of Korea had a comparative advantage in manufacturing sector. Decline in trade costs was reflected more in manufacturing goods than in agricultural goods. Because of the opening to international trade, growth rate of economy was no higher relative to the close economy case. From 1992 onwards, China's growth rate of export has surpassed that of Republic of Korea. With the membership to WTO, China experienced a decrease in trade costs and an increase in productivity growth in the manufacturing sector. Because of the stated two reasons, China overtook the manufacture share of Republic of Korea.

Grossman (2013) explains the source of structural change mainly in three stages. Firstly, modern sector which is industrial sector experiences endogenous technological growth and the result of technological growth is the improvement in productivity growth. Secondly, productivity growth in the modern sector spread to the traditional sector and generally it is the agricultural sector. Thirdly, Engel's Law holds, i.e. income elasticity of agricultural goods became less than one. If structural change causes congestion effects, it would decrease the sustainable economic growth. Under this condition, author proposes the manufacturing investment of government. Thus, sustainable economic growth ensures.

3.2. Structural Change in China

Between 1978 – 2012, growth rate of GDP was approximately 9.9 percent and growth rate of GDP per capita was approximately 8.8 percent in China. Composition of the economy began to change with the reform process in China. Formerly, agriculture played an important role in the Chinese economy. With the reform process, economy began to be transformed from agriculture dominant economy to an industry and service sectors dominant economy. Kuznets (1957) used the production per worker to examine the differences between agriculture and non – agricultural sectors. Production per worker is calculated by the division of the sector share to employment share in the labor force.

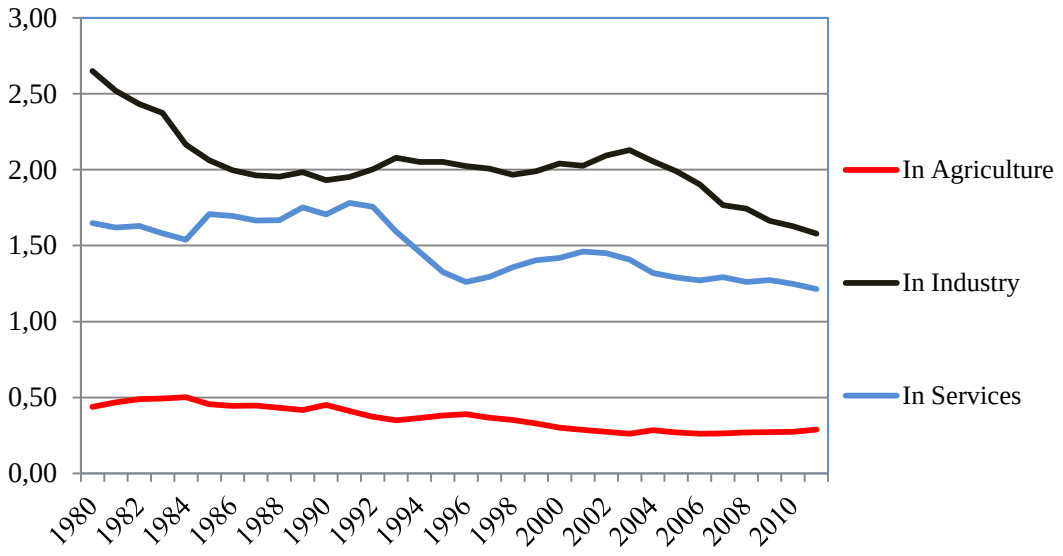

Figure 4: Product per Worker in China

Source: World Bank, World Development Indicators, 2013

Based on Kuznet's idea, Figure 4 shows the product per worker in China. In the 1980 – 2011 period, average product per worker in agriculture, industry and services sectors are respectively 0.36, 2.02 and 1.48. Minimum and maximum values of the product per worker in agricultural, industry and services sectors are respectively 0.26, 0.50; 1.58, 2.65; and 1.21, 1.78. The reason for the decrease in the product per worker is either the decrease in the share of the sectors, or the increase in the employment share of sectors. The share of labor in the agricultural sector decreases in general. The share of agriculture in GDP decreases as well as. In general, product per worker in the agricultural sector decreased because of the decrease in the agricultural GDP outweighs the decrease in the agricultural employment share. Initially, the industrial product per worker decreased, then it stayed quite stable, and finally began to decrease. The share of the industry in GDP decreased until 1990, later it increased until 2007, and then it displayed a decreasing trend. The share of labor in the services sector increases. The share of the services sector in GDP in general increases except for the 1993 – 1996 period. Product per worker is higher in the industrial sector and it is lower in the agricultural sector in China in the 1980 – 2011 period.

Cai and Wang (2010) examine the change in the employment during the transition of the Chinese economy from planned economy into the market economy. Cai and Wang point out three important elements of the change in employment. The first element was that the allocation of employment was realized by the government. The main reason of the allocation of employment by the government was due to the capital – intensive sector in the urban sector gave rise to the increase in unemployment. To protect the surplus labor government played an important role. The second element was the ban on the migration from rural parts of the country into the urban parts. This enforcement was also known as the hukou system. In the absence of this system rural labor could migrate into the urban parts of China. Since production in urban areas displayed a relatively more capital intensive nature compared to rural areas, unemployment would be higher in urban areas relative to that in the absence of hukou system. This system prevented the increase in the unemployment in the urban areas. Due to this legislation, unemployment didn't increase too much, and thus political stability was satisfied. Third property was related to the welfare policies. In the urban areas people could gain more relative to the rural parts of the country. Also, in the urban parts of the country, State Owned Enterprise (SOE) workers were able to access social security. This gave rise to the rural – urban income disparity. Transition of employment occurred firstly with the transformation of employment from agricultural sector especially from farming sector to the other parts of the agricultural sector. Cai and Wang indicate that since the reform period, the share of working age population has increased whereas the dependency ratio decreased. Because of this reason, China has been able to sustain a high saving rate.

Liu, Yao and Zhang (1999) examined the economic growth and structural change in China for the 1985 – 1994 period. Authors are in accordance with Cai and Wang regarding the role of the government. They state that conscious policy of the government was to create rapid growing centers in a short time. It was expected that developing zones would catch – up with the developed zones. Instead of the decrease in differences between the zones, inequality occurred between the eastern and

western part of the China. The main elements of the industrialization policy of the Chinese government were the Special Economic Zones (SEZs) and openness of the country. Wang (2013) indicated the effect of the SEZs on Chinese economy as the increase in investment, contribution to the creation of agglomeration economies, increase in average wages, increase in total factor productivity, and attraction of FDI into these zones. Li, Liu and Parker (2001) examined the effect of FDI and productivity spillovers in the Chinese manufacturing sector. Authors divide the FDI into two parts to examine the productivity and spillover effect. One of them is the market – oriented FDI and the other one is the export – oriented FDI. The market – oriented FDI increases the productivity via increasing competition with domestic enterprises and spillover effect whereas the export – oriented FDI does not cause the competition and it has limited effect on productivity.

Kawakami (2004) examined the structural change in China in 1978 – 1998 period by using provincial level data. Kawakami used the Solow model and tried to show whether there is an absolute and conditional convergence between Chinese provinces. He divided data in two groups; one of them comprises of the 1978 – 1990 period and the other 1990 – 1998 period. In the first sub – sample period, he found the evidence of higher growth rate in rural parts relative to urban parts. In other words, in the first sub – sample period there was both absolute and conditional convergence. Also, he found the evidence of a positive impact of human capital accumulation on economic growth not only in the first sub – sample period, but also the second one.

Bagnai and Ospina (2007) examined the structural change and transition process in a macro econometric modelling framework as a case study for China. They found the capital share in GDP as 79 percent. They simulated the model for the cases of an increase in government expenditure and a reduction in foreign direct investment. The result of the increase in government expenditure is the increase in aggregate demand as well as aggregate supply. The effect of the increase in government expenditure on aggregate supply was mainly due to the increase in investment. Thus unit wages increases and the increase in wages (this is reflected mostly in the urban wages) leads

to increase in disposable income and consumption. Also, increase in wages contributes to increase in rural – urban income disparity. Because of the increase in income disparity, migration occurs from rural parts of the country to the urban parts. Due to the migration, employment increases and unemployment decreases. The second experiment of the authors in the framework of macro econometric modelling is the decrease in foreign direct investment. Authors indicated that foreign direct investment affects production as well as growth. Also, they saw the foreign direct investment as an indicator of competitiveness. Following model the flow of foreign direct investment (De'es 2001, cited in Bagnai and Ospina, 2007) as an explanation for total factor productivity, this model shows a decrease in productivity if there was a decrease in foreign direct investment. The second effect of the decrease in foreign direct investment was the decrease in capital input. From the two experiment results, the importance of foreign direct investment as a main tool which explains the growth and competitiveness of the Chinese economy is supported.

In the rest of the third chapter, change in the factor productivity, employment and education as an indicator for human capital will be evaluated in the analysis of structural change in China.

3.2.1. The Effect of Factor Productivity on Structural Change in China

Chow (1993 and 2008, cited in Chen et al., 2011) and Chow and Lin (2002, cited in Chen et al., 2011) estimated that the growth of total factor productivity in China was zero during 1952 – 1978 period, and after 1979 the growth of total factor productivity reached 2.7 percent yearly. Perkins (1988, cited in Chen et al., 2011) estimated the average total factor productivity for China as 4.1 percent in 1953 – 1957 period, -1.4 percent in 1957 – 1965 period, 0.6 percent in 1965 – 1976 period, and 3.8 percent in 1978 – 2005 period. Also, Perkins and Rawski (2008, cited in Chen et al., 2011) stated that the total factor productivity was the highest during the 1990 – 1995 period, which was 6.7 percent, and then it began to decrease after 1995. Borensztein and Ostry (1996, cited in Chen et al., 2011) estimated the growth of total

factor productivity as –0.7 percent in 1953 – 1978 period and 3.8 percent for 1979 – 1994 period. Holz (2006, cited in Cen et al., 2011) estimated the total factor productivity of China as -0.6 percent in 1953 – 1978 period and 3.9 percent in 1978 – 2005 period. The references which stated before agree that the large part of the growth of total factor productivity comes from the manufacturing sector.

Fleisher, Hu, Li and Kim (2011) examined the worker productivity in China. In the article they divided workers into two groups; less educated and high educated workers. Authors used the Productivity and Investment Climate Survey data for the period 1998 - 2000. Engineers, technical employees, managerial employees are counted as high educated workers. Blue collar workers are counted as less educated workers. Authors used the marginal product of capital as a proxy for marginal rate of return to investment. The lowest rate of return on investment was realized in the SOEs whereas the highest one belonged to the non – SOEs. In general, less educated workers can find a job more easily relative to the higher educated workers. So, it is natural to say that less educated workers can gain more experience. Authors constructed fixed effect model and used a Mincer – type[23] equation. The result of the author's model is that the rate of return to education in the production is approximately 30 percent. Foreign invested enterprises employ more educated worker relative to the SOEs. The highest total factor productivity in China belongs to the foreign invested enterprises whereas the lowest one is belong to the SOEs.

Brandt and Rawski (2008) examined the change in the factor productivity in agricultural sector versus non – agricultural sectors, and state sector versus non – state sectors in the framework of growth accounting. In the framework of fixed land and mild capital accumulation, productivity growth of labor in the agricultural sector was –0.62 percent. Total factor productivity growth in the non – state sector was smaller relative to state sector in the initial years of the reform. With the foundation of new institutions such as TVEs total factor productivity in the non – state sector

[23] Mincer – type equation is known as the human capital earnings function. In this type of equation, as an independent variable schooling years, experience, square of earnings are chosen.

increased and in the state sector decreased. Authors also stated that non – agricultural non – state sectors of China contributed to China's high rate of economic growth.

Su and Heshmati (2011) state that capital - labor ratio is lower in the light industries relative to the heavy industries. Also they state that relatively more capital – intensive sectors have benefited more from labor productivity. Especially, in command economies fixed capital formation plays an important role and China can be an example. Authors state in their article that fixed capital formation and capital stock formation affect labor productivity in a positive way. As stated in the second chapter of this thesis, in rural parts of China agriculture prevailed and in urban areas manufacturing sector prevailed. Wages in urban areas are higher, and most SOEs facilitate their activities in urban areas. High wages attract rural labor to migrate from rural areas of the country to urban areas even though the law doesn't allow to rural households to migrate to the urban areas of the country.

Wang and Szirmai (2008) examined the relationship between productivity growth in the manufacturing sector and structural change in China between 1980 – 2002. An important feature of the article is the evaluation of structural change as the change in the production, ownership and regional structure. The authors find a negative total factor productivity growth in the pre – reform period, and a positive total factor productivity growth in the reform period. Authors measure the labor productivity growth in China and they conclude that labor productivity growth was higher in the 1992 – 2002 period relative to the 1980 – 1992 period. Also, they state that structural change in the industry sector began with the introduction of reforms. Authors support the idea of the high growth rate of China was thanks to the manufacturing sector which was also important for generation of employment and value added. It is stated in the article that TVEs play a more important role in the Chinese manufacturing sector relative to the SOEs. Foreign financed and domestic private enterprises have the highest productivity relative to the SOEs which have the lowest total factor productivity. In the 1980 – 2002 period total factor productivity growth was 9.1 percent annually. Structural change affected mostly the coastal regions of China due to the fact that coastal zones attract FDI inflow as well as concentration of high –

tech industries in the coastal zones. Authors found that the contribution of the change in the ownership structure affected the growth rate of the economy negatively.

Opper (2001) used the coefficient of compositional change to measure the structural change. To calculate this coefficient, equation (1) below is used. Coefficient of compositional change takes the value between zero and one. If this coefficient is zero, this means that there is no change in the sectors with the initial and terminal period. If it is one, this means that sector *i*'s employment share is zero either in the initial period or in the terminal period. In the case of the low coefficient of compositional change, macroeconomic policy does not ensure the reallocation of the employment. In equation (1) X_{it} shows the employment share of the sector *i* in period *t*:

$$Coefficient\ of\ Compositional\ Change = 0.5 * \sum|X_{it} - X_{it-1}| \qquad (1)$$

By using the World Development Indicators of World Bank, coefficient of compositional change is constructed. Then the formula which is stated in the equation (1) is applied. In 1980 – 2011 period coefficient of compositional change in China in agriculture, industry and services sectors were respectively 0.35, 0.24 and 0.29. These coefficients mean that agricultural employment played an important role in the transformation process of the economy. Opper (2001) constructed coefficient of compositional change for TVEs, SOEs, individual and private enterprises in China. She stated that structural change occurred because of the existence of non – state enterprises. In the reform process, non – state owned enterprises more adopted to change in the economic environment relative to the SOEs.

As we said before, structural change leads to change in the factor productivity. To observe the change in the Chinese factor productivity I obtain the factor productivity data which is obtained from United Nations Industrial Development Organization, World Productivity Database. In this database, capital stock is constructed by the assumption of six percent depreciation rate. Data is available from 1960 to 2000.

Since the importance was given to the reform process and the later years in this thesis, I used the data for the 1978 – 2000 period.

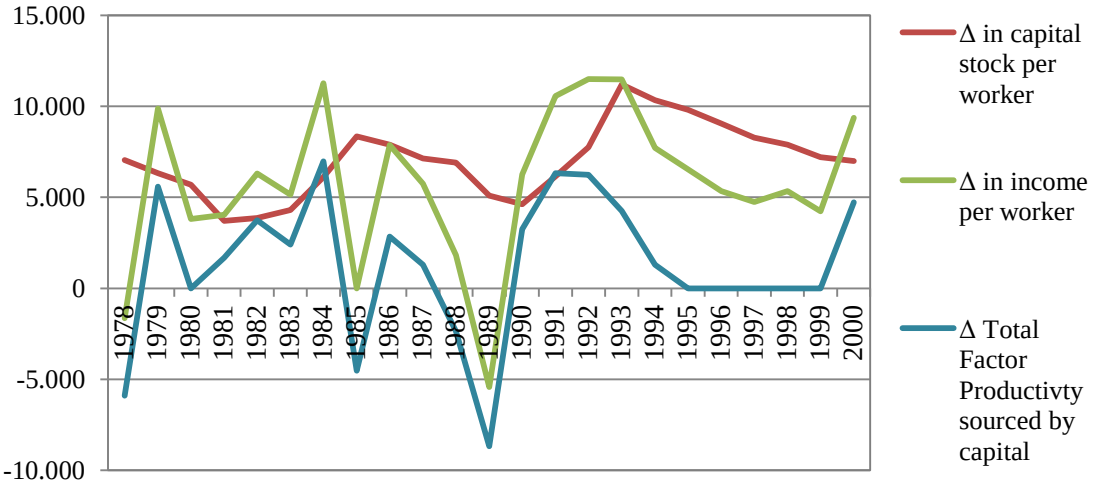

Figure 5: Change in Capital Stock per Worker and TFP in China

Source: United Nations Industrial Development Organization, World Productivity Database

In the 1978 – 2000 period, the growth rate of income per worker is approximately six percent on average. In the late of 1980s, the reason of the decrease in income per worker was the Tiananmen Interlude. Because of the Asian Financial Crisis, there was also a decrease in the growth rate of income per worker in the late of 1990s. The change in total factor productivity shows a similar pattern with the growth rate of income per worker. Growth rate of the capital stock per worker was approximately 7.03 percent in 1978 – 2000 timeframe. In the same time interval growth rate of employment was approximately 2.7 percent. Growth rate of capital stock shows an increasing trend in general because capital stock grows more relative to the employment.

