2017-12-03

Structural Change: the Case of China

Yiran Tan

University of Miami, yirantane17@gmail.com

Follow this and additional works at: https://scholarlyrepository.miami.edu/oa_dissertations

Recommended Citation
https://scholarlyrepository.miami.edu/oa_dissertations/1986

This Embargoed is brought to you for free and open access by the Electronic Theses and Dissertations at Scholarly Repository. It has been accepted for inclusion in Open Access Dissertations by an authorized administrator of Scholarly Repository. For more information, please contact repository.library@miami.edu.
UNIVERSITY OF MIAMI

STRUCTURAL CHANGE: THE CASE OF CHINA

By

Yiran Tan

A DISSERTATION

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Doctor of Philosophy

Coral Gables, Florida

December 2017
UNIVERSITY OF MIAMI

A dissertation submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

STRUCTURAL CHANGE: THE CASE OF CHINA

Yiran Tan

Approved:

Manuel Santos, Ph.D.
Professor of Economics

David Kelly, Ph.D.
Professor of Economics

Chunzan Wu, Ph.D.
Assistant Professor of Economics

Guillermo Prado, Ph.D.
Dean of the Graduate School

Zhigang Feng, Ph.D.
Assistant Professor of Economics
University of Nebraska Omaha
This paper studies a case of China in the perspective of structural change and industrial revolution. According to industrial revolution theory of Wen (2015), China is at the completion stage of its second industrial revolution and needs to finish agricultural mechanization. Comparing China’s economic structure and agricultural productivity to those of Japan and South Korea, this paper confirms that China has been through the first and second industrial revolution and is on the point of starting the mechanization of its agriculture. The main findings include (1) there exists a similar pattern of economic development in China, South Korea, and Japan. (2) I observe high saving rates in China and Korea during their early developmental stage, and offer the behavior pattern of the first-generation workers as a potential explanation. (3) Industrial structure does not change much after 2000 in China. I believe the development of the first industrial revolution gradually forms the industrial structure of the second industrial revolution. (4) I observe low agricultural productivity in China and identify the public land ownership as a cause of low fixed investment in agricultural production, which could be an obstacle of China’s agricultural mechanization. (5) I choose the model of Ju, Lin, and Wang (2015) to give a general description of industrialization procedure and upgrades of industrialized production.
TABLE OF CONTENTS

List of Figures................................................................................................................... iv
List of Tables .................................................................................................................... vi
Introduction..................................................................................................................... 1
Chapter 1 Structural Change of China........................................................................... 3
Chapter 2 Low Purchasing Power Problem of China ................................................. 42
Chapter 3 Model and Possible Extensions................................................................... 58
Chapter 4 Literature Review ......................................................................................... 66
Bibliography .................................................................................................................. 106
List of Figures

Figure 1 ........................................................................................................................... 4
Figure 2 ........................................................................................................................... 4
Figure 3 ........................................................................................................................... 6
Figure 4 ........................................................................................................................... 6
Figure 5 ........................................................................................................................... 7
Figure 6 ........................................................................................................................... 9
Figure 7 ........................................................................................................................... 9
Figure 8 ........................................................................................................................... 10
Figure 9 ........................................................................................................................... 10
Figure 10 ......................................................................................................................... 13
Figure 11 ......................................................................................................................... 14
Figure 12 ......................................................................................................................... 15
Figure 13 ......................................................................................................................... 15
Figure 14 ......................................................................................................................... 16
Figure 15 ......................................................................................................................... 17
Figure 16 ......................................................................................................................... 17
Figure 17 ......................................................................................................................... 19
Figure 18 ......................................................................................................................... 19
Figure 19 ......................................................................................................................... 20
Figure 20 ......................................................................................................................... 23
Figure 21 ......................................................................................................................... 25
Figure 22 ......................................................................................................................... 26
Figure 23 ......................................................................................................................... 27
Figure 24 ......................................................................................................................... 29
Figure 25 ......................................................................................................................... 29
Figure 26 ......................................................................................................................... 30
Figure 27 ......................................................................................................................... 30
Figure 28 ......................................................................................................................... 32
Figure 29 ......................................................................................................................... 33
Figure 30 ......................................................................................................................... 33
Figure 31 ......................................................................................................................... 35
Figure 32 ......................................................................................................................... 37
Figure 33 ......................................................................................................................... 39
Figure 34 ......................................................................................................................... 40
Figure 35 ......................................................................................................................... 42
Figure 36 ......................................................................................................................... 43
Figure 37 ......................................................................................................................... 44
Figure 38 ......................................................................................................................... 45
Figure 39 ......................................................................................................................... 45
Figure 40 ......................................................................................................................... 46
Figure 41 ......................................................................................................................... 47
Figure 42 ......................................................................................................................... 47
Figure 43 ......................................................................................................................... 60
Figure 44 ........................................................................................................................... 61
Figure 45 ........................................................................................................................... 63
Figure 46 ........................................................................................................................... 77
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>85</td>
</tr>
<tr>
<td>Table 2</td>
<td>85</td>
</tr>
<tr>
<td>Table 3</td>
<td>87</td>
</tr>
<tr>
<td>Table 4</td>
<td>92</td>
</tr>
</tbody>
</table>
Introduction

Through industrializations since 1700, economic development brings wealth to human society, but not every country experiences the same speed of economic growth. Out of the 195 countries in the world, only less than 30 countries are developed countries. As a student in Economics, I want to explore:

1) Why some economies are rich and well developed?
2) Why most of the countries in the word are poor and under-developed?
3) Is there a general path of economic development by which a poor country could follow and become rich gradually?

In this thesis, I study the economic development of China since 1978 and compare China’s economic development with that of Korea and Japan to show that there is a general path of economic development. Therefore, my answer to question 3) is yes. Question 1) is also partially answered by this general developmental path. I leave question 2) unanswered. After studying economic development, I learn that it is much easier to give a definition of a healthy person (an economy) and his normal body functions than to point out the reasons for the specific illness of a patient (an economy).

I am excited to share with you my study on this developmental topic. First, I introduce the stage-theory of economic development (Wen, 2015). Second, I study the developmental process of China after 1978 and compare it with the economic development process of Korea and Japan to show that a general path of industrialization does exist as Wen’s theory proposes. Lastly, I provide a model of Ju et al. (2015) that
describes this general process of industrialization during a country’s economic development. The literature review is at the end of this thesis.
Chapter 1 Structural Change of China

The Importance of Agricultural Transition

Temin (2002) states:

I approach the Golden Age in the context of economic growth over the past century or two, which had a large component of economic transition. National economies around 1800 with very few exceptions were almost completely agricultural. Starting in the nineteenth century and even later, productive resources were moved out of agriculture into manufacturing and services. Residents became urban, and the share of the labor force in agriculture fell. Since workers were more productive in non-agricultural activities, national income grew during this transition. (p. 9)

I agree with this statement and I believe that labor is the only meaningful productive resource during this transition, since the volume of capital is negligible in an agrarian society. Therefore, I choose to use the percentage of a country’s rural population as a measure of its developmental stage. In this thesis, I explore the general characteristics and mechanism of an agrarian economy’s industrialization process.

In an agrarian society, more than 80% of a country’s population lives in rural areas. I believe the essence of economic development (industrialization) is a process that utilizes rural agricultural labor force and transforms them into industrial and service sectors. Thus, I use urbanization rate as a threshold to select sample countries in my study of economic
development. The following figure shows the urban population rate from 1960 to 2015 of all the OECD countries, China, India, and Russia.

**Figure 1**

![Urban Population (OECD, China, India and Russia)](image)

**Figure 2**

![Urban Population below 40% in 1960 and (Population in 2015)](image)

I want to focus on a full development process starting from an agrarian society. I could set 40% urban population in 1960 as a threshold, since other countries were well above
this threshold; the closet one was Ireland with 46.8% and Spain was at 56.6% in 1960. Slovak and Slovenia have total population of 5 million and 2 million in 2015. I choose to leave these two countries out. Thus, potential candidates become India, China, Korea, Portugal, and Turkey.

I choose not to include Portugal and Turkey in this study since the economic data of Portugal is not available before 1995 and it seems that Turkey’s political system is not very stable. In my study, China is my main interest. I will compare the development of China with that Korea and Japan since all three countries followed a manufacturing and exporting oriented developmental strategy. India’s urban population rate is still at 32% in 2015, thus a direct pairwise comparison of economic development between China and India is difficult.

The emerging of China has influence all over the world. I am interested in how China’s real GDP per capita increases from $307 in 1978, which is the year China opens its economy, to $6497 in 2015, a 21-time increase in 37 years. Is this a special event that is only specific for China and is there a general path of development that every successful country follows? The following graphs compare the development of China and India, each country in 2017 accounts for 18% of the world population. China accounts for 18.4% and India accounts for 17.7%.
I choose the starting year of China at 1978 because China opens its economy at 1978 through its “reform and opening policy”. The starting year of other countries in this paper is 1960 because the World Bank provides data since 1960.
From the above two graphs, I could make the following comparison between China and India. I connect the developmental trend of India to that of China, and left a blank space in between. The left-side trend is India 1960 to 2015, and the right-side trend is China 2000 to 2015. All the measures match well. In terms of GDP per capita, urban population, Gross Fixed capital formation, employment in agriculture, and agriculture value added, India in 2015 is at the same level of China in 2000.