3.2.2. Change in the Employment & Wages in China

Economically active population and wage data is obtained from annual yearbook of China which was published in 2003. Employment data is obtained from International Labor Organization (ILO) database. ILO database is used because of the limited coverage of employment in the annual yearbook of China. In the 1978 – 2002 time

period, there was a perpetual increase in both economically active population and employment. In general, nominal wages show an increasing trend except for 1998. The reason of the decrease in wages in 1998 could be the negative effect of Asian Financial Crisis.

Table 8: Employment & Wages in China

Years	Employment (1000 persons)	Economically Active Population (10.000 Persons)	Total Wages (100 million yuan)	Growth Rate of Real Wage
1978	401520	40682	568,9	NA
1979	410240	41592	NA	NA
1980	423610	42903	772,4	NA
1981	437250	44165	NA	NA
1982	452950	45674	NA	NA
1983	464360	46707	NA	NA
1984	481970	48433	NA	NA
1985	498730	50112	1383	NA
1986	512820	51546	NA	NA
1987	527830	53060	NA	NA
1988	543340	54630	NA	NA
1989	563290	55707	2618,5	2,8
1990	639090	65323	2951,5	5,4
1991	647990	66091	3323,9	8,7
1992	655540	66782	3939,2	11,7
1993	668080	67468	4916,2	11,0
1994	674550	68135	6656,4	-2,8
1995	680650	68855	8100	-2,9
1996	689500	69765	9080	-2,9
1997	698200	70800	9405,3	-2,7
1998	706370	72087	9296,5	6,8
1999	713940	72791	9875,5	8,6

Source: Annual Yearbook of China (2003) and ILO database

Increase in the nominal wages could be deceptive because of the inflation. To refrain from this drawback growth rate of real wages is constructed and it can be seen in Table 8. Average growth rate of real wages was approximately 4.6 percent in 1989 –

2001 period whereas in 1989 – 2002 time interval average growth rate of nominal wages was approximately 13.66 percent. The increase in the growth rate of real wages is more initially in the second phase of reforms relative to the 1989 – 2001 period. The increase in the real wages could be due to the increase in the productivity of labor.

Fan, Zhang and Robinson (2003) examined the sources of economic growth in China by using sector data at the provincial level. Their finding is that the rise in the input usage comprises approximately 41 percent of GDP growth. Labor growth comprises the 15 percent of economic growth whereas capital growth comprises 26 percent of economic growth.

3.2.3. The Effect of Human Capital on Total Factor Productivity

The increase in the total factor productivity of labor in China could be due to the increase in human capital. To evaluate the effect of human capital on productivity we need to observe the change in the education level of China because of education could be used as a proxy for accumulation of human capital. Duration of primary and secondary education in China is respectively five and six years. According to World Bank Education Statistics adult literacy rate which comprises ages 15 and above reached 95 percent of the population in 2010 whereas in 1982 it was only 66 percent of the population. Average female labor force participation rate was 44.4 percent of total labor force in 1990 – 2012 period. Public expenditure on education was 1.86 percent of GDP in 1971 – 1999 period. Expenditure on education as a percent of government expenditure was approximately 10.2 percent.

Wang and Yao (2003) evaluated the sources of economic growth of China by the introduction of human capital for 1952 – 1999 period. The authors state two assertions related with the high growth rate of China. One of them is that China's high growth rate is due to the increase in the factor accumulation. The other one relates China's high growth rate to the increase in total factor productivity. The importance of their article is the incorporation of human capital into the production function. In 1986, China started to implement the mandatory nine-year education

policy. Authors estimate the sources of economic growth under the assumption of 0.50 labor and human capital share, and 0.50 capital share. In the 1953 – 1999 period, average growth rate of physical capital stock was 7.30 percent and its contribution to GDP growth was approximately 51 percent. Authors constructed the growth rate of human capital stock by using the proxy of the number of years spent during education. Average growth rate of human capital stock is found to be 4.28 percent in 1953 – 1999 period and its contribution to GDP growth approximately as 29.8 percent. Authors also constructed the growth rate of total factor productivity as 0.02 percent for the aforementioned time interval. And contribution of total factor productivity to GDP is measured as 0.2 percent. They found that growth rate of total factor productivity is negative during 1953 – 1977 period and it became positive during 1978 – 1999 period. Despite the increase in the education expenditure, the share of the education expenditure as a percent of GDP is still smaller in China relative to other transitional economies.

Fleisher, Li and Zhao (2010) examined the relationship between economic growth and human capital, physical capital, infrastructure capital and foreign direct investment. In the article, authors indicated that regional disparity increased especially after the year 1991. China fell behind the human capital investment compared to her developed counterparts. Authors state that the direct effect of investment in human capital occurs in the production process via the increase in the skills, and the indirect effect of investment in human capital is related with the technology spillover. Also, authors examine the effect of foreign direct investment as well as infrastructure investment on economic growth. The effect of human capital on economic growth is examined by the division of education level into two: less educated workers whose education level is primary education or less, and educated workers whose education level is junior high school and above. The direct effect of education on growth is the increase in the marginal product of labor while the indirect effect is via the effect on total factor productivity. The main finding of the article is that foreign direct investment plays a larger role in the change of total factor productivity especially before the second phase of reforms, and then its effect

decreases. Also, educated workers affect total factor productivity in a positive way. The indirect effect of human capital on total factor productivity is positive and significant. Infrastructure investment including telecommunication and highway intensity affects productivity positively.

The consequence of the structural change in the Chinese manufacturing sector is the increase in the high – technology and emerging industries. Coastal parts of China benefited most from the structural change relative to the other parts of the country. Coastal parts attract more skilled workers, more FDI and more foreign trade companies relative to the other parts of the country. Two – thirds of the Chinese exports comprise of the finished goods and in the production of finished goods labor which has the comparative advantage of China is used mostly. Two – thirds of the Chinese imports are intermediate goods and the main property of the Chinese imports is based on the being capital and skill intensive goods. (Naughton, 2007).

CHAPTER 4

LITERATURE SURVEY ON INFRASTRUCTURE INVESTMENT

In the first part of this chapter I will introduce infrastructure investment of government by reviewing the existing literature. In the second part of this chapter I will summarize the existing literature on Chinese government infrastructure investment.

4.1. The Literature Survey on Infrastructure Investment of Government

In the literature, government can be included into the model in two ways; either exogenously or endogenously. In general, the infrastructure investment is attributed to the government. Gramlich (1994) defines the infrastructure investment as the construction of transportation and communication facilities and provision of water and sewer lines.

Eakin and Schwartz (1995) examined the infrastructure investment in a structural model framework. Eakin and Schwartz state that infrastructure investment leads to decrease in production costs. Eakin and Schwartz find that growth increases in the case of an increase in both the private capital per worker and government sector investment.

Aschauer (1990) evaluates the importance of infrastructure investment. Aschauer states that infrastructure investment affects the life quality of individuals. As transportation investment increases people can access more easily to health services and improvement occurs in the provision of health services. In addition to improvement in health services, there should be less accidents, access to the entertainment facilities gets easier and access to suburban jobs enhances. Aschauer

divides the capital into two components as private and public in the production function. The direct effect of government involvement in the production function is related with the productivity effect on private sector. The indirect effect of government involvement in the production function is related with the positive effect on marginal productivity of private inputs. Aschauer states that government involvement in the production function increases growth rate of the economy.

Barro (1988) examined the government expenditure in an endogenous growth model framework. Barro assumed that private capital and public services determine the production activity in a closed economy. Finance of government expenditure actualizes by taxation of household's income. Barro uses Cobb – Douglas type production function by the incorporation of government as a function of private capital and government public services. Because of its simplicity, Barro preferred to use the AK-type growth model. Government produces non – rival goods. The source of government' revenue is the flat rate income taxation. Because of the AK type production function, the model has no transitional dynamics. The maximization of growth rate necessitates the taxation by the share of government in the economy. This taxation policy can be actualized in two cases: either the usage of income taxation of government expenditure or government's power in directing the saving behavior of households.

Lynde and Richmond (1992) evaluated the role of public capital in production by using the data during the period 1958 – 1989 for United States. Lynde and Richmond use an econometric model and government enters the production function together with the conventional inputs like capital and labor. In the modelling framework, government capital can be used by private firms without paying any charge. In conclusion, Lynde and Richmond show that private and public capital are complements to each other rather than substitutes. Also, they show that the role of public capital is important for the production of private firms. Lastly, in the absence of public infrastructure investment such as construction of roads and provision of healthy water, potential economic growth will be less relative to the case of infrastructure investment which is done by the government.

Agénor (2010) examined the effect of government infrastructure investment on growth. In the model, the role of the government is to invest in health services as well as infrastructure in the economy. The source of government budget revenue is the income tax collection. The effect of the infrastructure investment in the economy is the decrease in the production costs, increase in the provision of health services, easier access to the health services and increase in the growth rate of output. In the case of an increase in health services, people become more willing to save and their productivity level increases. This is growth enhancing effect of government's health services provision. Government expenditures can be examined by the government's infrastructure investment, health investment and unproductive investment. Agénor proposes that the perpetual increase in the share of the government infrastructure investment increases the steady state growth rate if it finances by the decrease in the government's unproductive investment. The distinct feature of the model is that infrastructure investment leads to congestion effect whereas invest in health services leads to positive externality effect by increasing the productivity of labor. When the infrastructure investment reaches up to a point, producers prefer to use modern technologies and they benefit from the modern technology. Usage of more modern technology increases the growth rate and productivity.

Schmitz (2001) examined the effect of government involvement which produces investment goods on the aggregate productivity. As a case study, Schmitz evaluated the existence of government both in Egypt and Turkey. As opposed to Agénor, Schmitz found a negative relationship between the existence of government and aggregate factor productivity in the economy. The main reason of this is due to the fact that less efficient industries can employ the people who have a close ties with political governments. Schmitz stated that government manufacturing production involvement is higher in the developing countries relative to the developed counterpart. As the economy begins to development process, government involvement begins to decrease. Government employs less efficient technology relative to the private sector. Existence of both public and private sectors can be

released such that government levies tax on private sector and its tax revenue can be distributed as a subsidy for public firms.

Chatterjee and Morshed (2011) examined the effect of infrastructure investment on macroeconomic performance of the economy. If the infrastructure provision increases, accumulation or congestion affect occurs and accumulation of infrastructure in an economy has a positive effect on the aggregate productivity. In the evaluation of provision of infrastructure investment, Chatterjee and Morshed examined two cases; provision by private sector or public sector. An increase in the infrastructural capital with respect to private capital, improves the marginal product of private capital. The finance of infrastructure investment can be released by the income tax collection of the government. Optimal tax rate which is levied on income causes congestion effect such that in the case of congestion, marginal product of private capital increases and the increase in marginal product of private capital is higher than social rate of return. The main mission of the government tax collection is the equalization of both private and social rate of return. In the case of providing infrastructure investment by the privately owned firms, if there is an infrastructural subsidy, there is productivity growth in the long run. An increase in the infrastructural capital affects the marginal productivity of private capital in a positive way. Chatterjee and Morshed find that subsidization of private sector results with higher welfare gains relative to the case the equal amount of subsidization of private and public sector released by the government.

Wang (2002) examined the relationship between government's infrastructure investment and economic growth for East Asian countries. Wang uses data for the period 1979 – 1998. Infrastructure investment effects aggregate output in several ways; as infrastructure investment increases output increases, when examining infrastructure investment as a kind of intermediate good; as infrastructure investment increases there could be seen improvement in the productivity of inputs and infrastructure investment leads to externality effect and thus infrastructure investment increases the long run growth of the economy. Infrastructure investment has a spillover effect on private sector. With the infrastructure investment, there

would be improvement in the productivity, decrease in the production costs and effective usage of time are satisfied. Thus, as infrastructure investment increases, private sector experiences a positive externality effect. From another angle, the relationship between infrastructure investment of government and private sector can be evaluated as private sector expands private sector's demand for government infrastructure investment increases and so does infrastructure investment. Wang, also, states the importance of both public and private capital for East Asian countries.

Paul (2003) examined the effect of public infrastructure investment mainly in two parts. One of them is the examination of cost – saving and the other one is the examination of output – augmented behaviors. As a case study Paul choses Australia. Paul thinks that public capital is a substitute for private capital as well as labor. Government's infrastructure investment affects the efficiency of private sector in a positive way. Substitutability between labor and government's capital is higher relative to the substitutability between private capital and labor. The effect of public infrastructure investment is seen mostly in labor – intensive sectors relative to capital – intensive sectors. Paul states that the effect of public infrastructure investment is seen mostly in manufacturing sectors relative to the other sectors. The reason of the most affected industry is manufacturing sector could be the high degree of substitutability between private and public capital. Also, Paul states that in the case of an increase in the infrastructure investment, demand for inputs decreases in most of the industries. In the provision of infrastructural services, government plays more important role relative to private sector. The reason of the limited role of private firms in the provision of infrastructure investment is due to infrastructure investment is capital – intensive in general, it is hard to compete with public sector for private sector and infrastructure investment necessitates the regulatory risk. Because of the stated three reasons private sector plays a limited role in the provision of infrastructure investment.

Button (1998) examined the relationship between infrastructure investment and the economic growth and convergence. Button says that there should be differences between the regions of the countries. And to get rid of the differences between the

regions convergence needs to be ensured. As a tool for convergence of the regions infrastructure investment can be used. Aschauer (1989, cited in Button, 1998), Holtz – Eakin (1988, cited in Button, 1998) and Munnel (1990, cited in Button, 1998) estimated the total factor productivity for the period 1949 – 1985 in the case of an increase in infrastructure investment by 1 percent are respectively, 0.39, 0.39 and 0.34. Button handles the effect of infrastructure investment on employment mainly in two parts. On the one hand if public infrastructure investment increases, private capital and employment decreases because of the substitutability of public and private capital. On the other hand infrastructure investment contributes to competition between the regions of the country. Higher competition leads to decrease in prices and at the end increases the aggregate demand in general. From the other perspective, assume that infrastructure investment is in the form of transportation infrastructure investment. In the case of an enhancement in the transportation infrastructure investment, transportation costs decreases and it encourages the inter – regional trade in the economy.

Fisher and Turnovsky (1998) examined the relationship between public investment, congestion and private capital accumulation. Fisher and Turnovsky state that most of public investment has some degree of congestion and they use the Ramsey type growth model to examine the effect of public investment. To evaluate the effect of public investment Fisher and Turnovsky handle two cases; one of them is the lump – sum taxation which is used for the compensation of public investment. The other one is that distortionary taxation policy. If there is a perpetual increase in the public investment which is financed by the lump – sum taxation, in the long – run government capital stock increases. In the case of the absence of congestion, the large amount of government capital will help to increase the government services and thus it will increase the marginal productivity of capital as well as long – run capital accumulation. If in the production function private and public capital is used as a complement, then as public investment increases, private capital decreases. Financing of government investment by distortionary taxation instead of lump – sum

taxation will increase the private capital stock less relative to the case of lump – sum taxation.

Esfahani and Ramírez (2003) examined the effect of infrastructure investment on growth rate of the economy. Esfahani and Ramírez states that there are endogeneity and causality relationship between infrastructure investment and growth rate. If there is an increase in the infrastructure investment, productivity and economic growth increases. Increase in economic growth affects both demand as well as supply. Esfahani and Ramírez indicate the benefit of infrastructure investment is greater than the cost of infrastructure investment by the cross – country estimation. Esfahani and Ramírez state that the infrastructure investment is affected by the credibility of government and private asset ownership. As the credibility of government increases productivity increases and thus the steady – state per worker income. Human capital and market distortions do not affect the infrastructure capital accumulation but they affect the other types of capital accumulation. Population density and urbanization decreases the steady state infrastructure accumulation rate. In conclusion, Esfahani and Ramírez state that as total investment increases so does the share which is attributable to infrastructure.

Bom and Ligthart (2014) examined the effect of public infrastructure investment on the change in the production level under the case of balanced budget rule of government. They use overlapping generations model in a small-open economy. Main finance source of government is the labor income taxation. By assumption, public infrastructure capital stock is non – excludable and non – rival for private firms. The effect of a permanent increase in government expenditure on macroeconomic variables depends on the difference between the output elasticity of public capital and the public investment share in GDP. For example the difference between output elasticity of public capital and public investment share in GDP is high for OECD countries. If the rate of returns to public capital is greater than that of the private investment resource augmentation is encouraged. Promotion of resource augmentation leads to increase in the wage rates. If consumption and leisure which take place in the utility function are complement to each other household will prefer

to consume leisure instead of working. If consumption and leisure are substitutes rather than complement, then household prefers to work instead of leisure. Public investment encourages private capital accumulation as well as employment in the long run. So, we can say that public investment has an externality effect on private sector. And thus output multiplier is greater in the case of positive externality spillover case. Productive public investment affects the welfare in a positive way whereas the unproductive one affects in a negative way.

Delorme, Thompson and Warren (1999) showed the effect of public infrastructure investment on private firms. They use the stochastic frontier approach to examine the effect of public infrastructure investment on private firms. The model result shows that infrastructure investment decreases technical inefficiency and thus increases productivity and output. Indirect effect of infrastructure investment is the increase in output. Thus, the effect of public infrastructure investment on private firm is via the decrease in the aggregate technical inefficiency of private sector production.

4.2. Literature Survey on Public Infrastructure Investment in China

Vijverberg, Fu and Vijverberg (2011) examined the effect of public infrastructure investment on productivity in China. In the late of 1980s, public infrastructure investment is approximately 12 percent of fixed asset investment and in 2001 public infrastructure investment reaches the 30 percent of fixed asset investment and the share of public infrastructure investment shows an increasing trend. The main objective of the Chinese government infrastructure investment is to decrease the regional inequality in the country wide. Fleisher and Chen (1997, cited in Vijverberg, Fu and Vijverberg, 2011) find the public transportation investment has a minor role in the producitivity of China for 1978 – 1993 period, whereas Mody and Wang (1997, cited in Vijverberg, Fu and Vijverberg, 2011) find the transportation and telecommunication investments of Chinese government affects the growth of the economy in a large extent. Zhang and Fan (2004, cited in Vijverberg, Fu and Vijverberg, 2011) find that public investment affects the agricultural as well as rural non – agricultural sectors in a positive way. Vijverberg, Fu and Vijverberg use the cost function to examine the effect of public infrastructure investment in China.

Their dataset comprises 30 provinces of China for 1993 – 2003 period. Ordinary least squares result of the model is that the rate of return to public investment is approximately 39 percent. Another result of the model is that as government expenditure increases by 1 percent, production cost decreases approximately 0.08 percent in 1993 – 1995 period and 0.16 percent in 1995 – 2003 period. The main implication of the model is that the rate of return for infrastructure investment takes the values between ranges 22 and 25 percent in China annually. Public infrastructure investment contributes approximately 25 percent of increase in the total factor productivity in China.

Zhang and Fan (2004) examined the relationship between public investment and inequality for the case of rural China. Their provincial level data comprises 1978 – 1995 period. Public investments in the econometric model are invest in roads, education, electrification, telephones, irrigation and agricultural R&D expenditure. Zhang and Fan states the special reason of the evaluation of China as; firstly China can sustain approximately 10 percent annual growth rate and increase in regional inequality, secondly Chinese government expenditure aims to decrease the inequality. For the period 1978 – 1995, the average yearly growth rate of investment is approximately 8.3 percent. In 1978 – 1995 period agricultural R&D expenditure declined at a rate 3.9 percent annually whereas invest in communication sector increased 11.9 percent annually. The elasticity of education and irrigation is the highest whereas the elasticity of roads and agricultural R&D is relatively lower among the public infrastructure investment. In 1978 – 1995 period the contribution of capital, labor and land to the agricultural output decreased whereas the contribution of six public investments increased. Zhang and Fan state that government implemented coast – biased investment policy in the development process. The conscious biased policy of Chinese government contributed to regional inequality. Zhang and Fan propose to invest in education for the aim of decreasing regional inequality as well as increase the agricultural productivity.

Démurger (2001) examined the effect of infrastructure investment both on growth and regional inequality between the regions of China. Démurger uses twenty four

Chinese provinces for 1985 – 1998 period. Formerly, invest in heavy industrialization policy is adopted then emphasize shifts on to provincial self-sufficiency and transportation plays an important role in the provincial self – sufficiency. To transport the raw materials, railway transport investment is emphasized. In 1980s invest in energy and infrastructure sectors are supported. In 1990s invest in infrastructure especially transportation and telecommunication investment gain importance. Decentralization affects the infrastructure investment in two ways: one of them is that local governments have better information related with the infrastructure necessities of provinces. Thus, well – informed local governments can ensure the demand for public goods. The other one is that as local governments' autonomy increases they prefer to invest in more productive projects rather than infrastructure investment. The effect of infrastructure investment is the increase in total factor productivity. Also, infrastructure investment creates positive externality effect. Mody and Wang (1997, cited in Démurger, 2001) find the main element which explain the huge growth rate of China are to invest in road construction and telecommunication investment. Démurger finds that development policy of China contributes the rapid growth in China and thus inequality between the urban and rural parts of China increases. In rural areas infrastructure investment especially telecommunication investment contributes the increase in growth rate of economy and decreases inequality.

Ramesh (2012) examined the relationship between infrastructure investment, knowledge and economic growth for the case of China during the interval 1953 – 2004 period. Ramesh indicates the main reason of the distinction between central and county of China is that conscious policy of government. Especially reforms which implemented in 1979 contribute the awareness of the distinction between central and county level of China. If the aim is to decrease the income disparity between the rural and urban part of China, the only way is to invest in infrastructure investment. Invest in the telecommunication sector and libraries, research centers are known as the knowledge infrastructure investment. The benefit of invest in knowledge infrastructure investment is the creation of knowledge spillover effect. Also,

knowledge infrastructure investment contributes the creation of national innovation system. Due to close ties with the border countries, Special Economic Zones are established in the coastal parts of China. To establish the connection with other countries, SEZs take huge amount of infrastructure investment. Ramesh emphasizes the difference between the varieties in the investment policy as, after 1978 importance is given to the variety in the infrastructure investment whereas before 1978 importance is given to the construction of roads for the aim of supporting heavy industrialization strategy policy. Ramesh states the knowledge infrastructure investment is one of the reasons which contribute the increase in income disparity in China.

Bai and Qian (2010) evaluated the infrastructure investment for rural China. Bai and Qian prefer to examine the electricity, highways and railways as the type of infrastructure investment. Before the reforms which began in 1978, central government plays dominant role in the provision of electricity, highways and railways services. With the reform process, private sector begins to take place in the infrastructure investment together with the central government. Also, government encourages private firms to invest in the infrastructure via subsidization. Together with the private sector involvement, competition begins in the provision of infrastructure investment and together with the competition there is a decrease in prices.

Germaschewski (2013) evaluated the finance of government infrastructure investment via the reserve financing and examined China as a case study. The effect of infrastructure investment is the increase in productivity and decrease in the poverty rate. Due to huge population of China, demand for infrastructure services outweighs the supply of infrastructure services. Germaschewski states that formerly infrastructure investment is financed by the bank credits and this method leads to increase in the government debt. To keep the inflation under control, Germaschewski proposes the reserve financing method. In the article, Germaschewski uses two – sector open economy general equilibrium model to evaluate the effect of infrastructure investment in the Chinese economy. If the aim is to ensure a successful

reserve financing method, the return on government infrastructure investment could not be too low. In the model there are non-traded and traded goods. Germaschewski proposes that in the short run to fight with high inflation, it is necessary to sell foreign reserves. Government provides the infrastructure investment via selling the foreign reserves and government uses managed float exchange rate system. Germaschewski makes the experiment if there is an increase in infrastructure investment approximately half of the current infrastructure investment in a few years. The result of the increase in infrastructure capital by the amount of 50 percent is the increase in productivity and efficiency in private sector. Thus, there is a rapid economic growth in the economy. Germaschewski states the main reason of China's high growth rate is the infrastructure investment and infrastructure investment is going to be foster the Chinese growth rate in the near future.

Chen, Khan, Yu and Zhang (2013) examined the relationship between government intervention and investment comovement and as a case study they examined the China. Chen, Khan, Yu and Zhang use Chinese National Industrial Enterprises Census data for the period of 2001- 2005. Knyyazeva (2008, cited in Chen, Khan, Yu and Zhang, 2013) states that in the case of asymmetric information, the absence of private property rights affects the investment decision of the firms and also, in this case the accumulation of capital can be distributed to unproductive investment projects. The main idea of this article is that the role of government in the economy can affect the investment decisions of firms, for example taxation or subsidization policy of government. Chen, Khan, Yu and Zhang use an econometric model to evaluate the effect of government intervention to investment decisions of firms. The main results are the effect of government intervention is reflected more in the state owned enterprises relative to private and foreign enterprises, as government intervention increases investment comovement releases and huge amount of investment comovement gives rise to decrease corporate firm's performance.

Xu and Yan (2014) examined the effect of government expenditure on private investment. Xu and Yan's main concern is that government expenditure which is either in the form of infrastructure investment or investment in private sector leads to

crowding in or crowding out of private firms which operate in China. Liu and Ma (2001, cited in Xu and Yan, 2014) states that budget deficit of government does not lead to crowding out of private firms in China. Dong (2006, cited in Xu and Yan, 2014) states that government expenditure leads to crowding out of private firms in the short run whereas in the long run crowding in phenomenon occurs rather than crowding out. Barro (1990, cited in Xu and Yan, 2014) states that productive infrastructure investment of government affects positively private investment whereas unproductive government investment expenditure affects negatively private investment. Serven (1996, cited in Xu and Yan, 2014) states that productive infrastructure investment of government affects private capital formation in a positive way whereas unproductive infrastructure investment affects private capital formation in a negative way. Xu and Yan used Chinese data for the period 1980 – 2011 to examine the phenomenon of crowding out in the case of expansion of government expenditure. Result of the model is that government infrastructure investment increases private firms' investment and thus crowding in phenomenon occurs.

CHAPTER 5

MODEL & QUANTITATIVE ANALYSIS

In this chapter we construct the three – sector Ramsey growth model. In the first part of this chapter I will introduce the three – sector Ramsey growth model. In the second part, I will introduce the three-sector Ramsey growth model by incorporating infrastructure investment of government. Also, the results for both of the models will present in this chapter. The contribution of this chapter to the literature is the incorporation of infrastructure investment of government into the three sector Ramsey growth model and explanation of China's high manufacturing share with infrastructure investment of government.

5.1.Three – Sector Ramsey Growth Model

In the modelling framework I benefited from Roe,Smith & Saracoğlu (2010). In the model, it is assumed that there are three sectors in the open economy. These sectors are agricultural, manufacturing and services good production sectors. All of the three sectors use capital and labor as a factor of production in the production process. In the agricultural good production sector, in addition to capital and labor, land is also used. It is allowed to trade in the manufacturing and agricultural sectors. In this model labor is mobile between the sectors but immobile between the countries. Due to immobility of labor between the countries, it is not allowed to trade in the services sector. Whatever produced in the services sector, it is consumed. So, we can call the services sector as the domestic – good producing sector. Manufacturing goods could be thought as an investment good as well as the source of capital accumulation in the economy. The agricultural and services sectors are the consumption good producing sectors. In this basic model, there are two types of agents: household and firms.

5.1.1. Agent 1: Household's Intra – Temporal Behavior

Household maximizes her inter – temporal utility under the intertemporal budget constraint. In the utility function of the household leisure is not valuable. So, all the time is devoted to work by the household. Household owns the whole assets. Household earns income from labor, land, and capital. Population grows at a rate *n* and it is constant.

Given the initial values of capital and land and if the utility function is in the form of constant elasticity of substitution (CES), household's optimization problem can be expressed in terms of per worker as the equation (2);

$$\max_{q_i} \int_0^{\infty} \frac{U(q_i(t))^{1-\theta}-1}{1-\theta}\, e^{(n-\rho)t} dt \qquad (2)$$

Where *i, n* and ρ show that

i = sectors of the economy i.e. agricultural, manufacturing or services sectors

n = population growth rate

$\rho =$ time preference rate

$q_i = composite$ consumption

$$U(q_i) = U(q_m, q_a, q_s) = q_m^{\lambda_m} q_a^{\lambda_a} q_a^{\lambda_s} \; where \; i = m, s, a \; and \; \sum \lambda_i = 1 \qquad (3)$$

In (3) λ_i shows the consumption shares in expenditure.

subject to per labor budget constraint

$$\dot{k} = w + k\,(r - n) + \pi T - \epsilon \qquad (4)$$

In (4) $\dot{k}$ shows the accumulation of capital per labor, w shows the rental rate of per labor, k shows the capital per labor, r shows the economy wide interest rate, π denotes the rental rate of land per labor and T denotes the amount of land and ϵ denotes the per labor expenditure.

$1/\theta$ shows the intertemporal elasticity of substitution. If θ is high, intertemporal elasticity of substitution is low. High θ corresponds to the case which household prefers to consume today more relative to the future. If θ is low, intertemporal elasticity of substitution is high. Low θ corresponds to the case which household prefers to consume future more relative to the today.

Transversality condition implies that household cannot borrow infinitely. In this model, the transversality condition can be expressed as;

$$\lim_{t\to\infty}\left\{k(t).e^{-\int_0^t[r(v)-n]dv}\right\}\geq 0 \qquad (5)$$

Equation (5) shows there is no Ponzi Game in this economy. In other words, equation (5) shows that household cannot borrow at a rate higher than *r*. If interest rate exceeds *r*, household will always want to borrow and consume and obtains higher utility. At the end, household's utility doesn't reach a satiation point. Thus, equilibrium cannot occur.

If household have a constant elasticity of substitution type utility function, then Hamiltonian for the household maximization problem can be stated as;

$$\mathcal{H}=\int_0^{\infty}\frac{U(q_i(t))^{1-\theta}-1}{1-\theta}\,e^{(n-\rho)t}dt+\mu\,[w+k\,(r-n)+\pi T-\epsilon] \qquad (6)$$

When we take the derivative of the Hamiltonian with respect to composite consumption and capital we obtain the following expression.

$$\frac{\dot{q}}{q}=\frac{1}{\theta}\,[r-\rho-\frac{\dot{p_s}}{p_s}.\lambda_s\,] \qquad (7)$$

where λ_s shows the share of the services good in the expenditure. $p_s$shows the price of services goods. When θ goes to unity, utility function becomes felicity function and with some manipulation equation (7) turns into the following

$$\frac{\dot{\epsilon}}{\epsilon}=\frac{\dot{q}}{q}+\frac{\dot{p_s}}{p_s}.\lambda_s=r-\rho \qquad (8)$$

Equation (8) means that the change in the expenditure is due to either the change in the consumption or the change in the relative price of *services good i*.

5.1.2. Agent 2: Firm's Intra – Temporal Behavior

Firms will operate under the perfectly competitive environment in this model. The direct implication of the perfect competition is that factor prices are determined by the marginal rate of return to factors. As stated formerly, in the production of manufacturing and services good, capital and labor is used whereas in the production of agricultural goods in addition to capital and labor, land is also used. So production functions of the firms can be expressed as;

$$Y_i(L_i, K_i) = F_i(A(t).L_i,\ K_i) \tag{9}$$

where *i* shows the manufacturing and services sectors' production function.

The agricultural good production function can be stated as;

$$Y_a(L, K, T) = F_a(A(t).L_a,\ K_a,\ B(t).T) \tag{10}$$

A(t) shows the technology level and it varies with time. Also, A(t) is the same for the all sectors in the economy. B(t) shows the exogenous technology level which is used in the agricultural good production. In this model, firms solve the profit maximization or alternatively cost minimization problem. Firms' problem per labor for the manufacturing and services sector can be expressed as;

$$\max_{l_i,k_i}\{p_i.\ f_i\,(l_i, k_i) - w.l_i - \ r^k.k_i\} \tag{11}$$

In (11), p_i shows the price of services and manufacturing goods .