However, taking a close look at the two graphs on the previous page, I could observe that China increases GDP per capital from $307 to $1771 in 22 years from 1978 to 2000, and India increases GDP per capital from $307 to $1750 in 55 years from 1960 to 2015. Making the same comparison of the urban population rate, China increases the rate from 17.9% to 36% in 22 years from 1978 to 2000, and India increases the rate from 17.9% to 33% in 55 years from 1960 to 2015.
It takes China 22 years to achieve the economic development that India makes in 55 years. Therefore, in the above graph, China shortens the left-side developmental trend into 22 year, instead of using 55 years by India. Thus, I believe that China achieves a relatively fast economic development after its opening of economy in 1978. The quick-developed countries in the last 50 years also include Korea and Japan. Then, is there a general path of development that these fast-developed countries follow?

The stage-theory of economic development of Wen (2015) provides a general path of economic development. This theory divides economic development into different stages and these stages are separated by three different industrial revolutions. First, an economy is in a status that there are no modern manufacturing sectors and most of its population is agricultural workers living in rural area. There is no organization of rural population for production in this stage. The agricultural workers are like unorganized molecules wandering around. An economy in this stage is an agrarian society before industrial revolutions change its economic structure.

I believe the whole process of industrial revolutions is a procedure that exploits these unorganized agricultural workers in an agrarian society, transforms them into manufacturing and accompanying service workers, and increases their productivity and value added. During this process of exploiting idle agricultural workers and gathering them in the industrialized production, I observe both fast urbanization and high investment rate. The expansion of cities and new industries simply call for fast capital accumulation. The following graphs show a general transformation path of decreasing
rural workers and the share of agricultural value added, and increasing urbanization rate during the process of economic development of China, Japan, Korea, and India.

Figure 6

China 1978-2015

Figure 7

Korea
I observe that all countries experience high Gross Fixed Capital Formation (GFCF) well above 30% during their fast developmental stage. Only India’s GFCF is below 30%
before 2004, I think this is due to the fact that the development of India is very slow and takes 55 years to reach such an economic level instead of 22 years by China. I use India here as a counter example.

The stage-theory of economic development (Wen, 2015) includes three industrial revolutions. During the first industrial revolution, rural workers are organized to produce labor-intensive goods such as textile, clothing, footwear, furniture, etc. As production volume increases and the market expands, owners of the rural production accumulate more capital and start to invest in machinery to achieve better productivity. During this process, the increased production also increases wages of rural workers. This larger quantity of products also calls for a better infrastructure to support transportation of both raw materials and final goods. Fast urbanization is not observed at the beginning of the first industrial revolution process since most capital owners only hires rural workers for their part-time production and the cost of building a fixed facility in urban areas is too high. The completion of this stage includes the mechanization of the production of light-consumer goods. At the end of the first industrial revolution, a country experiences the boom of railroad and steel industries; this is due to the increasing need of transportation capacity for delivering the large quantity of raw materials, intermediate goods, and final goods produced by mechanization. This boom of railroad and steel industries also activates the second industrial revolution.

The main features of the second industrial revolution are the production of industrial goods and further mechanization of the production of those industrial goods. This
production and mechanization of the production are the general features of every industrial revolution, but the targeting goods are different in each industrial revolution. The production of these goods and further urbanization gradually transform more agricultural workers into industrial and service sectors. In the second industrial revolution, these goods include coal, chemical, cement, electricity, energy, steel, railroads, electronics, automobile, etc. During this industrial revolution, we still observe the expansion of market and infrastructure, the deepening of market, and the increase of productivity and income. At the same time, we also witness fast urbanization and city extension during this stage because production locations have moved to urban areas. According to the experience of developed countries such as UK, US, Japan, Korea, etc., this theory defines the completion of mechanization of agriculture, and the beginning of mechanization of financial sector as the end of the second industrial revolution. Only through the completion of agricultural mechanization, a country will experience a welfare stage, since food prices will go down and thus the whole price system will become stable. The relative food price goes down during this stage because capital investments industrialize the agriculture industry and makes the agricultural productivity increase rapidly. I will discuss the difference of agricultural productivity for different countries in a later section. Finally, the third industrial revolution is about information mechanization and it is not the focus of this essay.

To test this theory of economic development, I compare different countries at the same developmental stage. Newly developed countries include Japan and Korea. The early stage of development of other developed countries such as UK and US was a few
hundred years ago; no detailed data is available for them. The data I use is from the World Bank and the starting point is 1960.

First, I divide GDP into: agriculture, manufacturing, other industries (industry minus manufacture), and services, where other industries include mining (M), construction (C), electricity (E), water (W), and gas (G). In the following figures, I connect 1960-2015 China data and 1960-2015 Japan data together. The blank space in the middle is due to the lack of Japanese data in the early period. I can see that if China’s economic success could continue, then it should converge to an economic structure similar to that of Japan. The orange line is urbanization and there is a jump of 7.7% between 2015 China and 1960 Japan.

Add in real GDP per capita using the right axis, I have:
The real GDP per capita at the joint is $6416 for 2015 China and $8369 for 1960 Japan, a difference of $1953. There is also a 55-year gap between the two comparison points, thus a difference of $1953 in real value might be acceptable.

The following graphs make a similar comparison between Japan and Korea. Since the trends match so well, I make one-year blank space between the two lines. The only big gap is a 6.3% difference on urban population.
Remove the blank space in between and add in GDP per capita, I have:

Everything matches including real GDP per capita. The gap between real GDP per capita at the joint is only $240. I think the higher value added of MCEWG in 1980 Japan might explain its lower urban population to some extent; MCEWG is 11.9% in 1980 Japan and
is 8.5% in 2015 Korea. Higher utility cost might decrease the rate of urbanization. Next, I make a comparison between China and Korea:

*Figure 14*

The trend of economic transition is clear on the graph. The only structural difference is that Korea experienced higher urbanization than did China and Japan.

The following graph makes comparison on other aspects of these three economies.
Japan’s imports and exports are lower than Korea at the similar developmental stage. Population difference may explain this trade gap between Korea and Japan. Japan’s population was 117 millions in 1980 and Korea is 51 millions in 2016. Decreasing transportation cost could be another reason. China’s larger population could not lead to lower trade as in Japan because GDP per capita of China is only $6400 in 2015, thus China’s domestic market is not fully developed. I also observe lower consumption and higher savings that is more than 50% in China at the similar developmental stage.

In the following graphs, I add in India as a counter example of a normal developmental path. In the first graph, we could see that manufacturing value added is only 16.6% in India in 2015, and it is 32% in China in 2000. In the second graph, we observe that India is the only country has a continued trade deficit. Its import percentage of GDP (green line) consistently lies above its export percentage of GDP (purple line) in 52 out 56 years, and the trade surpluses of the other 4 years are all less than 1% of GDP. I believe that India does not follow a normal industrial path by effectively transforming its agricultural workers into manufacturing sector. Thus, India’s manufacturing goods are uncompetitive, leading to this continued trade deficit.
I believe that when an agrarian society could not effectively transform its agricultural workers into manufacturing sector and achieve sustained increases in productivity and income, the choice of how to distribute its limited income between saving and consumption is not very important. For example, in the case of India, the increasing of gross domestic savings is beneficial, but the positive effect on its development is not obvious since its manufacturing sector is still under-developed and income per capita remains low.

On the following graph, the trend of savings and gross fixed capital formation is positively correlated. In the case of China, Korea, and Japan, I think that the gross fixed capital formation (the net increase in physical assets) is more related to their manufacturing industries than in the case of India, where the capital formation could concentrate more in other sectors of India’s economy.

*Figure 19*
The Importance of Trade

I think that trade is a beneficial channel for a latecomer of industrialization and that trade with developed countries provides a well-developed external market for a latecomer’s manufactured goods.

I believe that the development of market takes time. It took UK more than 100 years after 1700 to ferment its market of supply and demand to make mass production of light consumer goods feasible. However, a latecomer of industrialization could exploit existing external markets for free. Using its less productive and thus cheaper labor force as an advantage, a latecomer of industrialization always captures the external markets, using it to further accelerate both the transformation and the training of domestic agricultural labor force into other industries. The sequence of capture of external markets is obvious from the experience of Japan, Korea, Taiwan, and China. First, these latecomers take the foreign market of light consumer goods. Then, they gradually become an important supplier of electronics and other more skill and capital-intensive goods. Finally, they evolve to become a supplier of capital-intensive goods, such as cars, machinery, technology and service goods. The influence of a latecomer to the world market depends on the size of that country. For example, the world commodity prices increase continuously after China becomes an important player of the world economy in 2000. There is not a similar level of influence from the rise of Japan, Korea, and Taiwan because of their relatively small size to the world economy. This process of replacement of suppliers is continuous. Taking the market of light consumer goods as an example,
Vietnam, Indonesia, and other Asian countries have joined the world market and gained market shares from China because of their lower labor costs.

Therefore, as a country climbs up the industrialization ladder and becomes more productive, its wage will increase with its productivity. This country will lose market shares of less capital and knowledge-based markets to a newcomer due to the fact that the newcomer is less developed, less productive, and has a lower labor cost. I believe the exploitation of external markets works as an accelerator for a country’s industrialization process by cutting the necessary time of domestic market development.