Firms' problem for the agricultural sector can be stated as;

$$\max_{l_a,k_a}\{p_a.\ f_a\,(l_a, k_a, T) - w.l_a - \ r^k.k_a\} \tag{12}$$

where $r^k = r + \ \delta$ and p_a shows the price of agricultural goods. r^k shows the rate of return to the capital and it is equal to the sum of economy wide interest rate and depreciation rate of capital. Equation (11) and (12) could be defined as respectively

the profit maximization problem and value – added problem of the firms. Under the perfectly competitive environment, firms which operate in either manufacturing or services sector will obtain zero profit whereas firms which operate in the agricultural good production can obtain profit. The reason of the profit in the agricultural sector is that firms employ capital, labor and land in the production process but they pay only for capital and labor. Because of this reason, it is possible to obtain profit in the agricultural good production sector.

Rental rate of factors is obtained by the equality of marginal cost of the factors to the marginal revenue. Firms decide on the factor demand by using the Hotelling's Lemma[24].

5.1.3. Characterization and Description of the Equilibrium

Given services good prices $p_s(0)$, initial capital K(0), labor L(0) and land T(0) endowments and fixed world prices p_w, agricultural and manufacturing good prices respectively $p_a \; and \; p_m$, a competitive equilibrium is a sequence of non – negative services good prices and capital prices such that,

- **i.** The representative household solves the utility maximization problem and decides on the composition of consumption bundle for agricultural, manufacturing and services good amounts.
- **ii.** Firms solve the profit maximization or alternatively cost minimization problem with respect to their technology levels.
- **iii.** Markets clear for services goods and there might be excess demand and/or supply for agricultural and manufacturing goods. The reason of the excess demand and/or supply in the agricultural and manufacturing goods is the trade. Labor is chosen as numeraire and it is normalized to unity. Total capital stock which is used in the production of agriculture, manufacturing and services good is equal to capital per labor in the modelling framework.

[24] Hotelling's Lemma states that agricultural labor demand can be found as the derivative of agricultural value added function with respect to wage.

Constant population and technology level are assumed in the construction of the model.

iv. No arbitrage condition holds in this economy. Rental rate of capital and land is equal to each other.

In this economy GDP can be computed as the sum of factor incomes and profit which is obtained from agricultural good production. Computation of GDP can be expressed as;

$$GDP(p_s, p_a, \hat{k}, T) = W(p_s) + R(p_s)\hat{k} + \pi^a(p_a, W(p_s), R(p_s))T \quad (13)$$

In (13) $W(p_s)$ shows the rental rate of wage in terms of services good prices, $R(p_s)$ shows the rental rate of capital in terms of services good prices, $\hat{k}$ shows the capital per effective worker and $\pi^a(p_a, W(p_s), R(p_s))$ shows the profit in the agricultural sector.

5.1.4. Construction of the Steady State Values

By assuming there is an interior solution to this model, we can construct the steady state values. First of all, from the zero profit condition of the firms we can express the factor prices i.e. rental rate of capital and labor in terms of services good prices. We can denote the capital and labor prices in terms of services good prices as;

$$\hat{w} = W(p_s) \quad \text{and} \quad r^k = R(p_s) \quad (14)$$

In the steady state, growth rate of all variables equal to zero. When we apply this rule into the Euler Equation (8), we can find steady state interest rate and express as;

$$r^{ss} = \rho + x \quad (15)$$

We defined the rate of return to physical capital investment as $r^k = r + \delta$. Combining this definition together with the equation (15), we can express interest rate in terms of services good prices as;

$$\rho + x + \delta = R(p_s) \quad (16)$$

Assuming that R is invertible, we can find the steady state services good prices as;

$$p_s^{ss} = R^{-1}(\rho + x + \delta) \quad (17)$$

After the foundation of steady state services good prices, we can find the wage per labor by the substitution of equation (17) into (14) and we can state wage per effective labor as;

$$\widehat{w}^{ss} = W(p_s^{ss}) \quad (18)$$

In (18) we have expressed effective wages in terms of steady-state services good prices.

Budget constraint in terms of per effective labor units can be expressed as;

$$\dot{\hat{k}} = \widehat{w} + \hat{k}(r - x - n) + \hat{\pi}T - \hat{\epsilon} \quad (19)$$

where x shows the growth rate of technology, $\hat{\pi}$ shows the agricultural profit in terms of per effective worker and $\hat{\epsilon}$ shows the expenditure per effective labor. In the case of homothetic preferences, domestic – good market clearing condition can be showed as;

$$\hat{\epsilon} = \frac{p_s}{\lambda_s}\widetilde{y_s}(p_s, \hat{k}) \quad (20)$$

In (20) $\widetilde{y_s}(p_s, \hat{k}) = y_s(p_a, p_s, \hat{k}, T)$ and $\widetilde{y_s}(p_s, \hat{k})$ shows the services output per labor in terms of endogenous variables. By the substitution of the equation (20) into the equations (14), we can express the capital per effective labor as;

$$\dot{\hat{k}} = \widetilde{K}(p_s, \hat{k}) \equiv W(p_s) + \hat{k}(R(p_s) - \delta - n - x) + \widetilde{\pi^a}(p_s) - \frac{p_s}{\lambda_s}\widetilde{y_s}(p_s, \hat{k}) \quad (21)$$

In (21) $\dot{\hat{k}}$ shows the capital per effective worker and $\widetilde{\pi^a}(p_s)$ shows the agricultural profit per labor in terms of endogenous variables. We found the steady state services good prices in equation (17). Since we know the steady state prices, equation (21) turns into a linear equation in per effective capital units. To find the steady state capital per effective labor, we can impose the restrictions $\dot{\hat{k}} = 0$ & $\dot{p_s} = 0$ into

equation (21). To find the growth rate of services prices we can take the derivative of equation (21) with respect to time to obtain

$$\dot{\hat{\epsilon}} = \frac{1}{\lambda_s}\left[\left(\widetilde{y_s}(p_s,\hat{k}) + p_s\widetilde{y_{p_s}}(p_s,\hat{k})\right)\dot{p}_s + p_s\widetilde{y^s}_{\hat{k}}(p_s,\hat{k})\dot{\hat{k}}\right] \quad (22)$$

$$\frac{\dot{\hat{q}}}{\hat{q}} = \frac{1}{\theta}\left[r - \rho - \theta x - \lambda_s\frac{\dot{p}_s}{p_s}\right] \quad (23)$$

$$\frac{\dot{\hat{q}}}{\hat{q}} = \frac{\dot{q}}{q} - x \quad (24)$$

Equation (23) shows the Euler equation in terms of per effective labor. Equation (24) shows the relationship between growth rate of consumption per effective labor and consumption per labor. We can find $\widetilde{y_s}(p_s,\hat{k})$ by benefited from equation (20), and by using the Euler equation (23), we can express expenditure per effective labor as

$$\dot{\hat{\epsilon}} = \hat{\epsilon}\frac{1}{\theta}\left[R(p_s) - \theta x - \delta - \rho - \lambda_s(1-\theta)\frac{\dot{p}_s}{p_s}\right] \quad (25)$$

In (25) $\dot{\hat{\epsilon}}$ shows the change in the expenditure per effective labor and $\hat{\epsilon}$ shows the expenditure per effective labor. Substitution of equation (20) into equation (25) and then by using the equation (22) we obtain the growth of per worker services prices as;

$$\dot{p_s} = \frac{[R(p_s) - \delta - \rho - \theta x]p_s\widetilde{y_s}(p_s,\hat{k}) - \theta p_s\widetilde{y^s_{\hat{k}}}(p_s,\hat{k})\dot{\hat{k}}}{\theta[\widetilde{y^s}(p_s,\hat{k}) + p_s\widetilde{y^s_{p_s}}(p_s,\hat{k})] + \widetilde{y_s}(p_s,\hat{k})\lambda_s(1-\theta)} \quad (26)$$

By substituting equation (21) into equation (26), we could find an expression for the per labor services good prices. If θ goes to one we obtain the following equation,

$$\dot{p_s} = \frac{[R(p_s) - \delta - \rho - x]p_s\widetilde{y_s}(p_s,\hat{k}) - p_s\widetilde{y^s_{\hat{k}}}(p_s,\hat{k})\dot{\hat{k}}}{[\widetilde{y^s}(p_s,\hat{k}) + p_s\widetilde{y^s_{p_s}}(p_s,\hat{k})]} \quad (27)$$

5.1.5. Introduction of Dynamics into the Model by Using Time Elimination Method

First of all, the model has solved for the steady – state values. Then, by using time elimination method which was developed by Mulligan & Sala – i Martin (1991,

1993), dynamics are introduced into the model. The time elimination method converts the boundary problem into the initial value problem. We have showed that growth rate of capital and prices are function of capital and price.

$$\dot{k}(t) = g^k\,(k(t), p(t)) \tag{28}$$

$$\dot{p}(t) = g^p(k(t), p(t)) \tag{29}$$

Capital is a state variable and it changes throughout time. Price is a control variable. If capital is known, we can compute the price and capital. For this aim, policy function is constructed and it is expressed as;

$$p = P(k) \tag{30}$$

Equation (30) solves the optimal values of prices. If equation (30) exists, then by the substitution of this function into equation (28), we can express the evolution of capital per labor as the function of only capital. This case can be stated as

$$\dot{k}(t) = g^k\,\Big(k(t), P\big(k(t)\big)\Big) \tag{31}$$

If the initial values of capital are known, we can integrate the initial capital values to find the steady state capital value. After the foundation of optimal capital values, we can express the policy function. At this point, definition of the policy function plays an important role. After founding the policy function, we can construct the phase diagram and choose the stable arm which encompasses stable equilibrium path along the transition process. Stable arm can be constructed by the linearization of the differential equations in proximity of the steady state. After that, determinants of the characteristic matrix are constructed. To have the stable arm stability one of the eigenvalues needs to be negative and the other one needs to be positive. The negative eigenvalue corresponds to stable arm.

The derivative of the policy function is

$$\dot{p}(t) = \frac{dP(k(t))}{dk(t)}\,\dot{k}(t) \tag{32}$$

$$\frac{\dot{p}(t)}{\dot{k}(t)} = \frac{dP(k(t))}{dk(t)} \tag{33}$$

From the equations (28) and (29) we can write equation (34),

$$\frac{\dot{p}}{\dot{k}} = \frac{g^{p}\,(k,P(K))}{g^{k}(k,P(k))} \tag{34}$$

When we combine the equations (33) and (34), we obtain the following expression,

$$\frac{dP(k)}{dk} = \frac{g^{p}\,(k,P(K))}{g^{k}(k,P(k))} \tag{35}$$

Equation (35) is the slope of the policy function. As can be seen in equation (35), we get rid of the time by using the time elimination method. By using the equation (35), we can integrate backward to obtain the rest of the policy function. In steady state growth rate of capital and prices are zero. Because of this reason we cannot obtain the slope of the policy function at the steady state. To get rid of this indeterminacy, there are two approaches; one of them is L'Hopital's rule[25] and the other one is the eigenvalues – eigenvectors approach[26]. In the solution of the model, eigenvalues – eigenvectors approach is used.

The solution of the model has been done by using Mathematica program for the aim of projecting long rate growth dynamics and structural transformation process of China. In the first part of this chapter I will explain the parameters and results of the three sector Ramsey growth model for China. In the last part, I will explain the model environment, parameters and result of the three sector Ramsey growth model by the incorporation of public infrastructure investment.

[25] $\frac{dP(k)}{dk}|k \cong k^{ss} = \frac{\frac{\partial g^{p}}{\partial k}+\frac{\partial g^{p}}{\partial p}\frac{dP(k)}{dk}}{\frac{\partial g^{k}}{\partial k}+\frac{\partial g^{k}}{\partial p}\frac{dP(k)}{dk}}|k \cong k^{sss}$ and then $(\frac{dP(k)}{dk})^{2}\ \frac{\partial g^{k}}{\partial k}+\left(\frac{\partial g^{k}}{\partial k}-\frac{\partial g^{p}}{\partial k}\right)\frac{dP(k)}{dk}-\frac{\partial g^{p}}{\partial k}=0$

This approach is hard to implement in the complex equation systems. Also, this approach involves the trial and error path.

[26] In this approach, firstly Jacobian matrix is constructed. The negative eigenvalue of the characteristic equation corresponds to stable arm. The positive eigenvalue of the characteristic equation corresponds to unstable arm, so it can be ignored.

5.2. Parameters of the Basic Model

For the aim of establishing the parameters of the model, I constructed a three sector social accounting matrix. Data which are used in the construction of social accounting matrix is obtained either from World Development Indicator database or annual yearbook of China for (2003). Social accounting matrix is constructed for 1992 year since China started more market oriented reforms in that period.

Table 9: Basic Model's Parameters

Parameter		**Value**
Share of expenditures on manufactured good in total household expenditures	λ_m	0.10
Share of expenditures on agricultural good in total household expenditures	λ_a	0.36
Share of expenditures on services good in total household expenditures	λ_s	0.54
Time preference rate	ρ	0.042
Land (normalized)	T	1
Relative price of manufactured good(numeraire)	p_m	1
Elasticity of intertemporal substitution	$1/\theta$	1
Labor share in the production of manufactured goods	α	0.13
Labor share in the production of agricultural goods	β_1	0.73
Land share in the production of agricultural goods	β_3	0.10
Labor share in the production of services goods	δ	0.16

Source: Calculations and calibration of parameters are done by using World Development Indicators database and annual yearbook of China (2003). Some values are assumed values.

In China, wages are low and this situation is generally known by the researchers. Due to low wage levels of China, total labor payments comprise a low value in the cost function of firms and so labor shares take place a low value in factor payments. In the literature, labor share of China changes between the 0.35 – 0.50 range. In the construction of social accounting matrix, labor share is taken as 0.27 which is a close value stated in the literature.

In China, it is hard to find a reliable data for wages. Because of the hardship of reliable wage data, in the model economy wide wage definition is used. While constructing economy wide wage, it is assumed that manufactured and services goods production take place in the urban parts of China. When we come to the agricultural goods production case, it is activity which takes place in the rural parts of China. Economy wide wage definition is expressed as (36),

$$w_{economy\ wide} = (w_{urban} * urban\ weight) + (w_{rural} * rural\ weight) \quad (36)$$

In general, wage differentials between rural and urban China are important. According to World Bank, World Development Indicators database, in 1992 year 71.8 percent of total population lives in the rural parts of China, whereas 28.2 percent of population lives in the urban parts of China. According to National Bureau of Statistics of China which published in 2003, urban consumption is 3.3 times more than rural consumption in 1992 year. With the aim of simplification, it is assumed that urban consumption is three times more than rural consumption. The main reason of this differential consumption level is assumed due to the fact that urban income is three times more relative to the rural income. In addition to that, the main reason of wage differentials is more productive urban employment relative to rural employment. Under the competitive market conditions as productivity increases, rental rate of factor increases. Urban wage income is three times more with respect to rural income is one of the most basic assumptions in the model.

5.2.1. Quantitative Results from the Basic 3-Sector Model

Figures 6, 7, 8, 9 and 10 are obtained from the three sector Ramsey growth model. The result of the model shows that rental rate of capital shows a decreasing trend because of the accumulation capital whereas rental rate of labor shows an increasing trend. In general, result of the model shows the growth rate of China and growth rate of capital construction show a decreasing trend.