High Saving Rate of China

Bai and Qian (2009) and Wen (2011) study the high saving rate of China. The household saving rate is defined in their papers as the ratio of net changes in aggregate household financial wealth to aggregate household disposable income. Aggregate household financial wealth includes bank deposit, government bonds, and stocks. This definition does not include changes in household nonfinancial wealth such as housing investment.
I use data of Bai and Qian (2009) to draw the above figure. The obvious upward trend of household saving rate, from 2.5% in 1978 to 27% in 1994, happen within the period of China’s proto-industrialization and first industrialization between 1978 and 1994. After the over supply of production capacity of labor-intensive goods occurred in 1995, the household saving rate dropped gradually from 27% in 1994 to 14.4% in 2000.

The potential usage of disposable income includes consumption, investment (such as buying a house), and saving as defined in this chart (financial wealth). Why consumption and household investment increase much slower than saving? China’s economy grows by 2.4 times between 1978 and 1994. Real GDP per capita increases from $320 to $1100. Why consumption does not take the dominant position when disposable income increases rapidly during this period?
I think the answer of the low consumption is the attitude of the first-generation producers or workers. Before 1978, China is an agrarian society. After reform and opening in 1978, the mechanism of market starts to function. Rural workers were gradually gathered to produce light-consumer goods, market deepened with buy and sell, and production owners started to accumulate capital. However, the agrarian mindset, logic and behavior pattern still existed in the labor and capital owners. The previous life experience and agrarian thinking and mindset still dominated Chinese’s behavior. Thus, saving increased persistently in consumer’s disposable income from 2% to 27% during this period. I think the safety threshold of Chinese first-generation producers (or workers) should be higher than 27% because the upward saving trend was interrupted by the first over-supply production capacity of light-consumer goods in 1995 and a big layoff involving more than 20 million workers of state-owned enterprises happened between 1998 and 2000. After saving rate hit 14% at 2000, it increased to 25% in 2004. I believe this increase is due to the fact that employment structure and sectorial structure had rebalanced and adjusted between 1995 and 2000, which means economic environment and employment stabilized again. Later I will show that the trend of assets and sales of China’s industrial sector between 2000 and 2014 support this viewpoint that China’s industrial structure is very stable after 2000.

The following graph shows the consumption trends of China, Korea, and Japan in comparable developmental stages. We can see that China’s household consumption was 37% in 2015, and that of Korea was 52% in 1986. I think China’s consumption of 37%
was low relative to its developmental stage, even though Korea’s urbanization rate was 13% higher. (Korea’s 67% in 1986 and China’s 55% in 2015)

*Figure 21*

Then, when will China’s consumption increase? I think the main contributors to China’s consumption will be the children of the first-generation producers (or workers), because these children were born in a wealthier society and mostly in a city environment, which is totally different from the agrarian society before 1978. At the same time, when these children grew up, the wealth of Chinese society and households increased rapidly. Real GDP per capital increased more than 20 times between 1978 and 2014. Therefore, I think it is the differences in ideology and agrarian mindset actually explain the high saving rate of China. This high saving rate pattern of first-generation producers after an agrarian society is not unique. Bai and Qian (2009) and Wen (2015) document the same pattern during Korea’s proto-industrialization and first industrialization between 1961 and 1977. The following picture shows this similarity.
From the above quoted figure (Wang & Wen, 2011, p. 68), We can see that Korea reached 18% saving rate in 1977, then dropped to 8% in 1979. Then gradually increased to 25% in 1988. After studying Korea’s economic development after the Second World War, I think the period around 1977 could be the time of the first over-supply of production capacity of light-consumer goods in Korea. Similarly to China’s trend after 2000, through a structural adjustment and rebalance, the second industrialization started and industrial goods became the main engine of Korea’s economy after this rebalance, and then saving rate started to increase again in Korea after 1979. I think these assumptions could make sense, since previous section finds out that Korea in 1986 is similar to China in 2015, and China’s first oversupply happened at 1995. We know that the demand of world textile and light-consumer good market went down in late 1970s and this demand shock could be one of the main causes of the restructure of Korea’s textile industry. The following figure compares the growth rates of China and Korea.
The economic development of Korea started after the 1961 military coup. The average growth rate of Korea between 1961 and 1977 was 9.5%. The average growth rate of China between 1979 and 1995 was 10%. Both are 17-year periods. If Korea’s first over-supply of production capacity happened in 1977, then similar growth rates of a 17-year period exist in both China and Korea before the end of the first industrialization. At least I observe a very similar growth trend during proto-industrialization and the first industrialization in these two countries.

After making comparison among these countries, I think the structure change theory is applicable for these countries and a general industrialization path does exist, at least in Japan, Korea, and China. I will further check different developmental stages, such as the start of organizing rural workers at the beginning of the first industrial revolution to produce light consumer goods, then the rise of coal, steel, cement, electricity, energy and transportation sectors, and after that the emerging of electronics, machinery, and
automobile production. It is worth mentioning that in China’s development, I observe over-supply of production capacity at the end of each industrial revolution. The first over-supply of production capacity of textile and other light-consumer goods happened in 1995. The second over-supply of production capacity of industrial goods such as steel, cement, coal, and etc. is happening from 2015 until now, and forcing the Chinese government to take a project of supply-side reform since 2015.

Employment Changes of China

The economic structure of Japan in 1960 is similar to that of China in 2015. I could not compare the structural change of sector employment between China and Japan, since the World Bank sector employment data starts from 1980. I could make a comparison between China and Korea because the economic structure of China in 2015 is similar to that of Korea in 1986. The sector employment data is from the Bureau of Statistics of China, the World Bank data of employment of China is also from this source, but it uses a wrong row for the recent years. The 2015 sector employment data of China is not available yet. Comparing China 2014 with Korea 1986 is not what I want; however, the connection of two trends still shows a very close match. To make it clear, I leave a one-year blank space between the two trends.
Since the data of China ends in 2014 instead of 2015, this makes the beginning of the Korean data from 1983 an even better fit.

Without the blank space, the transition of sector employment between China and Korea is very smooth, even though the urban population gap is 8%.
In China, I observe an efficient utilization of idle agricultural workers, from 70% in 1979 to 30% in 2014. Urbanization of China increased from 19% in 1979 to 54% in 2014. If the developmental trend continues, I think the economic structure of China would converge to that of Korea. What factors contributed to this urbanization trend in China? Did China’s economy provide enough jobs during this transition? The following graph shows the employment trend.
I observe that urban employment increased by 293% and rural employment increased by 22%, and total employment increased by 88%. The population increase of China is 41% during this period. I don’t observe an obvious decrease of rural employment until 2002. The rural sector actually created jobs twice as fast as urban sector did until 1996. This observation is consistent with the new stage theory of development in that at the starting point of the first industrialization, the organizations of rural workers and production activities happen at rural areas. At the start of China’s industrialization in 1979, 24% of employment is urban workers, whereas the share is 51% in 2014.

Chinese Industrial Structure 2000-2014

I have made comparisons of China with Japan and Korea. I will continue study Chinese economic development. The detailed data of China is available from 2000 to 2014 and I will study this period in this section. Before checking the data, I assumed that I could find out a steady transition of the Chinese economy and especially in the industrial sectors during 2000-2014. The reasons that I made this assumption are that (1) the first over-supply of production capacity of labor-intensive goods happened in 1995 and the Chinese government made a supply-side reform since 1997, (2) after 1995, manufactured goods of the second industrial revolution, such goods including coal, chemical, cement, electricity, energy, steel, railroads, electronics, automobile, etc. took a leading position in Chinese economy, and this is the time period China became a world factory. Therefore, I think that the expansion of China’s economy should consistently focus on these industries after 2000.
First, the following figure gives a general description of the development of China. The urban population increased from 17.9% in 1978 to 55.6% in 2015. Real GDP per capita increased around 20 times and it reached $6400 in 2015. Services value added increased from 22% in 1978 to 50% in 2015. Manufacturing decreased from 40% in 1978 to 30% in 2013. Agriculture decreased from 28% in 1978 to 9% in 2015.

After a general description, I will now focus on the structural change of the industrial sectors of China. The following value added data and later detailed sector data is from the Bureau of Statistics of China.
The nominal valued-added of industry (manufacturing + MCEWG) increased from 0.55 trillion US dollars in 2000 to 4.45 trillion US dollars in 2014, an increase of 8.1 times (I use the exchange rate in December of every year).
The percentage of industry value-added in GDP decreased from 45.5% in 2000 to 43.1% in 2014, a 2.4% decrease. The relative percentage of industry is stable, even though the size of the industrial sector is 8.1 times larger. Therefore, I do not observe a substantial increase of the relative size of industry compared to agriculture and services. Then, I move on to explore what happened in the specific sectors of industry, to see whether drastic transitions happened within the industry. I will check both assets and sales data of different sectors within the industry. The following figure shows assets of different industrial sectors in percentages from 2000 to 2014.
Figure 31
There are no big structural changes within the industry sectors during this period. The changes larger than 2% include production and supply of electric power, heat, and water, which decreased from 15% in 2000 to 12% in 2014; the manufacturing of textiles decreased from 5% in 2000 to 3% in 2014; mining and washing of coal, and the mining of other ores, increased from 3% in 2000 to 6% in 2014. Therefore, after 2000, I only observe that the coal production and the production of electricity increased by 5% in total, while textile production decreased by 2%. Assets of all other sectors were relatively stable even though they experienced an average increase of 7.6 times.

I think that these observations are consistent with using a bundle of industries representing by increasing per capita capital \((K/L)\) in the modeling section, where industries keep upgrading their products with a relatively stable structure.
The following figure shows industrial sales in percentages from 2000 to 2014.

*Figure 32*
The pattern of industrial sales is very similar to that of assets from 2000 to 2014. The changes larger than 2% include production and supply of electric power, heat, and water decreased from 8.7% in 2000 to 5% in 2014; the manufacturing of textiles decreased from 5.7% in 2000 to 3.5% in 2014; mining and washing of coal, and the mining of other ores increased from 1% in 2000 to 3% in 2014. Sales of all other sectors were relatively stable even though they experienced an average increase of 13 times.

A drastic transition of industrial sectors did not happen from 2000 to 2014. I find that the industrial development of China after 2000 is an extension on a well-structured industrial foundation. This balanced foundation must be established from previous economic development. China’s development starts from 1979. I know that the first over-supply of production capacity of labor-intensive goods happened in 1995, and the Chinese government made a supply-side reform in 1997. Thus, I think its first industrial revolution would have ended a few years later than 1995. I can infer that during its first industrial revolution, China established a well-structured industrial foundation. I will further explore the transition of China in the first industrial revolution.

The following figure shows the change of sector employment and urbanization in China from 1979 to 2000. I observe that (1) industry employment and service employment increased together since the very beginning of development. I think the service sectors served industrial sectors and they also provided alternative jobs for rural workers, since urban population kept increasing from 19% in 1979 to 36% in 2000 and the agricultural employment decreased from 69% in 1979 to 50% in 2000. (2) The overlap of the red and
green line happened in 1994. This is very close to the time of the first over-supply of production capacity. I could think of this period as the ending of the first industrial revolution. The figure shows that service employment first was led by industrial employment and finally exceeded industrial employment at the end of the first industrial revolution. I think this pattern could be one of the features of this specific developmental stage.

*Figure 33*

A similar overlap probably happened in South Korea’s industrialization, but its sector employment data only starts from 1980. I have the following figure for Korea.
I think that a similar intersection of red and green lines existed in Korean data before 1980, since the urban population already reached 56% in 1980 and based on the observations on Japan, China, and Korea, urbanization rate and service sector increase together continuously during the process of economic development.

I believe that the process of development during the first industrial revolution forms an industrial structure for the second industrial revolution. However, in the case of China, I don’t have detailed data before 2000. I think the reason could be that during the first industrial revolution, a country actually transforms from an under-developed agrarian society to a developing country, and wealth and developmental stage at this specific period do not allow for the proper functioning of a systematic statistical system and accounting system. I assume this lack of detailed data problem during this initial stage of
development could be a common phenomenon in every country due to the constraint of wealth and under-development.
Chapter 2 Low Purchasing Power Problem of China

In this part of the essay, I discuss that the low purchasing power of GDP per capita in China is due to the low productivity of the Chinese agricultural industry; this low productivity is caused by the public ownership of land in China. I believe that this public ownership of land will further postpone the beginning of agricultural industrialization in China, leading to continuous cycles of increase of domestic price level. This increasing trend of price level may further damage social stability in China.

The above issue can be seen from my comparison study of India, China, and other economies. In the following figure, the dark colors represent real GDPs. For example, light green and dark green represent nominal and real GDP per capita of Japan, respectively.

Figure 35
This figure shows that China has a continuous problem of low purchasing power.

The following figure shows that in China 2014, nominal GDP per capita is $7590 and real GDP per capita is $3862. Why is the purchasing value in China so low? Why is China’s price level and price structure so high compared to the US, Japan, Korea, and even much-less-developed India?

Based on the comparison of China with South Korea and Japan in essay part (1), I observe that Japan in 1960 is similar to China in 2015, and South Korea in 1986 is similar to China in 2015. With a similar analysis, I find that India’s development is at least 15 years behind the development of China in 2015. Thus, my question is why does China have the lowest purchasing power compared to both more advanced countries and less developed India? I believe that the low agricultural productivity of China may explain this issue. Next figure shows the agriculture value added per worker in different countries.
In 2013, the World Bank data shows that agriculture value added per worker is $70,000 in the US, $50,700 in Japan, and $28,800 in 2014 Korea. In 2014, agriculture value added per worker is $790 in China and $715 in India. The following graph shows China’s agriculture productivity is low in a comparable developmental stage. I use constant 2010 US dollar in this graph because I divide comparable developmental stages between countries in part (i) based on 2010 US dollar.
I observe that the agriculture productivity of China is flat and does not increase with its income. The following figure shows Korea’s agriculture productivity increases with its income between 1980 and 2014.
From the following figure, I can see that before 2011, the agriculture productivity in China is even less than that of India.

**Figure 40**

![Agriculture value added per worker (constant 2005 US$)](image)

The next section will compare the economic structure of China with that of India and show that India has not experienced any industrialization.

India and China

The following figures compare China and India. The GDP data uses the left axis and all other data uses the right axis in percentage. I can see that India has not experienced any mechanization in its manufacturing sector. The increasing gap between industry sector and manufacturing sector is mainly due to its increasing production of fuels for consumption and export. Thus, based on the stage-theory of economic development (Wen, 2015), India has not started the first industrial revolution since its manufacturing is only
17% of the GDP. The red lines represent the percentage of agricultural workers in the total labor force.

**Figure 41**

![Graph showing employment and GDP growth for China 1960-2014](image)

**Figure 42**

![Graph showing employment and GDP growth for India 1960-2014](image)

I observe that China’s agriculture workers is 30% in 2014, while India’s is 50% in 2013, although these two countries have very similar individual agricultural productivities and total population. From 1978 to 2014, real GDP per capita of China increased from $195
to $3862, an increase of 18.8 times, and at the same time China’s nominal GDP per capita increased from $155 to $7590, an increase of 47.9 times. I believe the true growth should have been some number between 18.8 times and 47.9 times. However, during 1980-2014 the real agricultural productivity per worker in China increased from $220 to $790, only an increase of 2.58 times. This small increase is also accompanied by a decrease of agricultural population from 70.5% to 29.5%.

Since 1978, China experienced an increase in income somewhere between 18.8 to 47.9 times, and with only a 2.58 times increase of agriculture productivity per worker accompanied by a huge loss of agricultural workers. I believe these two occurrences could have resulted in a continuous imbalance of supply and demand of agricultural products in China. This imbalance would lead to price increases of agricultural products, and then further price increases in all other commodities. This cycle of increases of price would be continuous due to the steady increase in productivity and income during this period. Therefore, I believe the low purchasing power of real GDP per capita in China is a price-structure-imbalance phenomenon caused by low agricultural productivity per worker, decrease of agriculture workers, and continuous increase of productivity and income altogether.

Then, why did China only have an agricultural productivity per worker of $790, while less-developed India had a very close one of $710? I believe this is due to the public ownership of land in China. Even today, the principle of collectively owned land is being applied in China, in which the village level governments allocate the arable lands to its
rural residents, and a reallocation of plots of land happens every two to three years. Because the allocated plots of land are relatively small for each individual or household, there is no incentive for making long-term capital investments to achieve production of scale. This means that the mechanization of agriculture could not begin. The uncertainty caused by reallocations also serves as a disincentive to capital investments. At the same time, after “the reform and opening” in 1978, the Chinese people experienced a steady increase in productivity and income, a greater demand of rural workers from manufacturing and service sectors (which leads to a decreasing trend of agricultural workers), and thus an acceleration in urbanization. All these phenomena are very attractive to rural residents (or agricultural workers), so farmers do not want to remain in agriculture anymore. Thus, the current situation is that rural labor force is working in cities and leasing their arable land to those who want to engage in the farming business. For example, city investors who want to do this business could lease arable lands from rural residents who work and live in the cities but still maintain their rural residency and still “own” the allocated arable land due to China’s household registration system. When the leased lands become large enough and joined to form a land block, the investors could invest in large agricultural machineries to increase production efficiency and also cut production cost. These fixed investments form a very large portion of agricultural investment, such as thermostatic warehouses and irrigation facilities. However, the city investors prefer not to make such fixed investments due to the uncertainty of land leasing. For example, a leasing contract is signed between an investor and hundreds of individual farmers. The subsequent term of land leasing fee depends on the market situation for the upcoming year. When an investor’s profit becomes large due to capital investment and
production of scale, a farmer could always increase the rent in order to capture a large portion of that profit or even retake his land. This would make the fixed investment of big machinery, warehouse and other facilities a total loss. Thus, this reap-without-sowing behavior of rural residents becomes a great obstacle of agricultural mechanization in China. Due to this reason, in the last several years, there are many cases where Chinese investor groups paid billions of US dollars to lease land in Russia to do agriculture and stockbreeding because Chinese land is not a profitable resource of agriculture production. All these problems are caused by the public ownership of land, which interrupt the normal functioning of land as a resource of agricultural production.

In this situation, can China still finish its agriculture mechanization and complete its second industrial revolution? I think agricultural investments would still take place when the prices of agricultural products become high enough. However, such high prices could be very dangerous to an economy. For example, to reach such high prices of agricultural products, the market will experience many more rounds of the price-increasing cycles that first happen on agricultural products and then pass to all other commodities. Since there has been no clear sign of agricultural mechanization in China, we do not have an idea of how high the prices of agricultural products need to be for China to successfully finish the agriculture industrialization on the base of public ownership of land.