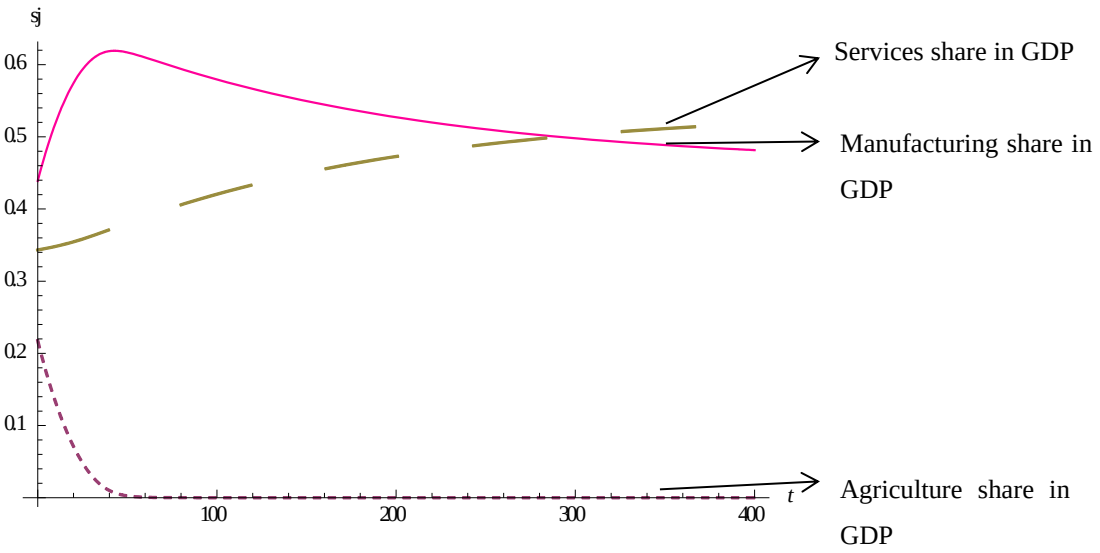

Figure 6: Sectoral Shares in GDP

Source: Model results

Figure 6 shows the sectoral shares in GDP and this figure is projected for 400 periods. The solid line shows the manufacturing sector share in GDP, the large dashed line shows the share of services sector in GDP and the small dashed line shows the share of agricultural sector in GDP. As time passes we see that the share of manufactured sector in GDP firstly increases and then decreases, the share of agricultural sector in GDP decreases and services sector share in GDP shows an increasing trend. In steady-state services sector share in GDP exceeds the manufacturing sector share in GDP (similar to what we observe in other developing countries or already developed economies).

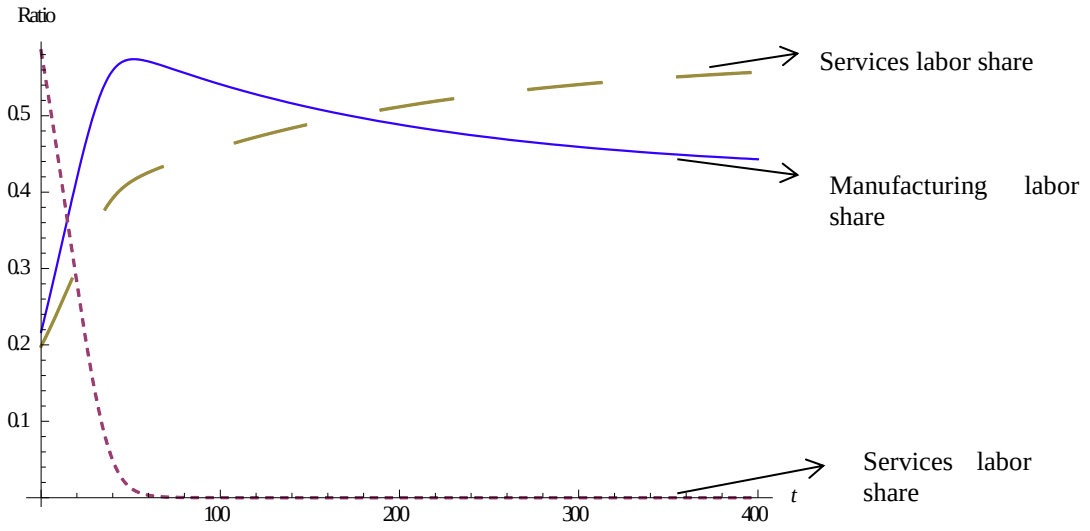

Figure 7: Sectoral Labor Shares in Total Labor

Source: Model results

Figure 7 shows the sectoral labor shares in total labor in the Chinese economy for 400 periods. The solid line shows the labor share in the manufactured goods production, the large dashed line shows labor share in the services goods production and the small dashed line shows the labor share in the agricultural good production. As seen in Figure 7, labor share in the services sector increases, labor share in the manufacturing sector firstly increases and then decreases whereas in the agricultural sector decreases. Increase in labor shares in the production of services goods is due to the fact that in the production of services goods labor is used more intensively relative to capital. Initial increase in the labor share of manufactured goods sector is due to the increase in the share of manufacturing sector in GDP. As seen in Figure 7, decrease in the agricultural goods share in GDP is reflected by the decrease in the labor share of agricultural sector.

The change in the sector shares of the economy is one of the signs of structural change. The other sign is the change in the factor shares. As seen in Figure 7, people exit the agricultural sector begins to work either in the manufacturing sector or services sector.

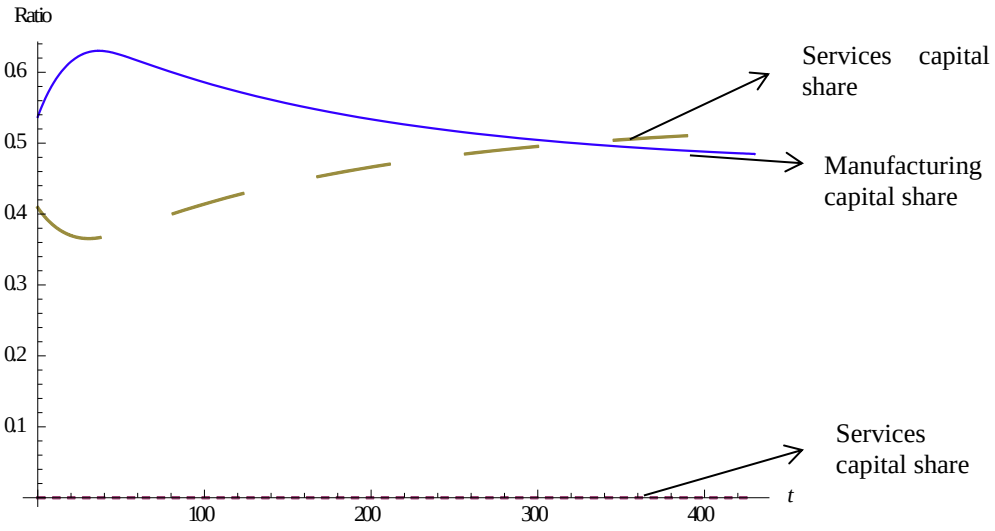

Figure 8: Capital Shares in Total Capital

Source: Model results

Figure 8 shows the capital shares in total capital. Capital shares are projected for 400 periods. The solid line shows the capital share in the manufactured goods production. The large dashed line shows the capital shares in the services sector. The small dashed line shows the capital share in the agricultural sector. In general, the production of agricultural and services goods necessitates more labor with respect to capital. The manufactured goods production necessitates more capital with respect to labor. During 400 years, capital share in the manufactured goods production sector increases initially and then decreases whereas in the services sector decreases initially and then increases. Capital share of agricultural sector is quite stable. The main reason of the low capital share of agricultural sector is probably due to decrease in the share of agricultural sector in GDP.

When we handle together Figure 7 and Figure 8, towards the steady state, in the production of manufactured goods labor begins to be used more intensively initially, then it decreases. In the agricultural good production, labor share and capital share decrease because of the decrease in the share of agricultural sector in GDP. In the services goods sector labor share increases and capital share decreases firstly and then they show an increasing trend. In the labor market, there is a transmission of labor from agricultural sector to the services and manufacturing sectors. In the capital

market, transmission occurs between the services goods and manufactured goods production sectors. As can be seen in Figure 8, capital share in the services goods production increases. Capital which is not used by the manufacturing goods sector, begins to be used in the services sector.

The change in the labor and capital shares in the economy is due to the change in the sector shares of the economy. Manufacturing and services goods share in GDP increases initially and then manufacturing goods share in GDP decreases. Agricultural goods share in GDP decreases initially and then it stays quite stable. Agricultural goods demand decreases and production decreases and subsequently this situation is reflected by the decrease in the factor shares of the agricultural sector. Unemployed people which work in the production of agricultural good begin to work either in the services or in the manufactured goods production sectors.

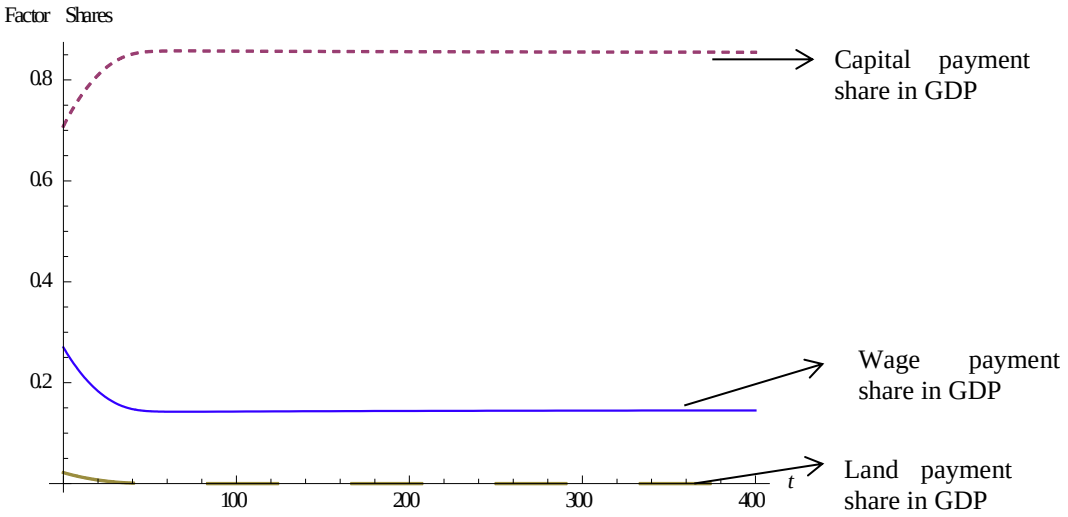

Figure 9: Factor Shares in GDP

Source: Model results

Figure 9 shows the factor shares in GDP and factor shares in GDP is projected towards the steady state. The solid line shows wage payment shares in GDP, big dashed line shows land payment share in GDP and small dashed line shows capital payment share in GDP. As seen in Figure 9, land and labor payments shows a decreasing trend whereas capital payment in GDP shows an increasing trend initially. Then, wage payments share, capital payment share and land payment share stay quite

stable. As we said formerly, rental rate of capital decreases and under this condition it is profitable to employ more capital in the production process for the firms. Due to change in the rental rates of production factors, firms begin to substitute labor with capital. Because of the subsititution labor with capital, labor payments in GDP decreases.

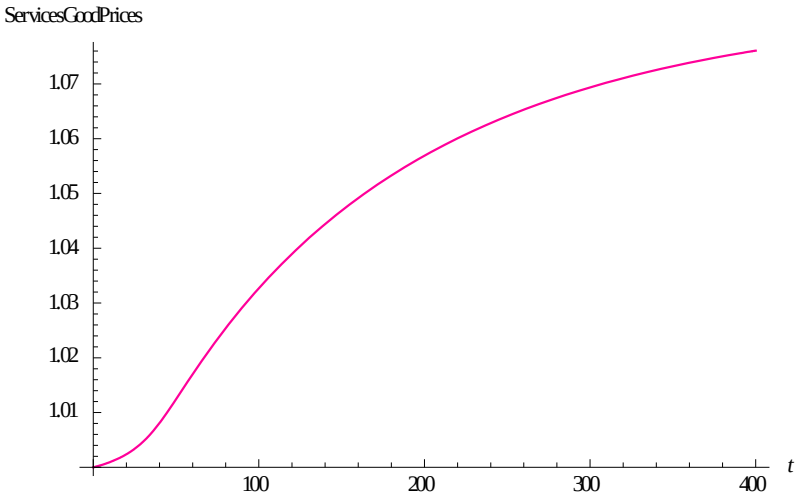

Figure 10: Evolution of Services Good Prices

Source: Model results

Figure 11 shows the services good prices. As seen in Figure 11, services good prices show an increasing trend and during 400 years services good prices increases approximately by 8 percent. Increase in the services good prices can be explained by the increase in labor demand of services sector and due to increase in the rental rate of labor, cost of the services sector increases and this situation is reflected in the increase in services goods prices.

5.2.2. Initial and Steady State Values from the Basic 3-Sector Model

Table 10 shows the initial SAM values and steady-state values of the basic model. Initial values of the basic model reproduce the same initial SAM values. In the basic model, interest rate is taken as given and its value is chosen so as to produce initial SAM values and steady-state values.

Table 10: Steady – State Results of Basic Model

	Initial SAM value	Steady–state value
Prices		
Interest rate	0.068	0.042
Manufactured good price	1	1
Agricultural good price	1	1
Services good price	1	1.08
Output shares in GDP		
Manufactured good production share in GDP	0.44	0.46
Agricultural good production share in GDP	0.22	0.01
Services good production share in GDP	0.34	0.53
Factor payments		
Wage payments in GDP	0.27	0.14
Capital share in GDP	0.71	0.85
Land share in GDP	0.02	0.01
Factor allocation in sectors		
Manufacturing labor share in total labor	0.22	0.42
Agricultural labor share in total labor	0.58	0.01
Services labor share in total labor	0.20	0.57
Manufacturing capital share in total capital	0.54	0.46
Agricultural capital share in total capital	0.05	0.01
Services capital share in total capital	0.41	0.53
Household expenditures and consumption		
Total household expenditures in GDP	0.64	1
Manufacturing consumption share in expenditures	0.10	0.10
Agricultural consumption share in expenditures	0.36	0.36
Services consumption share in expenditures	0.54	0.54

Source: Model results.

In the basic model, manufactured good price is chosen as numeraire. Agricultural good price is the world price and is equated to unity. Services good price is found by the clearance of services good market. Initially, prices of all goods are unity. In steady state, services good price increases from unity to 1.08. Increase in the services good prices affirms the view of Syrquin. There is no change in the manufactured and agricultural good prices because of our restriction on these goods.

Initially, interest rate is chosen approximately 7 percent. In steady-state, interest rate decreases approximately to 4 percent. Since China has huge capital stock, rental rate of capital is low. In steady-state capital stock increases more and more. So, rental rate of capital decreases.

Initially, manufactured good production share, agricultural good production share and services good production share in GDP are respectively 44 percent, 22 percent and 34 percent. In steady-state, manufactured good production share, agricultural good production share and services good production share in GDP are respectively 46 percent, 1 percent and 53 percent. In steady-state, manufactured and services good production share in GDP increases whereas agricultural good production share in GDP decreases. In the beginning, manufactured good production share in GDP is higher relative to agricultural good production share and services good production share in GDP. In steady-state, services good production share in GDP is higher relative to manufactured and agricultural good production share in GDP. Structural change of China actualized by the domination of services good production share to manufactured good production share.

When we come to evaluation of the change in the factor payments case, initially, wage payments, capital share and land share in GDP are respectively, 27 percent, 71 percent and 2 percent. In steady-state, wage payments, capital share and land share are respectively 14 percent, 85 percent and 1 percent. In China, capital share in GDP dominates wage and land shares in GDP. The reason of this case is due to high saving rate of household and government.

When we come to evaluation of the factor allocation in sectors case, initially 58 percent of labor works in the agricultural good production sector, 22 percent of labor works in the manufactured good production sector and 20 percent of labor works in the services good production sector. In steady-state, 57 percent of labor works in the services good production sector, 42 percent of labor works in the manufactured good production sector and 1 percent of labor works in the agricultural good production sector. Initially, 54 percent of total capital is used in the production of manufactured goods, 41 percent of total capital is used in the production of services goods and 5

percent of total capital is used in the production of services goods. In steady-state, 53 percent of total capital is used in the production of services goods, 46 percent of total capital is used in the production of manufactured goods and 1 percent of total capital is used in the production of agricultural goods.

In the beginning, 64 percent of GDP consists of total household expenditures. In steady-state, all GDP consists of total household expenditures. In the basic model, households have homothetic preferences. So, there will be no change in the consumption share in household expenditures. In the beginning and in steady-state, 54 percent of expenditures devoted to services good consumption, 36 percent of expenditures devoted to agricultural good consumption and 10 percent of expenditures devoted to manufactured good consumption.

To sum up, China experiences structural change both by the change in the sectors and by the change in the factor allocations of sectors. Initially, manufactured good production sector is the dominant sector in the economy. Together with the structural transformation of the economy, the share of services good production sector increases more relative to the share of manufactured good production sector. Countries which experiences structural change observe a decrease in the share of agricultural good production sector. Decrease in the share of agricultural good production in GDP is observed also in China. Structural change by the evaluation of the change in the factor allocation of sectors can be summarized as the agricultural laborer begins to work either in the services good production sector or in the manufactured good production sector. Manufacturing and agricultural capital share in total capital decreases and services capital share in total capital increases. At the end, services sector share in GDP increases and services good production sector actualized by using more capital and labor.

5.3. Extended Three Sector Ramsey Growth Model by Incorporating Public Infrastructure Investment

At first sight, China's huge capital stock can be seem as if due to high saving rate of households. But when we examine the literature, we see that China's high saving rate

is related to high saving rate of both households and government. In China, the share of manufacturing sector in GDP is quite high relative to the other sectors of the economy. In the literature, it is widely stated that the reason of the high manufacturing share in GDP is due to infrastructure investment of government. So, we extended the basic model with infrastructure investment of government.

In the extended model there are three sectors in the economy: manufacturing sector, agricultural sector and services sector. With the introduction of public infrastructure investment, we divided capital stock as private and public capital stock. All of the three sectors in the economy use private capital and labor in the production process. In addition to private capital and labor, in the production of manufacturing goods public capital is also used. In the agricultural sector, in addition to private capital and labor, land is also used. In the manufactured and agricultural goods production sectors, trade can occur. Due to immobility of labor between the countries, it is not allowed to trade in the services goods production sector. In the extended model, there are three agents: households, firms and government.

In the first part I will explain the model setup. Then I will introduce the parameters and results of the extended model.

5.3.1. Agent 1: Household's Intra-Temporal Behavior

With the introduction of public infrastructure investment into the basic model, there will be no change in the household behavior. Household solves utility maximization problem as in (2) subject to (3). Household has homothetic preferences by assumption. Transversality condition holds as in (4). Euler equation of household is the same as in (6).

5.3.2. Agent 2: Firm's Intra-Temporal Behavior

In the extended model, firms operate in a perfectly competitive market. Manufactured production function can be expressed as;

$$Y_m = F_m(A(t).L_m, K_{private}, K_{public}) \quad (37)$$

As seen in (37), in the production of manufactured goods labor, private capital and public capital are used.

$$Y_s = F_s(A(t).L_s, K_{private}) \quad (38)$$

$$Y_a = F_a(A(t), L_a, K_{private}, B(t).T) \quad (39)$$

Equations (38) and (39) show the services goods and agricultural goods production functions. In the production of services goods private capital and labor are used. In the production of agricultural goods private capital, labor and land is used. There is no change in the profit maximization problem of services and agricultural goods production firms. Production functions of the firms are in the form of Cobb-Douglas-type production function.

In the extended model, by assumption public capital is a kind of services which does not necessitate any payment for households and agricultural and services goods production sectors. There is no need to clearance of the public capital market since all public capital is used in the manufacturing production and it has no return to its owner, the government. Since all public capital is used by the manufacturing production, the manufacturing firm does not choose how much of the public capital in order to maximize economic profits, like private capital or labor. Manufacturing good production firm on the other hand pays taxes in return for the usage of public capital in the production process. The taxes which are collected from manufacturing goods production sector are called as taxable profit. Taxable profit is determined by the amount of profit in the manufacturing sector by government. Government uses taxable profit in infrastructure investment. Zero profit condition in the manufacturing goods production sector is satisfied with the introduction of taxable profit definition.

Manufactured goods production firms' profit maximization problem can be expressed as;

$$max_{l_m,\, kprivate_m}\{p_m.f_m(l_m, kprivate_m, kpublic_m) - w.l_m - r^{kprivate}.k_{private} - taxable\ profit\} \quad (40)$$

Again, we emphasize that public capital is not a choice variable for the manufacturing firm. All available public capital is used during production. There will be no change in the profit maximization problem of services and agricultural goods production firms. Manufactured and services goods production firms obtain zero profit. Profit can occur only in the agricultural goods production sector.

Rental rate of private capital and labor are determined in a perfectly competitive market.

5.3.3. Agent 3: The Role of Government in the Extended Model

In the extended model, government collects taxes from the manufactured goods production firm by the amount of profit in the manufactured goods production firm. Government tax revenue can be expressed as in (41).

$$Taxable\ profit = p_m . f_m(l_m, kprivate_m, kpublic_m) - w . l_m - r^{kprivate} . k_{private} \quad (41)$$

Government revenue is used in the provision of infrastructure investment which is a part of manufactured goods production. By assumption, government implements balanced budget.

In the model environment public capital accumulates as in (42)

$$\dot{K_{public}} = \lambda_{public} . GDP - \delta_{public} . K_{public} \quad (42)$$

In (42), λ_{public} shows the government share in the expenditures and δ_{public} shows the depreciation rate of public capital. In steady-state accumulation of public capital is equal to zero. By using the steady-state property, we can find the public capital which is used in the infrastructure investment in steady-state. in the first period public capital accumulates by the share of government expenditures in GDP. In the following years, public capital is subject to depreciation rate δ_{public}.

5.3.4. Characterization and Description of the Equilibrium in the Extended Model

Given services good prices $p_s(0)$, initial private capital Kprivate(0), public capital Kpublic(0), labor L(0) and land H(0) endowments and fixed world prices p_w, agricultural and manufacturing good prices respectively $p_a \; and \; p_m$, a competitive equilibrium is a sequence of non – negative services good prices and private capital prices such that,

- **i.** The representative household solves the utility maximization problem and decides on the composition of consumption bundle for agricultural, manufacturing and services good quantities.
- **ii.** Firms solve the profit maximization problem with respect to their technology levels.
- **iii.** Markets clear for services goods and there might be excess demand and/or supply for agricultural and manufacturing goods. The reason of the excess demand and/or supply in the agricultural and manufacturing goods is the trade. Labor is chosen as numeraire and it is normalized to unity. Total private capital stock which is used in the production of agriculture, manufacturing and services good is equal to private capital per labor in the extended model. Total public capital stock which is used in the production of manufacturing good is equal to public capital per labor. Constant population and technology level are assumed in the construction of the extended model.
- **iv.** No arbitrage condition holds also in the extended model.
- **v.** Government implements balanced budget policy.

5.4. Quantitative Analysis of the Extended Model

To obtain the parameters of the extended model, I extended three sector social accounting matrix by incorporating government. Social accounting matrix is constructed for 1992 year. According to World Bank World Development Indicators database, final consumption expenditure of Chinese government is 15.6 percent of

GDP in 1992. The share of public capital which is used in the infrastructure investment is adjusted according to this data. In the extended model public capital is subject to depreciation at a rate δ_{public}.

Table 11: Extended Model's Parameters

Parameter		**Value**
Share of expenditures on manufactured good in total household expenditures	λ_m	0.09
Share of expenditures on agricultural good in total household expenditures	λ_a	0.36
Share of expenditures on services good in total household expenditures	λ_s	0.55
Share of government in GDP	λ_{public}	0.156
Time preference rate	ρ	0.042
Land(Normalized)	T	1
Relative price of manufactured good(numeraire)	p_m	1
Elasticity of intertemporal substitution	θ	1
Labor share in the production of manufactured goods	α_1	0.13
Private capital share in the production of manufactured goods	α_2	0.51
Public capital share in the production of manufactured goods	α_3	0.36
Labor share in the production of agricultural goods	β_1	0.73
Land share in the production of agricultural goods	β_3	0.10
Labor share in the production of services goods	δ	0.16
Depreciation rate of public capital(assumed)	δ_{public}	0.10

Source: Calculations and calibration of parameters are done by using World Development Indicators database and annual yearbook of China (2003). Some values are assumed values.

Incorporation of public infrastructure investment into the three sector social accounting matrix affects only manufacturing sector parameters. There is no change in the labor share in the production of manufactured goods. Except for manufacturing

sector' private and public capital share, all parameters in the extended model is the same as in the basic model.

5.4.1. Initial and Steady State Values from the Extended 3-Sector Model

The extended model is solved only for steady-state. Table 12 shows the initial SAM and steady-state values of the extended model. Initial values of the extended model produce the same initial SAM values. Similar to the basic model, interest rate is taken as given in the extended model.

Table 12: Steady – State Results of Extended Model

		Steady-state value	
	Initial SAM value	**In the extended model**	**In the basic model**
Prices			
Interest rate	0.068	0.042	0.042
Manufactured good price	1	1	1
Agricultural good price	1	1	1
Services good price	1	0.89	1.08
Output shares in GDP			
Manufactured good production share in GDP	0.44	0.56	0.46
Agricultural good production share in GDP	0.22	0.01	0.01
Services good production share in GDP	0.34	0.43	0.53
Factor payments			
Wage payments in GDP	0.27	0.14	0.14
Private capital share in GDP	0.55	0.65	0.85

Table 12: (cont'd)

		Steady-state value	
	Initial SAM value	**In the extended model**	**In the basic model**
Factor payments			
Public capital share in GDP	0.16	0.20	-
Land share in GDP	0.02	0.01	0.01
Factor allocation in sectors			
Manufacturing labor share in total labor	0.22	0.53	0.42
Agricultural labor share in total labor	0.58	0.01	0.01
Services labor share in total labor	0.20	0.46	0.57
Manufacturing capital share in total capital	0.41	0.44	0.46
Agricultural capital share in total capital	0.07	0.01	0.01
Services capital share in total capital	0.52	0.55	0.53
Household expenditures and consumption			
Total household expenditures in GDP	0.64	1	1
Manufacturing consumption share in expenditures	0.10	0.10	0.10
Agricultural consumption share in expenditures	0.36	0.36	0.36
Services consumption share in expenditures	0.54	0.54	0.54

Source: Model results

In the extended model, interest rate is chosen same value as in the basic model. In the extended model, manufactured good price is chosen as numeraire. The price of agricultural good is the world price and is equated to unity. The price of services good is found by the assumption of the model which provides the clearance of the services goods market. In the beginning, all prices are equal to unity. In steady-state, the services good price decreases to 0.89. In the basic model, services good prices have increased to 1.08 in steady-state.

In the beginning, manufactured goods production share in GDP, agricultural goods production share in GDP and services goods production share in GDP are respectively 44 percent, 22 percent and 34 percent. The sector shares of the extended model are same with the basic model. In steady-state manufactured goods production share in GDP increases to 56 percent, services goods production share in GDP increases to 43 percent and agricultural goods production share in GDP decreases to 1 percent. Decrease in the share of agricultural good is the general property of countries which experience the structural change.

To compare the basic and extended model, initial values need to be same. For this aim, interest rate is taken same in both of the models. Introduction of public infrastructure investment into the basic model changes the steady-state share of manufactured and services goods production in GDP. In the basic model, in steady-state 46 percent of GDP belongs to manufactured goods production sector whereas in the extended model 56 percent of GDP belongs to manufactured goods production sector. In the basic model, in steady-state 53 percent of GDP goes to the services goods production while in the extended model 46 percent of GDP goes to the services goods production. Comparison of basic and extended models show us that in China manufacturing goods production in GDP is understated in the basic model because of the exclusion of government. Even though the same initial values of the basic and extended models, the manufacturing goods production share in GDP in the extended model exceeds that of the services goods production share in GDP. In China, to exclude the infrastructure investment of government can lead to misleading

results. The reason of high manufacturing goods production share in GDP is due to infrastructure investment of government.

In the extended model, factor payments in GDP are the same with the basic model. The only thing that makes difference is the division of capital as public and private capital. In the beginning, wage payments in GDP is 0.27 percent, private capital share in GDP is 55 percent, public capital share in GDP is 0.16 percent and land share is 2 percent of GDP in the extended model. In steady-state, wage payments in GDP are 14 percent, private capital share in GDP is 65 percent, public capital share in GDP is 20 percent and land share in GDP is 1 percent.

In the beginning, labor share in the manufacturing goods production sector is 22 percent of total labor, labor share in the agricultural goods production is 58 percent of total labor and labor share in the services goods production is 20 percent of total labor in the extended model. In the extended model, initial labor shares are the same with the initial labor shares of the basic model. In steady-state, divergence occurs between the basic and extended model. In steady-state, manufacturing labor share is 53 percent of total labor in the extended model, whereas it is 42 percent of total labor in the basic model. In steady-state, agricultural labor share is 1 percent of total labor both in the extended model and in the basic model. In steady-state, services labor share is 46 percent of total labor in the extended model, while it is 57 percent of total labor in the basic model. From the evaluation of steady-state labor shares in total labor, we can conclude that the increase in the manufacturing share in GDP in steady-state necessitates the increase in the labor share of manufacturing sector.

Initially, manufacturing capital share is 41 percent of total capital, agricultural capital share is 7 percent of total capital and services capital share is 52 percent of total capital. Since capital is divided into as public and private capital in the extended model capital shares of the sectors are different for extended and basic models. In steady-state, manufacturing capital share is 44 percent of total capital, agricultural capital share is 1 percent of total capital and services capital share is 55 percent of total capital in the extended model. Agricultural capital share in total capital is the same both the basic and extended models in the steady-state. From the examination

of the capital shares of sectors in total capital, we can say that in the production of services goods capital share increases. Increase in the capital share of services sector in total capital is more in the basic model relative to the extended model.

In the beginning, 64 percent of GDP consists of household expenditures. In steady-state, household expenditures are equal to GDP since there is no savings in steady-state. Household assigns 10 percent of expenditures to manufacturing goods consumption, 36 percent of expenditures to agricultural goods consumption and 54 percent of expenditures to services goods consumption. Since household has homothetic preferences, there is no change in the distribution of the expenditure shares in steady-state. Household's consumption shares in expenditure are the same both in the basic model and in the extended model.

CHAPTER 6

CONCLUSION

China has a different place in countries which implement command economy rules. In general, countries which implement command economy rules emphasize rapid transformation of the economy. Gradual transformation of the economy was adopted in China. Besides this, China has also special place in the world economy in the context of high growth rate and high capital accumulation. China experiences structural change in the mid-1980s. Because of these reasons, we handle the structural change process of China in this thesis.

In the second part of this thesis, we have examined the reform process of China by dividing reform process into two periods as first phase of reforms and second phase of reforms. In the reform process, China gives importance to gradual transformation of the economy. Especially in the second phase of reforms, China emphasizes the importance of market economy and mostly market oriented reforms are introduced.

In the third part of this thesis we have examined the structural change process of China by evaluating the existing literature on both structural change in a general way and structural change of China. Chinese economy begins to experience the structural change in the half of the 1980s. Formerly manufacturing sector is dominant sector in the Chinese economy. Later Chinese economy begins to be services and manufacturing sectors dominant economy. According to World Bank, World Development Indicators database, in 1998-2011 period, manufacturing sector value added in GDP for high income countries, middle income countries and China are respectively 16.4 percent, 22.1 percent and 32.2 percent. China has high manufacturing sector share in GDP relative to high and middle income countries. In

this thesis we have also tried to show the reason of high manufacturing sector share in Chinese economy.

In the fourth part of this thesis, I examined the literature on infrastructure investment of government. It is emphasized that infrastructure investment in China comprises big part of the manufacturing goods production. In general, in the countries which experience the structural change the share of manufacturing and agricultural sector in GDP decreases, while the share of services sector in GDP increases. Data shows that in China the share of agricultural sector in GDP decreases, the share of services sector in GDP increases and manufacturing sector share in GDP is quite stable. However we believe that manufacturing share in GDP is high because of the infrastructure investment of government. Since China is a developing country, it makes sense to examine the existing literature in the context of public infrastructure investment so we do.

In the fifth part of this thesis, we have showed the basic three sector model and results. According to the result of the basic three sector model, structural change occurs in China. In steady-state the share of agricultural sector in GDP decreases whereas the share of manufacturing and services sector increases. Services sector share in GDP exceeds that of the manufacturing sector in the long run, as we observe in other economies.

Also, in the fifth part of this thesis we extended the three sector model by the incorporation of public infrastructure investment. In the extended model, government collects taxes from manufacturing sector and invests in the infrastructure which is a part of manufacturing goods production sector. The result of the extended model shows that structural change occurs in China again. The share of agricultural sector in GDP decreases and the share of manufacturing and services sectors increase. But this time increase in the share of manufacturing sector exceeds that of the services sector. Since the share of manufacturing sector in GDP is higher relative to the share of services sector in GDP, most of the idle capacity of agricultural sector is used by the manufacturing good production sector. In this thesis, we have explained the high

manufacturing share in GDP with the infrastructure investment of Chinese government among the numerous explanations.

To compare the extended model with the basic model, all parameters are chosen the same as in the basic model except for government in the economy. In the extended model the share of manufacturing sector in GDP exceeds that of the services sector while in the basic model the share of services sector exceeds that of the manufacturing sector. This proves our claim. In China the share of manufacturing sector is high because of the infrastructure investment of government. In addition to that, the results of the extended model show us that the share of government in the economy tends to be increase in the long-run. So, we can say that infrastructure investment of Chinese government continues to play an important role in the manufacturing sector as well as economy.