Why is the agriculture industrialization so important and leads to the welfare stage of capitalistic industrialization? According to history and the stage-theory of economic development (Wen, 2015), agriculture industrialization or mechanization is the last stage
of the second industrial revolution. This means that agriculture is actually the last choice of capital investment. Before this stage, capital has industrialized (or mechanized) handicraft industry, light industry, heavy industry, infrastructure and all other industries except the intangible finance. This process of industrializations has continuously increased productivity for all these sectors, and these improvements of productivity manifest in the form of huge increases of individual productivity and income, urbanization, the loss of agriculture workers and other accompanying phenomena. Therefore, during the process of industrialization, the increase of individual productivity (and income) and the low agricultural productivity is a natural contradiction. I believe this contradiction could not be solved before the completion of agricultural mechanization. The governments of developing countries tend to avoid using imports of agricultural products as a solution to this contradiction. I will discuss this issue in the following section. Therefore, only until a large-scale expansion of agricultural industrialization, workers could start to enjoy the benefits brought by a combination of low price level and high growth of income. Thus, the welfare stage of those developed countries were actually starting from the completion of agricultural mechanization.

Capital: A Critique of Political Economy by Karl Marx was published in 1867. At that time UK just started its second industrial revolution and still far from the beginning of its agriculture mechanization, which happened during the period of 1890 to 1920. Therefore, we do not see any description about the increased welfare of the whole labor force in his book. Mr. Marx made his suggestion of public ownership or communism before he could witness the welfare stage of capitalism, and he passed away in 1883.
To sum up, I think public ownership of land is a great obstacle of agricultural industrialization in China. If the Chinese government does not rectify this policy on time, the simultaneous increase of price level and productivity will not come to an end. This phenomenon will damage social stability. Under this situation, I do not know whether China could complete its agricultural mechanization and the second industrial revolution, and I do not know whether workers in China could finally enjoy the welfare stage of China’s economic development.

Why not get rid of agriculture in China?

I think that the process of industrialization is the process of transforming the agricultural workers into manufacturing and manufacturing-based service industries. The observations and experiences of new developed Asian countries after the World War II show that labor-intensive production of light consumer goods is a healthy way to absorb these agricultural workers and possibly the only way to use the low-wage comparative advantage of a less-developed country.

The previous section shows that the Chinese agricultural productivity is very low and thus the relative price of agricultural products is high. Then, why a developing country does not get rid of its agricultural sector in a developmental stage similar to China today?

First, I think we need to recognize that this process of agricultural transition is gradual and time-consuming. It takes China 35 years to decrease its rural population from 81% to
46% (1979-2014). It takes 35 years Korea year to decrease its rural population from 72% to 22% (1960-1995). It takes Japan 15 years to decrease its rural population from 37% to 25% (1960-1975). All these countries achieve this “slow” transformation even with the help of exporting to external markets.

Second, in a government’s perspective, a fast transformation is definitely a good thing in term of economic development, but the economic stability and agricultural self-dependence are much more important. I observe that all these governments choose to use policies to protect their agricultural industry and thus agricultural jobs, because they do not want to simply open the domestic agricultural markets and let cheap foreign products flow in at a speed that is faster than their internal agricultural transformation could absorb. This would cause large-scale unemployment in agriculture sector and damage the stability of an economy. For example, the Chinese government uses subsidies, government-set price floors, quota and tariffs (3% within quota, 65% outside quota, and 180% on countries without most-favored-nation treatment) even after joined the WTO in 2001. One of the main principles of Chinese economic policy is to maintain the agricultural self-dependence.

I think there are two forces driving agricultural workers outside rural areas. The first force is the increasing productivity and thus higher wages in the manufacturing and manufacturing-supporting service sectors. This is the main driving force in China after reform and opening in 1978. I believe the second force happens when the industrialization of agriculture starts; this process will drive agricultural workers out of
rural areas because it makes agricultural production more capital-intensive and thus needs much fewer workers per land unit. The previous section shows that this could not happen in China due to the investor’s uncertainty based on the public land ownership. The Chinese government is aware of this obstacle and tries to make reforms in October 2017. It brings up a principle of “three power splits” that separates the ownership right, the contract right, and the management right. The ownership of land is still collective or owned by the country. The contract right is given to the farmer household that is assigned a plot of land. The management right is given to the person who rents lands to do agricultural production. In this way, the Chinese government hopes that the property right of renting farming lands could be more certain and clear, thus increasing agricultural investments. In October 2017, this principle of “three power splits” is just at an early stage. The Chinese central government requires local governments to assign the proper contract right to rural households within three years.

I do not think this principle of “three power splits” will have the expected effects to attract more investments in Chinese agriculture, since this is only a remedy on the problematic public ownership of land and it adds more loops in a simple uncertainty problem of land property right. The contract right, if operates properly, fixes a farmer’s uncertainty about reassignments of his plot of land every few years. However, the management right would not solve an investor’s uncertainty of profit distribution. A farmer or a group of farmers could still call back their plots of land or simply choose to interrupt the agricultural production of a land renter. Therefore, I think this new principle of “three power splits” could not solve the land ownership problem of China. I believe
that it is difficult to make policy recommendations on a problem of uncertain property right, especially in the case of Chinese agriculture that land is the main input of production. The Chinese government’s 2017 “three power splits” policy tries to avoid this underlying public-ownership problem by adding more loops and layers in market transactions. This policy adds in more certainty on the land allocation of a farmer, but still does not solve an investor’ uncertainty of profit distribution. I think the only valid way to solve this agricultural issue of China is to remove the barrier of public ownership of land. This is very difficult from Chinese government’s perspective, because this public ownership of land is a very fundamental principle of socialism. However, we all witness China’s great economic achievements after Chinese government removed the barrier of public ownership of assets and allowed the markets to function in 1978. Therefore, I believe that a policy that could remove the barrier of public land ownership and let agricultural markets function normally would solve this low-productivity and low-investment problem of China’s agriculture.

Similar Studies and Contributions of This Thesis

Similar studies to this thesis include Wen (2015), Akamatsu (1962), and two series papers by Costa, Kehoe, and Raveendranathan (2016a, 2016b).

Wen (2015) provides a general framework of economic development based on the process of industrialization. I use this framework in this case study of China. The contribution this thesis makes upon Wen’s 2015 study includes 1) I further look into the
structure changes of China and make comparison with Korea and Japan to illustrate that there exists a general path of industrial development as Wen suggested in his 2015 study, 2) I propose the behavior pattern of the first-generation workers as a potential explanation on the high saving rates observed in both Korea and China, 3) based on the experience of China, I points out that there exists a over-supply stage at the end of each industrial revolution, 4) I observe that the industrial structure of China does not change much after 2000. I think that the development of the first industrial revolution gradually forms the industrial structure of the second industrial revolution, and 5) I point out the low agricultural productivity in China and identify the public land ownership as a cause of low fixed investment in agricultural production, which could be an obstacle of China’s agricultural mechanization.

I think that Akamatsu (1962) is an earlier and less comprehensive form of Wen’s general framework. Akamatsu’s 1962 study is a case study of Japan between 1870 and World War II. Akamatsu (1962) proposes the circle of first imports, then domestic production, and finally exports of a manufactured good based on the developmental experience of Japan after 1870. This thesis contributes to Akamatsu’s study by providing more detailed observations on the development of China. The developmental framework used and the issues discussed in this thesis are more comprehensive than Akamatsu’s study.

The two series papers by Costa et al. (2016a, 2016b) classify countries into four stage of economic development based on consecutive growth rates. The four stages are Malthusian trap (stage 0), taking off into growth (stage 1), catching up to the economic
leader (stage 2), and joining the economic leader (stage 3). I think the propose and method of this paper series are similar to my thesis but lack a general framework to guide how they should incorporate all the valuable observations to reach a conclusion I believe my study of China could be an important complement to this paper series.

Conclusion

In this essay, I examine the stage-theory of economic development (Wen, 2015) in the case of China by studying its economic transition and comparing it with Korea and Japan. There are three important viewpoints. First, there exists a similar pattern of economic development in China, Korea, and Japan. Second, I observe high saving rates in China and Korea during their early developmental stage, and propose the behavior pattern of the first-generation workers as a potential explanation. Third, a drastic structural change of industrial sectors did not happen in China after 2000 and I claim that the first industrial revolution forms a stable industrial foundation for the future development of a country. Finally, I observe low agricultural productivity in China and identify the public ownership of land as a potential cause of low fixed investment in agricultural production, which could be an obstacle of China’s agricultural mechanization.
Chapter 3 Model and Possible Extensions

In this section, I want to choose a model that describes industrialization process and the upgrade of industries. The model of Ju et al. (2015) illustrates this process of industrialization properly. I will briefly introduce the results of this model and provide possible extensions in the following model section.

I believe the essence of the industrialization is the transformation of agricultural workers into manufacturing and service industries. Once I take the total labor force of a country as given, the importance factor becomes capital per worker. This makes the $K/L$ ratio the driving force of industrialization as long as an agrarian society starts the normal transformation of its agricultural workers. I see the capital $K$ as a board measure of capital and interpret it as a mix of physical capital and human capital.

Model of Ju et al. (2015) considers an economy with infinite industries and a unit mass of identical households. Assumptions include that the endowment of each household is $L$ units of labor and $E$ units of capital.