In the future, we are going to introduce the transition dynamics into the extended three sector Ramsey growth model.

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APPENDICES

A. TURKISH SUMMARY

Çin son otuz yıldır yıllık ortalama %10 büyüme oranını sürdürmektedir. Bu bağlamda Çin araştırmacılara yüksek büyümesinin incelenmesi için özgün bir çalışma alanı oluşturmaktadır. Yüksek büyüme oranı, yüksek tasarruf oranı ve devletin ekonomideki rolü Çin'i özel yapan nedenler olarak sayılabilir. Çoğu araştırmacı Çin'in yüksek büyümesini hane halkı tasarrufu ile ilişkilendirmektedir. Çin'in yüksek büyüme oranının nedenini hane halkının tasarrufuna ek olarak firmaların ve devletin tasarrufuyla ilişkilendiren çalışmalarda mevcuttur. Bize göre Çin'in yüksek büyümesinin nedeni hane halkı ve devletin tasarrufuyla ilişkilidir.

1998 – 2011 yılları arasında yüksek gelirli ülkelerde imalat üretimi sanayi oranının ülke geliri içindeki payı yaklaşık olarak %16, orta gelirli ülkelerin imalat üretimi sanayi oranının ülke geliri içindeki payı yaklaşık olarak %22 ve bu oran Çin'de % 32'dir. 1990-2011 yılları arasında yüksek gelirli ülkelerde hizmetler sektörünün ülke geliri içindeki payı %70, orta gelirli ülkelerde hizmetler sektörünün ülke geliri içindeki payı %50, bu oran Çin'de ise % 38'dir. Yüksek ve orta gelirli ülkeler ile kıyaslandığında, Çin göreceli olarak yüksek imalat sanayi üretim oranına ve düşük hizmet sektörü oranına sahiptir. Biz bu tezde Çin'in yüksek imalat sanayi oranını devletin altyapı yatırımıyla açıklayacağız.

Çin 1953 yılında planlı ekonomiye başlamıştır ve 1953 yılında ilk beş yıllık planı yürürlüğe koymuştur. Planlı ekonomi dönemi reform sürecine kadar devam etmiştir. Çin 1953-1961 yılları arasında Büyük Sıçrayış hareketiyle birlikte milli gelirin hızlı bir şekilde artırılmasını ve Amerika, İngiltere gibi ülkelerin gelime hızını yakalamak hatta bu ülkelerin gelişme hızlarının da ötesine geçmeyi amaçlamıştır. Bu amacı gerçekleştirmek için ise kaynaklar tarım sektöründen ağır sanayi üretim sektörüne aktarılmıştır. Kaynakların ağır sanayi üretimine aktarılmasına ek olarak kötü hava

koşulları yüzünden tarımsal üretimde ciddi bir azalma meydana gelmiştir. Büyük Sıçrayış hareketi yaklaşık olarak otuz milyon insanın ölümüyle sonuçlanmıştır. 1962-1969 döneminde, devletin amacı tarım, sanayi, savunma ve bilim-teknoloji alanlarında modernleşmektir. Ancak 1966-1976 yılları arasında yaşanan politik karmaşa ortamından dolayı modernleşme çabaları yarım kalmıştır.

1978 yılında Çin'de reform süreci başlamıştır. Genel olarak Çin'in reform süreci iki aşamada incelenmektedir: reformların ilk aşaması ve reformların ikinci aşaması. İlk reform süreci 1978-1992 zaman aralığını kapsamaktadır. İlk reform süreci daha çok mikro düzeydeki unsurlardan oluşur ve bu reform süreci ikinci reform süreci için zemin hazırlamıştır. İkinci reform süreci ise 1993 yılında başlamıştır ve halen devam etmektedir. İkinci reform süreci daha çok piyasa ekonomisine yönelik unsurlardan oluşmaktadır.

Çin reform süreci ile birlikte planlı ekonomiden piyasa ekonomisine geçmiştir. Çin reform sürecinde ekonominin aşamalı bir şekilde geçmesine önem vermiştir. Mesela, yeni kurulan kurumlar ve yeni politikalar öncelikle pilot bölgelerde gerçekleştirilmiştir. Eğer pilot bölgelerde başarı sağlanır ise yeni kurum ve politikalar ülke geneline yaygınlaştırılmıştır. Eğer pilot bölgelerde başarı sağlanamaz ise ülke şartlarına uyum sağlayacak yeni politikaların oluşturulmasına özen gösterilmiştir.

Çin'de uygulanan ilk reform sürecinin temel unsurları ikili system, tek çocuk politikası, devlet işletmelerinde reform, ilçe ve köylerde kurulan işletmeler, belli alanlarda uzmanlaşmış bankaların kurulması ve son olarak özel ekonomik bölgelerin kurulmasından oluşmaktadır. İkili sistem ekonomide hem piyasa hem de planlı ekonominin faaliyet göstermesi olarak tanımlanabilir. Çin devleti üreticilere üretim hedefi belirlemektedir ve üreticiler bu hedeflere uymak zorundadır; üreticilerin hedeflere uymaması durumunda işçi kamplarına gönderilirdi. Üreticiler, ürünlerinin devletin belirlediği üretim miktarı kadarını devletin belirlediği fiyatlardan devlete satardı. Eğer üretici, devletin belirlediği üretim miktarından daha fazla üretir ise, üretim miktarı ve devletin belirlediği üretim miktarı arasındaki farkı piyasada, piyasanın belirlediği fiyattan satardı. Zaman geçtikçe üretim miktarı arttı ve piyasa

için üretim plan üretimini geçti. Dolayısıyla ikili sistemi uygulamanın bir amacı kalmamıştı ve 1990'lı yılların ortasında ikili sistem yürürlükten kaldırıldı.

Çin ilk reform sürecinde tek çocuk politikası uyguladı. Bu politikanın temel amacı kişi başına düşen geliri ve tasarruf oranını artırmaktır. Belirtilen amaçlara ek olarak, Çin nüfusu çok kalabalık olduğu için işsizliği engellemekte bu politikanın amaçlarından sayılabilir.

Devlet işletmelerinde reformdan kastedilen şey üretici firmalar gelirlerinden devlete vergilerini ödemelerinden kalan kısmını kâr olarak elde tutmalarıdır. Bu uygulamanın temel amacı devlet işletmelerine özerklik sağlanmasıdır.

İlçe ve köylerde kurulan işletmeler ya yerel yönetim tarafından ya da kolektif şekilde işletilirdi. Devlet işletmelerine rakip işletmeler olarak görüldüğü için devlet tarafından ilçe ve köylerde işletmelerin kurulması desteklenmiştir.

1949 yılında Çin'de tek banka vardır: Çin halk bankası. Çin halk bankası hem merkez bankası hem de ticari banka olarak faaliyet göstermiştir. Devlet işletmelerinin artan borç yükünden dolayı Çin halk bankasının yükümlülükleri artmıştır. Çin halk bankasının artan yükümlülüğünü azaltmak için 4 uzmanlaşmış banka 1983 yılında kurulmuştur ve aynı yılda Çin halk bankası Çin merkez bankasına dönüştürülmüştür. 1983 yılınca kurulan uzmanlaşmış bankalar; Sanayi ve ticaret bankası, Tarım bankası, İnşa bankası ve Çin bankası. Belirtilen ilk üç banka, devlet işletmelerine kredi vermekle yükümlüdür. Çin bankası ise döviz değişimleriyle ilgilenmektedir.

Çin'in dünyaya açılması özel ekonomik bölgelerin kurulmasıyla başlamıştır. Genellikle özel ekonomik bölgeler Çin'in kıyı bölgelerinde yoğunlaşmıştır. Özel ekonomik bölgeler, bu bölgede kurulan firmalara vergi avantajı sağladığı için yabancı firmaların ilgisini çekmiştir.

Çin'de uygulanan reformların ikinci aşamasının temel unsurları; özelleştirme ve girişimcilikle ilgili reformlar, maliye politikası ve vergi sistemleri, bankacılık ve finansal sistem ve son olarak Dünya Ticaret Örgütüne üye olunmasıdır.

Devlet işletmelerinin artan borç yükünden ve Çin halk bankasına yük olmasından dolayı 1990'lı yılların ortalarında hızlı bir özelleştirme uygulaması başlamıştır. 1995 yılında devlet büyük olan devlet işletmelerinin durumlarının iyileşmesini sağlamıştır. Durumlarının iyileşmesinden kastedilen şey devlet işletmelerinin borçlarının ödemesinde yardımcı olmuştur. Küçük olan devlet işletmelerini ise özelleştirmiştir. Büyük olan devlet işletmelerinin özelleştirilmemesinin en temel nedeni ise ekonomide işsizlik oluşmasını engellenmesine yöneliktir.

Çin 1980'li yılların öncesinde merkezi yönetime önem verirken 1980 yılında ise yerinden yönetim uygulamasına geçmiştir. Yerinden yönetime geçişin temel nedeni ise yerel yönetimin bulunulan bölge ile ilgili daha iyi bilgi edinmesi, bölgenin ihtiyaçlarının yerel yönetimler tarafından daha iyi sağlanmasıyla ilgilidir. 1994 yılında merkezi yönetim uygulamasına geçilmiştir. Bu reform girişimcilerin birbiriyle eşit koşullar altında yarışmaya başlamasından dolayı verimli sektörde devlet müdahalesinin azalmasına yol açmıştır. Böylece devlet daha çok kamu mallarının temin edilmesine yönelmiştir. Naughton (2007)'de belirtildiğine göre Çin'in maliye politikası ülkenin makroekonomik koşullarına uyum sağlamıştır yani ülkenin ekonomik durumunu şekillendirmeye yönelik bir maliye politikası uygulanmamıştır.

Bankacılık ve finans sektöründe yapılmış olan reformlar ise şu şekilde özetlenebilir. 1994 yılında önceden kurulmuş dört uzmanlaşmış bankaya ilave olarak 3 politika bankası kurulmuştur; Devlet kalkınma bankası, Tarım kalkınma bankası ve İhracat-ithalat bankası. Bu politika bankaları devletin belirlediği ekonomik kalkınma hedefleriyle uyumlu olacak şekilde faaliyet göstermiştir. Devlet işletmelerinin, borçlarını ödemesi amacıyla bankalardan aldığı krediler nedeniyle finansal sektörde geri ödenmeyen kredilerde artış meydana gelmiştir. Bu koşullar altında devlet bankaların sermaye yeterlilik oranını artırmasına özen göstermiştir. 1995 yılında bütçe yasasının uygulamaya başlanmasıyla birlikte, devletin merkez bankası kanalı aracılığıyla borçlanması engellenmiştir.

Çin 1994 yılı öncesinde ikili döviz kuru uygulamıştır ve ikili döviz kuru uygulaması 1994 yılında piyasada belirlenen kur uygulamasına dönüştürülmüştür. 1996 yılında

Renminbi konvertibl hale gelmiştir. Devlet ihracatın artırılmasıyla ülke gelirini daha da artırmayı amaçlamıştır. İhracatı artırmak için ithalatın serbestleştirilmesi, finansal ve mali teşvikler ve son olarak devalüasyon gerçekleştirilmiştir. İhracatın artırılması için Dünya Ticaret Örgütüne üye olunması gerekiyordu. Dünya Ticaret Örgütüne üye olabilmesi için Çin'in ithalat tarifelerini azaltması, yabancı firmaların Çin'de faaliyet göstermesine izin vermesi ve son olarak finans ve telekomünikasyon sektörlerinin yabancı firmaların rekabetine açması gerekiyordu. Çin Dünya Ticaret Örgütünün istediği bu üç şartı yerine getirdi ve 2001 yılında Dünya Ticaret Örgütüne üye oldu.

Tezin 3. bölümünde yapısal değişim ile ilgili literatüre yer verilmiştir. Sektörlerin göreceli oranlarında değişme meydana gelmesi ya da büyümeyle birlikte ekonomik değişkenlerde değişim yaşanması yapısal değişim olarak adlandırılabilir. Yapısal değişim genel olarak üç aşamada incelenebilir. İlk aşamada ekonomide tarım sektörü yaygındır. Tarım sektörü hem üretimde hem de ticarette fazla yer kaplamaktadır. Ayrıca tarım sektöründeki istihdam oranı diğer sektörlere göre göreceli olarak daha fazladır. Tarım sektörünün katma değeri düşük olduğu için ilk aşamada ülke gelirindeki büyüme yavaştır. İkinci aşamada tarım sektöründen imalat sanayi üretim sektörüne kaynak aktarımı gerçekleşir. Ayrıca tarım sektöründeki istihdamın bir kısmı imalat sanayi üretim sektöründe çalışmaya başlar. Üçüncü aşamada ise imalat sanayi üretim sektörünün gelir içinde payı azalmaya başlar ve imalat sanayi üretim sektörünün gelir esnekliğinde azalma yaşanır. Syrquin (1988), uzun dönemde sermayenin fiyatının göreceli olarak azalacağını ve hizmet sektörünün fiyatlarında artış yaşanacağını belirtmektedir.

Yapısal değişimi içeren literatür çalışmaları üç şekilde sınıflandırılabilir; talep yaklaşımı, arz yaklaşımı ve diğer yaklaşımlar. Diğer yaklaşımları savunan kişilerin argümanları ne talep yaklaşımına ne de arz yaklaşımına girmeyen yaklaşım türü olarak ifade edilebilir.

Yapısal değişimi talep açısından açıklamaya çalışan kişiler; Laitner (2000), Cerina ve Mureddu (2013), Echeverria (1997), Foellmi ve Zweimüller (2008). Yapısal değişimi talep açısından açıklayan kişiler genellikle Engel yasasından, sektörlerin emek

oranlarındaki değişiklikten ve tüketim oranlarının toplam harcama içindeki değişikliğinden faydalanırlar.

Yapısal değişimi arz açısından açıklamaya çalışan kişiler; Reati (2014), Fagerberg (2000), Baumol (1967), Ngai ve Pissarides (2007). Yapısal değişimi arz açısından açıklayan kişiler genellikle toplam faktör verimliliğindeki değişimi gözlemleyerek açıklamaya çalışırlar.

Yapısal değişimi diğer yaklaşımlar açısından açıklamaya çalışan kişiler; Patriarca ve Vona (2013), Uy, Yi ve Zhang (2013) ve Grossman (2013). Yapısal değişimi diğer yaklaşımlar açısından açıklayan kişiler yapısal değişimi gelir dağılımı, küreselleşme, uluslararası ticaret ve teknolojideki büyüme gibi nedenlerle açıklamaya çalışırlar.

Çin'deki yapısal değişim sürecini Dünya Kalkınma Göstergeleri verisinden faydalanarak şu şekilde açıklayabiliriz. 1978 yılında imalat sanayi sektörünün gelir içerisindeki payı yaklaşık olarak % 48'dir ve genel olarak imalat sanayi sektörünün gelir içerisindeki oranında bir değişiklik olmamaktadır bu oran 2012 yılında ise yaklaşık olarak %43'tür. Tarım sektörünün gelir içerisindeki oranı 1978-2012 zaman periyodunda azalma eğilimi göstermektedir. 1978 yılında tarım sektörünün gelir içerisindeki oranı % 28 iken 2012 yılında bu oran %10 düzeyindedir. Hizmet sektörünün gelir içerisindeki oranı 1978-2012 zaman aralığında artış eğilimi sergilemektedir. 1978 yılında hizmet sektörünün gelir içerisindeki payı yaklaşık olarak % 23 iken bu oran 2012 yılında % 42.9'dur. İstihdamın sektörlere göre dağılımını inceleyecek olursak tarım sektörünün istihdam içindeki payı azalma göstermektedir. Hizmetler ve imalat sanayi üretiminde istihdam oranı ise artış eğilimi sergilemektedir. Bu bilgiler ışığında, Çin'de yapısal değişim tarım sektörünün hem istihdam hem de gelir içindeki payı azalmıştır, hizmetler sektörünün hem gelir hem de istihdam içindeki payı artmıştır ve imalat sanayi üretiminin gelir içindeki oranı yaklaşık olarak aynı kalırken imalat sanayi üretiminin istihdam içindeki oranında artış yaşanmıştır. İmalat sanayi üretiminin istihdam içindeki payı hizmet sektörünün istihdam içindeki payındaki artışından daha yavaş artma eğilimi sergilemektedir.