A household consumes a composite commodity $C$. Commodity $C$ is produced by combining all the intermediate goods $c_n$, where $n \in \{0,1,2,3 \ldots \}$. Each intermediate good could be interpreted as a different industry. The function of the final commodity is

$$C = \sum_{n=0}^{\infty} \lambda_n c_n$$
Where $\lambda_n$ is the marginal productivity of good $n$ and $\lambda_n$ is assumed to be increasing in $n$.

$$U = \frac{c^{1-\sigma-1}}{1-\sigma}, \text{where } \sigma \in (0,1)$$  \hspace{1cm} (1)

The model assumes Leontief production function and all the technologies exhibit constant returns to scale. Good 0 is produced with labor only; and one unit of labor produces one unit of good 0. For production of any good $c_n$ with $n \geq 1$, both labor and capital are need:

$$F_n(k, l) = \min\left\{ \frac{k}{a_n}, l \right\}$$

$a_n$ measures the capital intensity of good $n$ and $a_n$ is increasing in $n$. All markets are perfectly competitive and the zero profit condition implies that $p_0 = w$ and $p_n = w + a_n r$ for $n \geq 1$, where $p_n$ is the price of good $n$, $r$ is the rental price of capital, and $w$ is the wage rate. Assumptions include $\lambda_n = \lambda^n, a_n = a^n, a - 1 > \lambda > 1$.

The household’s problem is to maximize (1) subject to the budget constraint $C = wL + rE$.

In the market equilibrium, this model establishes that at most two goods ($n$ and $n+1$) are produced simultaneously and these two goods have to be adjacent in the capital intensities $a_n$. This conclusion is derived from the equilibrium condition that the marginal rate of transformation (MRT) between two intermediate goods must be equal to their price ratio. The equilibrium conditions for labor and capital are:

$$c_n + c_{n+1} = L \hspace{1cm} (2)$$
\[ a^n c_n + a^{n+1} c_{n+1} = E \] (3)

The following quoted figure (Ju et al., 2015, p. 253) illustrates this market equilibrium, where capital endowment \( E \) and labor \( L \) are on the vertical and horizontal. Point \( O \) is the origin and point \( W = (L, E) \) is the endowment point. In the figure, \( a^n L < E < a^{n+1} L \), markets only produce goods \( n \) and \( n + 1 \). Based on equation (2) and (3), the market equilibrium allocations of labor and capital in good \( n \) and \( n + 1 \) are illustrated by vector \( OA \) and \( OB \) in \( OAWB \), where \( \overrightarrow{OA} = (1, a^n) c_n \) and \( \overrightarrow{OB} = (1, a^{n+1}) c_{n+1} \) are the vectors of factors used in the production of \( c_n \) and \( c_{n+1} \). When the capital increases and endowment point moves to \( W' \), the new equilibrium changes to \( OW'B'A' \) and \( c_n \) decrease from X-axis value of \( A \) to that of \( A' \) and \( c_{n+1} \) increase from X-axis of \( B \) to that of \( B' \).

This figure shows the evolvement of a higher level of capital \( E \) is to produce more of a higher quality good \( n + 1 \) and less of a lower quality good \( n \).

*Figure 43*
Static equilibrium of this model is that when $0 \leq E < aL$, $C = L + (\lambda - 1)\frac{E}{a}$, and when $a^n L \leq E < a^{n+1} L$ for $n \geq 1$, $C = \frac{\lambda^{n+1} - \lambda^n}{a^{n+1} - a^n} E + \frac{\lambda^n (a - \lambda)}{a - 1} L$.

The following proposition further explains the figure and equilibrium. Ju et al. (2015) states:

Generically, there exist only two industries whose capital intensities are the most adjacent to the aggregate capital–labor ratio, $E/L$. As $E/L$ increases, each industry $n$ ($n \geq 1$) exhibits a hump shape: the output first remains zero, then increases and reaches its peak and then declines, and finally returns to zero and is fully replaced by the industry with the next higher capital intensity. (p. 253)

The following quoted figure (Ju et al., 2009, p. 12) shows when capital endowment $E$ reaches value $aL$, good 2 enters the market, and its output increases as $E$ increases up to the point $E = a^2 L$ and then declines. At the point $E = a^3 L$, good 2 exits and a new good with quality 4 comes into the market.

*Figure 44*
In the dynamic setting, this model has two sectors in the economy: a sector producing capital goods and a sector producing consumption goods. Capital goods are produced using an AK technology $AK(t) = X(t) + E(t)$. Where $X(t)$ denotes capital investment and $E(t)$ denotes the follow of capital used to produce consumption goods at time $t$. $E(t)$ fully depreciates, so capital in the who economy accumulates as follows: $\dot{K} = X(t) - \delta K(t)$. $\delta$ is the depreciation rate. The equation becomes $\dot{K} = \xi K(t) - E(t)$, where $\xi = A - \delta$.

The social planner problem is:

$$\max \int_0^\infty \frac{C^{1-\sigma} - 1}{1-\sigma} e^{-\rho t} dt$$

subject to

$$K(t) = \xi K(t) - E(C(t)),$$

$$K(0) = K_0$$ is given.

Where $\rho$ is the time discount rate.

Industry Upgrading

In the equilibrium solution, Ju et al. (2015) solves the discounted-value Hamiltonian and shows that there exists a series of increasing constants, $\vartheta_0, \vartheta_1, \ldots, \vartheta_n, \vartheta_{n+1}, \ldots$, such that if $0 < K(0) \leq \vartheta_0$, only good 0 will be produced until capital stock reaches $\vartheta_0$; if $\vartheta_n < K(0) \leq \vartheta_{n+1}$, only goods $n$ and $n+1$ will be produced and that $K(t_n) \equiv \vartheta_n$ for any $K(0) < \vartheta_n$. This means that the economy always starts to produce good $n+1$ whenever capital stock reaches $\vartheta_n$. 
The following quoted figure (Ju et al., 2015, p. 258) shows how industries evolve over time when $K_0 \in (\theta_0, \theta_1)$. Time is on the horizontal axis and the consumption $c_n$ is on the vertical axis.

*Figure 45*

This dynamics illustrate the industrial upgrading process that I think is essential in the stage theory of economic development of Wen (2015) and my case study of China.

**Possible Extensions and Future Researches**

The model of Ju et al. (2015) uses $AK$ technology in the capital good sector:

$$ AK(t) = X(t) + E(t) $$

I think introducing the influences of the world trade or world knowledge into the production of capital could be more realistic. For example, the evolvement of technology could follow this relation:
$$X(t) = \pi \int_{A_t}^{A_{t+1}} \left( \frac{s}{W_t} \right) ds$$

$$W_t = (1 + \gamma)^t W_0$$

This set-up is borrowed from Parente and Prescott (1994) as a description of barriers to technology adoption. $W_t$ is the world knowledge level at time $t$. $W_0$ is given. The growth rate is $\gamma$. This relation says that the amount of investment $X(t)$ needed to reach the next level of technology is a decreasing function of the level of the world knowledge, and increases with the barriers of technology adoption parameter $\pi$. The world knowledge increases at a constant rate $\gamma$.

We could also explain this $W_t$ as the level of the world trade. When the barriers of openness to trade decreases, a country will receive more foreign direct investment and organizational experience that could accelerate its production.

Both of these two explanations could deliver a faster industrialization process that took place in Japan, Korea, and China. I think these countries did benefit from these two sources of externality during their developmental process.

The agricultural disturbance of public land ownership of China is a unique barrier that only exists in certain socialist economies. In term of economic modeling, this barrier could be treated a disturbance term $\tau$ in the agricultural industry. This $\tau$ should capture the essence of the lack of property right of land, which will deter private investments in the agricultural industry.
Other possible extension includes modeling physical capital and human capital separately, instead of using $K$ as a mix of these two types of capital. Both of Caballe and Santos (1993 JPE) and Romer (1990 JPE) model the accumulation of human capital explicitly and conclude that an economy with a larger stock of human capital will experience faster growth.
Chapter 4 Literature Review

Growing like China
Song, Storesletten, and Zilibotti (2011)

This paper focuses on the reallocation of capital and labor within the manufacturing sector in China between 2000 and 2007. I believe this paper relates to my previous viewpoint that after China experienced its first over-supply of labor-intensive goods in 1995, main products of China changed from textiles and other labor-intensive goods to the more capital and skill-intensive goods of the second industrial revolution. I think that the reallocation of labor and capital within the manufacturing sector is a natural phenomenon that occurs naturally when a country goes through the process of industrialization and upgrades its products.

The authors think that it is puzzling when high growth and high return to capital and a growing foreign surplus happen together. In addition, the authors also provide similar observations during the development of Taiwan and Korea in 1980s.

The authors model this reallocation of capital and labor within manufacturing by introducing financial frictions between state owned firms (SOF) and private owned firms (POF). They assume that private owned firms are more efficient but have less access to external financing. Thus, their model describes a process in which the reallocation of capital and labor is transferred from less productive externally financed firms (SOF) to
entrepreneurial private firms (POF). During this transition, both the sustained return to capital and the foreign surplus are retained.

My comments:
I believe that this model doesn’t contribute much to my understanding of economic development. The reason is that the economic development in general and the allocation of labor and capital within the manufacturing sectors in specific are an organic process (of development and industrialization). However, it is just a simple fact that state owned firms and private firms have different efficiency and accessibility to external financing. These differences are universally true in all under-developed countries, but they could not be the driver of economic development. In any economic model, these two differences might be enough to deliver certain trends that are consistent with statistical observations, but they do not help our understanding of economic development in general.
Nevertheless, I think this is a good paper that tries to deal with real issues, and its literature review section presents many good papers to read.
Malthus to Solow

Hansen and Prescott (1998)

This paper contributes to the literature that describes in a single unified model the transition from Malthusian stagnation to modern growth. The authors’ approach focuses on the decline in the importance of land in production and the decline in land’s share following the industrial revolution. Their model includes two production functions, one for Malthusian production, which is land-intensive, and one for Solow production, which is capital-intensive. Both production methods produce the same good. Total factor productivity is assumed to be exogenous. With the initial condition of capital at time zero, labor at time zero, and the sequences of TFP of each production method (land will be 1 in equilibrium since no alternative usage is available), this model delivers the transition pattern from a Malthusian land-intensive economy to a Solow industrial and capital-intensive economy.