Cai ve Wang (2010) Çin'in planlı ekonomiden piyasa ekonomisine geçişi döneminde istihdamdaki değişikliği incelemiştir. Ve istihdamdaki değişikliği incelerken üç önemli hususu belirtirler. Bunlardan birincisi istihdamın sektörler arasındaki değişimi hükümet kanalıyla gerçekleşmiştir. İkincisi ise kırsal kesimden kente geçişin hükümet tarafından engellenmesidir. Devlet kentte işsizlik oranının artmaması için böyle bir yasak koymuştur. Üçüncü husus ise refah politikaları ile ilgilidir.

Kawakami (2004) 1978-1990 yılları arasında, Çin'in kırsal kesimdeki büyüme oranının kentteki büyüme oranından daha büyük olduğunu belirtmiştir. 1978-1990 dönemi reformların ilk aşamasına denk geldiği için reformların ilk aşamasının başarılı olduğunu ve gelirin artmasına katkıda bulunduğunu belirtebiliriz. Kawakami ayrıca beşeri sermayenin ülkedeki gelirin artmasını olumlu bir şekilde etkilediğini belirtmiştir.

Wang ve Szirmai (2008) Çin üzerine yaptıkları çalışmada reform öncesi dönemde negatif toplam faktör verimliliği, reform döneminde ise pozitif toplam faktör verimliliği bulmuşlardır.

Tezin dördüncü bölümünde hükümetin altyapı yatırımıyla ilgili literatür çalışması yapılmıştır. En genel anlamda hükümetin altyapı yatırımı, yol yapımı, temiz suyun sağlanması, elektrik sağlanması ve kanalizasyon gibi hizmetlerden oluşmaktadır. Eakin ve Schwartz (1995) hükümetin altyapı yatırımı sonucu üretim maliyetlerinde azalma meydana geldiğini belirtmiştir. Çünkü hükümetin altyapı yatırımı faktörlerin verimliliğini artırır ve verimlilik arttığı için maliyetlerde azalma meydana gelmektedir. Aschauer (1990) altyapı yatırımlarının hane halkının yaşam kalitesini artırdığını belirtmiştir. Ve hane halkının yaşam kalitesindeki artıştan dolayı, hane halklarının tasarruflarında artış meydana gelmektedir. Bu durumda da ülke gelirinde artış gözlemlenmektedir. Barro (1988) eğer amaç ülkenin büyümesini optimal düzeyde tutmak ise vergi oranı ile hükümetin ekonomideki payının birbirine eşit olması gerektiğini belirtmiştir. Lynde ve Richmond (1992) Amerika'da devlet sermayesinin üretimin içindeki rolünü 1958 – 1989 yılları için incelemiştir. Yazarlar devlet ve özel sektör sermayesinin birbirini tamamlayıcı etkisi olduğunu belirtmiştir.

Schmitz (2001) ekonomide devletin varlığının toplam faktör verimliliği üzerindeki etkisini incelemiştir. Schmitz, Mısır ve Türkiye'yi incelemiştir ve verimsiz işletmelerin verimsiz olma nedeni olarak işletmelerin hükümete yakın olan kişileri istihdam etmesi olarak açıklamaktadır. Wang (2002) devlet ve özel sermayenin büyüme üzerindeki etkisini Uzakdoğu ülkeleri için incelemiştir ve Uzakdoğu ülkelerinde devlet ve özel sermayenin birbiri üzerine önemli etkileri olduğunu belirtmiştir.

Vijververg, Fu ve Vijverberg (2011), Çin'de 1980'li yıllarda altyapı yatırımları sabit varlık yatırımı içindeki payı %12 iken bu oran 2001 yılında % 30 olduğunu belirtmiştir. Ayrıca Vijververg, Fu ve Vijverberg, Çin hükümetinin altyapı yatırımının yaklaşık toplam faktör verimliliğindeki artışın %25'ini açıkladığını belirtmiştir. Démurger (2001), Çin'in 1980li yıllarda enerji ve altyapı yatırımına öncelik verdiğini ancak 1990lı yıllarda ulaşım ve telekomünikasyon yatırımlarına öncelik verdiğini belirtmiştir. Ramesh (2012) Çin'in 1978 yılından sonra altyapı yatırımında çeşitliliğe önem verdiğini belirtirken, 1978 yılından önce ise yol yapımına önem verdiğini belirtmiştir. Xu ve Yan (2014) hükümet sermayesinin özel sermaye oluşumunu olumlu bir yönde etkilediğini ve Çin'de dışlama olgusunun olmadığını belirtmiştir. Barro (1988) üretken altyapı yatırımının özel sektör yatırımını olumlu yönde etkilerken üretken olmayan altyapı yatırımının özel sektör yatırımını olumsuz yönde etkilediğini belirtmiştir. Mody ve Wang (1997) Çin'in yüksek büyüme oranının nedenini yol yapımını ve telekomünikasyon yatırımı gibi değişkenlerden kaynaklandığını ifade etmişlerdir. Germaschewski (2013) Çin'in yüksek büyümesinin nedeni olarak altyapı yatırımını göstermiştir ve yakın gelecekte Çin'in altyapı yatırımı artacağı için büyüme hızının daha da artacağını belirtmiştir.

Roe, Smith ve Saracoğlu (2010)'ndan faydalanılarak 3 sektörlü Ramsey büyüme modeli oluşturulmuştur. Modelde yer alan sektörler imalat sanayi sektörü, hizmet sektörü ve tarım sektörüdür. 3 sektörlü Ramsey büyüme modeli temel model olarak isimlendirilmiştir. Temel modelde iki ekonomik ajan vardır; hane halkı ve firmalar. Temel modelde hane halkı fayda maksimizasyon problemi çözmektedir. Hane halkının fayda fonksiyonu olarak Cobb-Douglas fayda fonksiyonu kullanılmıştır.

Hane halkı fayda maksimizasyon problemi çözerek hangi maldan ne kadar tüketeceğine karar vermektedir. Temel modelde hane halkının homotetik tercihlere sahip olduğu varsayılmıştır. Yani zaman geçtikçe hane halkının mallardan tüketim oranı toplam harcama içerisinde sabit kalmaktadır. Firmalar imalat sanayi sektörü, tarım ve hizmetler sektöründen oluşmaktadır. İmalat sanayi ve hizmet sektöründe faaliyet gösteren firmalar üretimde emek ve sermaye kullanmaktadır. Tarım sektöründe faaliyet gösteren firma ise emek, sermaye ve arazi kullanmaktadır. İmalat sanayi ve hizmetler sektöründe faaliyet gösteren firmalar normal kâr elde etmektedir. Ancak tarım sektöründe faaliyet gösteren firma pozitif kâr elde etmektedir. Firmaların üretim fonksiyonu olarak Cobb-Douglas üretim fonksiyonu kullanmışlardır. Temel modelde, hizmetler sektör piyasası temizlenir ve ticaret yoktur. Yani hizmet sektöründe ne üretiliyor ise hane halkı onu tüketir böylece piyasada fazla talep ya da arz sorunu oluşmamaktadır. İmalat sanayi ve tarım sektöründe aşırı talep ve/veya arz oluşabilir. Yani imalat sanayi ve tarım sektöründe ticaret vardır, dolayısıyla imalat sanayi ve tarım sektöründe piyasa temizlenmek zorunda değildir. Temel modelde emek mobildir yani sektörler arasında yer değiştirebilir. Emek normalleştirilmiştir. Sermaye ve emek piyasası temizlenir. Ayrıca modelde sabit teknoloji ve nüfus varsayılmıştır. Modelde arbitrajın olmadığı varsayımı da yapılmıştır.

Temel modelde kullanılan parametreler sosyal hesaplar matrisi oluşturularak belirlenmiştir. 1992 yılı için sosyal hesaplar matrisi oluşturulmuştur. Sosyal hesaplar matrisi oluşturulurken ekonomi genelinde ücret tanımı yapılmıştır. Ve emek oranı olarak 0.27 seçilmiştir.

Temel model öncelikle durağan durum için çözümlenmiştir daha sonra geçiş dönemi incelenmiştir. Temel modelle ilgili grafikler beşinci bölümde yer almaktadır. Gelir içindeki sektör oranları Şekil 6'da gösterilmiştir. Şekil 6'da görüldüğü gibi başlangıçta imalat sanayi oranı gelir içerisinde hızlı bir artış sergilemektedir. Yaklaşık 50 periyod sonra imalat sanayi oranının gelir içerisindeki payında azalma gözlemlenmektedir. Hizmetler sektörünün gelir içerisindeki payında sürekli olarak artış gözlemlenmektedir. Tarım sektörünün gelir içerisindeki oranı ilk 50 periyod

içerisinde azalmakta ve durağan duruma geçişte sabit kalmaktadır. Şekil 7sektörlerin emek oranlarının toplam emek içerisindeki dağılımını göstermektedir. Şekil 7'de görüldüğü gibi imalat sanayi oranının gelir içerisindeki hızlı artışıyla birlikte imalat sanayinin emek oranı hızlı bir artış göstermektedir ve imalat sanayi oranının gelir içerisindeki azalmayla birlikte imalat sanayinin emek oranında da azalma gözlemlenmektedir. Tarım sektörünün emek oranı aynı tarım sektörünün gelir içindeki oranında azalma olduğu gibi bir eğilim sergilemektedir. Yani ilk 50 periyodda tarım sektöründe çalışan emek oranı azalmakta ve ekonomi durağan döneme geçerken tarım sektörü emek oranı sabit kalmaktadır. Hizmetler sektörünün emek oranı sürekli artmaktadır. Sektörlerin emek oranlarındaki değişme sektörlerin gelir içerisindeki değişimine paralel bir seyir izlemektedir. Şekil 8, sektörlerin sermaye oranlarının toplam sermaye içindeki değişimini göstermektedir. Şekil 8'de görüldüğü gibi imalat sanayinin sermaye oranı önce artmakta ekonomi durağan duruma geçerken azalma eğilimi sergilemektedir. Hizmet sektörünün sermaye oranı başlangıçta azalmakta ve daha sonra artış eğilimi gözlemlenmektedir. Tarım sektörü daha emek yoğun bir sektör olduğu için sermaye oranı diğer sektörlere göre daha azdır. Tarım sektörünün sermaye oranı ekonominin durağan hale gelmesine kadar geçen zaman periyodunda sabit kalmaktadır. Şekil 9, faktör oranlarının gelir içerisindeki dağılımını göstermektedir. Faktör oranları ilk elli periyodda değişim sergilemekte sonra durağan kalmaktadır. Şekil 9'da görüldüğü gibi sermaye oranının gelir içerisindeki payı önce artmakta ve sonra sabit kalmaktadır. Emek ve arazi oranlarının gelir içindeki payı önce azalmakta sonra sabit kalmaktadır. Şekil 10, hizmet mal fiyatlarındaki değişimi göstermektedir. Temel modelde imalat sanayi mal fiyatı normalleştirilmektedir. Ve tarım mal fiyatları sabit dünya fiyatlarını göstermekte olup normalleştirilmektedir. Modele değişim katan şey aslında hizmet mal fiyatındaki değişimdir. Bu yüzden Şekil 10 oluşturulmuştur. Zaman geçtikçe, Şekil 10'da da görüldüğü gibi hizmet mal fiyatlarında artış yaşanmaktadır. Bu durum Syrquin (1988)'in de dediği gibi uzun dönemde hizmet mal fiyatlarında artış olacağını doğrular niteliktedir.

Literatürden esinlenerek üç sektörlü Ramsey büyüme modeline devletin altyapı yatırımı eklenmiştir. Bu model geliştirilmiş model olarak isimlendirilmektedir. Geliştirilmiş model bizim literatüre olan katkımızı göstermektedir. Geliştirilmiş modelde üç ekonomik ajan vardır; hane halkı, firmalar ve devlet. Hane halkı aynı temel modelde olduğu gibi fayda maksimizasyon problemi çözmekte ve bu problemi çözerek ne kadar tüketim yapacağına karar vermektedir. Firmalar aynı temel modelde olduğu gibi davranmaktadır. Yani kâr maksimizasyon problemini çözmekte ve buna göre üretim miktarlarını belirlemektedirler. Geliştirilmiş modelin tek farkı imalat sanayi üretim sektöründe ortaya çıkmaktadır. İmalat sanayi üretimi yapan firma ve hizmet malı üreten firma normal kâr elde etmektedir. Pozitif kâr sadece tarım sektöründe faaliyet gösteren firmada oluşmaktadır. Geliştirilmiş modelde devlet denk bütçe uygulamaktadır. Devletin altyapı yatırımı bir çeşit imalat sanayi malı niteliğindedir. Bu nedenle devlet sermayesi imalat sanayi malı üreten firmanın üretim fonksiyonuna bir üretim faktörü olarak girmektedir. Ekonomide yer alan tüm devlet sermayesi imalat sanayi üretim faaliyetinde bulunan firma tarafından kullanılmaktadır. Bu yüzden ayrıca devlet sermayesinin piyasada temizlenmesi varsayımı yapmak gereksizdir. Geliştirilmiş modelde devlet sermayesinin herhangi bir getirisi yoktur. Bu yüzden imalat sanayi üretiminde bulunan firma devlet sermayesinden ne kadar kullanacağını optimizasyon probleminden belirleyemez, yani devlet sermayesini imalat sanayi üretimi yapan firma veri olarak alır ve üretimde kullanacağı özel sermaye ve emek miktarını belirlemektedir. İmalat sanayi üretiminde bulunan firma devlet sermayesi kullanımı karşılığında devlete vergi ödemektedir. Devletin imalat sanayi üretiminde bulunan firmadan aldığı vergi imalat sanayi üretiminde bulunan firmanın kârı kadardır. Böylelikle, imalat sanayi üretimi yapan firmanın normal kâr elde etmesi durumu sağlanmış olur.

Temel modele devletin altyapı yatırımlarının eklenmesiyle birlikte sosyal hesaplar matrisine devlet sektörü dâhil edilerek düzenlenmiştir. Geliştirilmiş modelde devletin yer almasıyla birlikte sermaye özel ve devlet sermayesi olarak ikiye ayrılmıştır. Geliştirilmiş model sadece durağan dönem için çözülmüştür. Temel ve geliştirilmiş modeli karşılaştırabilmek için her iki modelin parametreleri aynı seçilmiştir.

Böylelikle, Çin'de yüksek imalat sanayi üretimi içindeki yüksek payını açıklayabilme imkânı elde etmiş olacağız.

Geliştirilmiş modelin sonuçları Tablo 12'de yer almaktadır. Geliştirilmiş modelde ilk değişiklik hizmet mal fiyatlarında ortaya çıkmaktadır. Temel modelde hizmet fiyatları artarken geliştirilmiş modelde azalmaktadır. Bunun nedeni ücretlerin temel modelde geliştirilmiş modele nazaran daha fazla artmış olmasından dolayı temel modelde maliyetler artıp fiyatlara yansırken, geliştirilmiş modelde maliyetlerde azalma olup fiyatlara da azalma olarak yansıması şeklindedir. Temel modelde durağan durumda hizmetler sektörü dominant sektör iken geliştirilmiş modelde imalat sanayi sektörü dominant sektördür. Temel modelde emeğin en yoğun olduğu sektör hizmetler sektörü iken geliştirilmiş modelde ise imalat malı üreten sektördür. Sermayenin en yoğun kullanıldığı sektör hem temel hem de geliştirilmiş modelde hizmetler sektörüdür. Her iki modelde de hane halkının tüketimlerinin toplam harcama içerisindeki oranı aynıdır. Bunun nedeni hane halkının homotetik tercihlere sahip olması varsayımımızdan dolayıdır.

Sonuç olarak, Çin'de kent ve kırsal kesimde ciddi bir gelir adaletsizliği vardır. Bu durumu önlemenin tek yolu devletin altyapı yatırımı yapmasıdır. Devletin altyapı yatırımlarından dolayı Çin'de imalat sanayi üretim sektörünün oranı yüksek kalmakta ve hizmetler sektörünün gelir içerisindeki oranı düşük kalmaktadır. Bu durumu temel ve geliştirilmiş modelin sonuçlarına dayanarak ifade edebiliriz. Tablo 12'de de görüleceği üzere Çin'de devletin altyapı yatırımı yapmış olması özel sektörün sermaye oluşumunu pozitif bir şekilde etkilemektedir. Böylelikle, Xu ve Yan (2014)'in görüşlerine katılmaktayız. Çin devletinin yapmış olduğu altyapı yatırımı özel sektör yatırımları üzerinde dışlama etkisi yoktur

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