My comments:

I think this model is succinct and its story of economic transition is important. The exact business and political conditions around 1750 are not very relevant unless a researcher wants to explore why the first transition happened in the U.K. For example, when Japan, Korea, Taiwan, and China started their economic transition, I think that they just faced an opportunity for joining an advanced external market for free. I understand that the development of an internal market is very difficult and expensive, but for a latecomer, the developmental mechanism of simply joining and exploiting an existing external market
could be very different. Thus, based on this paper’s transition model, I could add in an option dummy as to whether or not a government chooses to participate in an existing external market and thus starts to become an industrial economy (or starts its own industrialization). This feature could explain why only a few countries developed successfully, whereas most of the other countries didn’t. Without this option, since the paper takes the total factor productivity as exogenous, it basically says every country should develop and transform from an agrarian economy to an industrial economy.
This paper explores the question regarding the underlying causes of the TFP differences (measured by output per worker) between rich and poor countries. The authors argue that the misallocation of resources across firms can have important effects on aggregate TFP. They use data from the manufacturing sectors in India, China, and the U.S. to study these potential effects. The authors first provide a model with two types of distortion to represent misallocation of resources. The profit of firm $i$ of industry $s$ is:

$$\pi_{si} = (1 - \tau_{ysi}) P_{si} Y_{si} - w L_{si} - (1 + \tau_{ksi}) R K_{si}$$

Where $s$ represents a different industry within the manufacturing sector, $i$ represents a different firm, $\tau_y$ is the output distortion, and $\tau_k$ is the capital distortion.

The authors let $P_s$ refer to the price of industry output $Y_s$, which is

$$Y_s = \left( \sum_{i=1}^{M_s} Y_{si} \right)^{\frac{\sigma}{\sigma-1}}$$

Thus $Y_s$ is itself a CES aggregate of $M_s$ differentiated products.

Applying this model and using data from India, China and the U.S., the authors quantify misallocation of resources, measured by the revenue productivity (the product of physical productivity and a firm’s output price). Then, the authors perform regressions and empirical studies based on this measure.
My comments:

First, to some extent, I disagree with simply adding up all the products in an industry and defining the sum as $Y_s$. In addition, there is no such thing as the price of industry output $P_s$. As a result, the following $Y$ and $P$ do not stand for anything realistic:

$$Y = \prod_{s=1}^{S} Y_s^\theta_s, \text{where} \sum_{s=1}^{S} \theta_s = 1$$

$$P = \prod_{s=1}^{S} \left( \frac{P_s}{\theta_s} \right)^{\theta_s}$$

This is only a minor disagreement since everyone should realize that this treatment (formula) is not real. Moreover, the authors probably are just following the convention of doing industrial research in economic modeling.

Second, I think there is a fundamental logic problem in this paper: I believe that the misallocation of resources is not a cause of low TFP, but a companion or result of low TFP, which stands for an early developmental stage.

The logic of the authors is simple and clear: once incorporating distortions ($\tau_y$ and $\tau_k$) in a firm’s profit function,

$$\pi_{sl} = (1 - \tau_{Y_{sl}})P_{sl}Y_{sl} - wL_{sl} - (1 + \tau_{K_{sl}})RK_{sl}$$

A firm’s choice of $K$ and $L$ will adjust accordingly. Such a choice confirms the economic theory that a firm will pick its quantities of $K$ and $L$ such that the marginal products of labor and capital are equal to their prices (the distortions changed their prices). Thus, for example, a firm enjoying subsidized credit with a lower interest rate will use more capital
and end with a lower marginal product than a firm facing a higher interest rate (assume both using the same technology). The authors argue that by removing this distortion of interest rates and by adjusting the misallocation of capital between firms, the aggregate output and TFP of a country should be higher.

Theoretically, I agree with the above logic. But do I really want to consider the development of an economy simply in marginal terms? It always seems better to remove barriers and unfairness in an economy so that a country can enjoy some economic improvement, but I think these barriers and unfairness themselves are actually the results and companions of low TFP, which is a measure of all other factors except for the quantities of capital, land, and labor (not to mention that it is highly unlikely that India, China, and the U.S. use the same or even similar production functions in their manufacturing sectors). Again, my understanding is that low TFP is the drive of these barriers and unfairness instead of the other way around. Theoretically, fixing and removing these barriers and unfairness will increase TPF and aggregate product, but I think to fix or mitigate these problems, a country can only develop step by step from the status of India to the status of China, and then to the status of Korea and Japan, and finally achieve the current status of U.S. in a very advanced stage.

The authors’ empirical findings and calculations actually support this developmental path. The paper shows that by removing these output and capital distortions, China could boost TFP by 30%-50% and India by 40%-60%. The authors point out that “… reallocation gains shrank about 2% per year from 1998-2005 in China, as if reforms there reaped
some of the gains”. I have studied the developmental history of China since 1979, and I understand that the development was not a result of removing unfairness, but a result of opening the market and simply producing more products and upgrading the production. I believe that with economic development, the market itself will gradually take care of unfairness and distortion.

My conclusion is that focusing on removing the barriers and unfairness is correct and always beneficial, but it is wrong that simply fixing these issues will lead to economic development. Countries like India and China need further economic development, instead of marginal gains by only correcting these barriers.
Industrialization and the Big Push

Murphy, Shleifer, and Vishny (1989)

This paper provides a model that describes Rosenstein-Rodan’s idea in Rosenstein-Rodan (1943) that simultaneous industrialization of many sectors of an economy can be profitable for them all even industrialization could be individually unprofitable for each sector. The authors design a model with profit spillovers across sectors to illustrate this idea.

My comments:

I do not agree with the underlying logic of Rosenstein-Rodan’s idea, even though I fully agree with the authors' emphasis on the growth in domestic demand and the growth in exports as the most important sources of achieving growth in total output of a country. In terms of Rosenstein-Rodan’s idea, I do not believe any sector could be individually unprofitable in the process of industrialization. My study of industrialization shows the pursuit of profit and higher wage and the fulfillment of demand happen in all the sectors and in the entire circle of the production of manufactured goods. I agree that coordination and help from the government sector and public projects such as railroad could accelerate the industrialization procedure but I believe the essence of industrialization is just the old topic of economics—the pursuit of profit. At least the experience from industrialization of Japan, Korea, and China does not support this individually unprofitable but simultaneous profitable idea of industrialization. I think this idea is even dangerous to the developing countries to some extent, because in my study I emphasize the sequence of
Industrialization in different manufacturing sectors, from labor-intensive to skill-intensive and capital-intensive goods. Thus, I suspect that giving a big push to an economy to achieve industrialization will not create the markets that require gradual development through a sequential industrialization process as I observe from the experience of Japan, Korea, and China. I think the fermentation of markets needs time and the profitability and fulfillment of demands in the entire circle of production is very important to the development of markets. Exports will definitely accelerate this process of market development, but exports of a manufactured good only happen after the imports and domestic production of that good according to the wild-geese-flying pattern of Akamatsu (1962). The developmental experience of Japan, Korea, and China supports this pattern.

In conclusion, I have doubts on Rosenstein-Rodan’s idea and I do not support to test this big-push idea in a real economic environment. I believe the authors fully aware this danger by suggesting that “We stress, however, that because all our models are highly stylized and capture what we can only hope to be one aspect of reality, policies suggested by these models should be interpreted with caution” (Murphy, Shleifer, & Vishny, 1989, p. 1006).
A Historical Pattern of Economic Growth in Developing Countries

Akamatsu (1962)

This paper coins the term “wild-geese-flying pattern” of development. Wild geese fly orderly in a V shape pattern. The author uses this pattern to describe the trends of import, domestic production, and export of manufactured goods in a developing country. The following quoted figure (Akamatsu, 1962, p. 12) shows this “wild-geese-flying pattern” in Japan’s different industries from 1870 to World War II. It is obvious that import increases first, then domestic production starts, and export follows. In general, the decrease of a country’s import is due to domestic production, and the decrease of a country’s export is due to the catch-up of less-developed countries’ manufactured goods that is produced with lower-income workers. Until World War II, the trend of Japan’s export of machinery and tools still goes up. This wild-geese-flying pattern also shows that there is a leading goose flying in the front of other followers, and there are different geographical groups of geese. For example, Japan is the leading goose in Asia, UK and Germany leading in Europe, and U.S. leading in the America Continent.
My comments:

This paper is a case study of Japan’s economic development from 1870 to 1956. It documents Japan’s developmental pattern by first importing, then domestic producing, and finally exporting of different manufactured goods. The author also points out that there exists a sequential order of industrial goods regarding to the economic development of less-developed countries. I agree with the author’s observation and statements, even though these statements are based on Japan’s early development from 1870 to 1956. The author’s perspective and focus of economic development are different from those in my study of China, I believe the differences are mainly due to the fact that the author wrote this paper in 1962 and at that time the information, data, and examples of successful industrialization of less-developed countries are not enough to make systemic discussion about a general path of industrialization and specially about the catch-up phenomenon of
these low-income countries. The author focuses on the transition of production of manufactured goods from labor-intensive goods, such as cotton yards and cotton cloth, to more skill-intensive goods, such as table clocks and wall clocks, to capital-intensive goods, such as machinery and tools. Each of these goods follows the wild-geese-flying pattern, by which Japan imports them first, then produces them for domestic uses, and finally exports these goods. The author also mentions the unique feature of Japan’s trade that the country could not levy tariffs to protect its domestic production of manufactured goods because of the Ansei Treaty of 1858. I believe all the information in this paper is helpful and broadens my understanding about economic development. However, I also think this paper lacks a systematic mechanism to link all the observations and statements about the development of Japan into an integrated and more general theory. The author’s theory is actually a miniature of Wen’s stage theory of economic development on which my case study of China is based. I believe that my study could complement the wild-geese-flying pattern of manufactured goods in recognizing the importance of both 1) agricultural workers (low-income rural workers or residents) as the only meaningful resource of production of a less-developed country and the transition (the organization to production) of these agricultural workers into manufactured sectors and 2) the exploitation of an established world market by trade due to the fact that self-development of market is very costly. I think a deeper and more basic logic is that it is the transition, reallocation, and training of agricultural workers behind the scene of the wild-geese-flying pattern of sequential manufactured goods, and the exploitation of established world markets by trade accelerate a less-developed country’s market formation and market deepening in raw materials, intermediate goods, final goods, and even in transition of
information and policy-making. All the phenomena follow and accompany this basic developmental logic, phenomena including urbanization, decreasing share of agriculture, import of technology, capital accumulation, increasing GDP per capita, and etc. The development of Japan is very similar to the development of Germany after World War II. Temin (2002) documents the observations in Germany after World War II and focuses on the important of the transitions of agricultural workers into manufacturing sectors.

To conclude, this paper is very helpful and insightful within its own time period in 1960s. I appreciate the author’s work and contribution to my knowledge in economic development by providing evidence and discussions on Japanese economic development between 1870 and 1956.
Barriers to Technology Adoption and Development

Parente and Prescott (1994)

This paper proposes the barriers to technology adoption as a driver of different technology $A_t$ across different countries. The author assume that the higher the world knowledge level, the lower the cost for a latecomer to adopt a new technology. With this feature of technology and different barriers to technology adoption of different countries, this paper states that this theory could explain the reason that after the World War II, Japan, Korea, Taiwan, and European countries catch up with a very fast speed to the level of income per capita of the U.S.

My comments:

This paper is elegant in its method and explanation. In the essence, the authors propose a method to further differing the technology $A_t$ in the production function of different countries and also make a rule for the adoption of technology such that a latecomer could adopt new technology with lower investment cost when the technology gap between a leading country and a latecomer is wider. Thus, after the World War II, the cost of evolvement or adoption of technology of a latecomer such as Japan or Germany is cheaper. The authors state that this underlying feature of cheaper cost of investment in technology is an advantage of a latecomer and this feature makes fast catching-up in GDP per capita possible if a country decreases its barriers of technology adoption to exploiting this advantage.
However, I do not agree with the author’s logic of economic development.

The authors’ logic is the following

1. Better technology will increase production (according to their production function)
2. Thus, if adopts new technology, a country’s GDP per capita will increase
3. Therefore, barriers to adoption of technology is bad for economic development

This logic of technology-driven development sounds plausible, but it is not consistent with the observation of economic development. I do not think that Japan, Germany, Korea, China and Taiwan developed fast due to their quick adoption of new technology.

On the contrary, the quick transformation of agricultural workers (idle citizens) into manufacturing sector is the main reason of their fast development (at least in my study of China, Korea, and Japan). Take China’s development as an example, between 1978-2000, China’s labor-intensive products gain huge market shares on world market not because China adopted new technologies, but because China’s low labor cost and the organization of idle agricultural workers to produce manufactured goods such as textile, shoes, clothing, furniture, etc.

Then, how the development of new technologies influences or helps a latecomer’s economic development? I believe that the technology improvement mainly takes place at economic leading countries; these technological developments would first increase income per capita of these leading countries. This increase of income per capita of leading countries (such as the USA) would make the low labor cost of a latecomer even
more advantageous in the market of labor-intensive goods. Therefore, as long as the agricultural transformation takes place in an agricultural society and a latecomer exploits world market through trade, the better the technology in the leading countries (or the world knowledge as the authors named it), the more advantageous and thus more competitive the labor-intensive goods of a low-income country become.

I am trying to say that the new technologies do not help a latecomer mainly by lowering its cost of adoption and increasing the $A_t$ in its production function. This argument is certainly true because technology always becomes cheaper as new ones become available. However, this cheaper adoption of technology is not the main reason that Japan, Germany (as in Temin’s 2002 paper suggests), Korea, and China developed very fast. The main reason is that these countries systematically organized their transformation from an agricultural society and rural idle citizens into manufacturing sector. I believe that the technology gap between developed countries and latecomers mainly points out the income gap per capita. The wider the technology gap and thus the income gap, the more competitive and thus a bigger market share of labor-intensive goods a latecomer could exploit and gain in the world trade market.

Therefore, I believe the authors of this article do not understand the logic of economic development very well, even though they provide an elegant model. If I explain the evolvement of $A_t$ in their model not as the adoption of technology, but as the development of exploitation of world trade market, all the results still hold and I will have a model of technology-driven trade market utilization which is much more realistic.
in term of economic catch-up of these latecomers. Instead of barriers to technology as the authors proposed, the barriers to trade will become the factor that determine a country’s catch-up speed. However, I think that all these modeling and explanations only make sense after a country starts its transformation from an agricultural society to manufacturing production, including the one I cite from Ju et al. (2015). Low labor cost (or lagging-behind) is an advantage only when a less-developed country uses its cheap labor resource as an input of manufacturing production. Otherwise, I believe that a less-developed country will just stay poor as most of the countries do.

This model is the most concise and relevant one I find so far in term of technology adoption. Therefore, I recommend a modification of the model of Ju et al. (2015) based on this paper.
Productivity Growth in U.S. Agriculture: A Postwar Perspective

Jorgenson and Gollop (1992)

This paper reports the postwar productivity growth (TFP growth) in agriculture and in other private nonfarm industries from 1947 to 1985. The authors also divide the growth rate of output into the growth rate of TFP and the growth rate of aggregate input. For the growth rate of aggregate input, the authors further divide it into the contribution of input stocks and the contribution of input quality.

My comments:

This paper is very concise and informative. It gives the trends and sources of the U.S. postwar productivity growth (TFP growth) in a broad industry classification, including agriculture, mining, construction, manufacturing, transportation, communication, public utilities, trade, finance, insurance and real estate, and other services. The time range is from 1947 to 1985. The paper finds out that TFP growth is a much more important source of economic growth in agriculture than in the private nonfarm economy. The annual rate of TFP growth is 1.58% in postwar period in agriculture, and the corresponding rate is 0.44% in the private nonfarm economy. The TFP growth explains 82% of the postwar output growth in agriculture, and it explains only 13% of the postwar output growth in the private nonfarm economy. Thus, the growth of the aggregate input accounts for 18% of total output growth in agriculture, and it explains 87% of output growth in the private nonfarm economy. For the sources of the growth of the aggregate input, input quality is the main source of growth in agriculture, and input stocks are the main source of growth.
in the private nonfarm economy. The following two quoted graphs (Jorgenson & Gollop, 1992, p. 749) illustrate the main findings in this paper.

Table 1

<table>
<thead>
<tr>
<th>Industry</th>
<th>Average annual rates of growth, 1947-85</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.0192</td>
</tr>
<tr>
<td>Private nonfarm economy</td>
<td>0.0335</td>
</tr>
<tr>
<td>Mining</td>
<td>0.0147</td>
</tr>
<tr>
<td>Construction</td>
<td>0.0308</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.0292</td>
</tr>
<tr>
<td>Transportation</td>
<td>0.0223</td>
</tr>
<tr>
<td>Communication</td>
<td>0.0637</td>
</tr>
<tr>
<td>Public utilities</td>
<td>0.0475</td>
</tr>
<tr>
<td>Trade</td>
<td>0.0354</td>
</tr>
<tr>
<td>Finance, insurance, and real estate</td>
<td>0.0405</td>
</tr>
<tr>
<td>Other services</td>
<td>0.0403</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Contribution of input stocks:</th>
<th>Agriculture</th>
<th>Private nonfarm economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor hours</td>
<td>-0.0014</td>
<td>0.0254</td>
</tr>
<tr>
<td>Capital stocks</td>
<td>-0.0009</td>
<td>0.0064</td>
</tr>
<tr>
<td>Energy</td>
<td>0.0005</td>
<td>0.0008</td>
</tr>
<tr>
<td>Materials</td>
<td>0.0064</td>
<td>0.0126</td>
</tr>
<tr>
<td>Contribution of input quality:</td>
<td>0.0048</td>
<td>0.0037</td>
</tr>
<tr>
<td>Labor hours</td>
<td>0.0026</td>
<td>0.0013</td>
</tr>
<tr>
<td>Capital stocks</td>
<td>0.0023</td>
<td>0.0024</td>
</tr>
<tr>
<td>Energy</td>
<td>0.0001</td>
<td>0</td>
</tr>
<tr>
<td>Materials</td>
<td>-0.0002</td>
<td>0</td>
</tr>
</tbody>
</table>

The graphs show that between 1947 and 1985, the main source of growth in agricultural output is TFP, while the input stocks of labor and capital in agriculture decrease consistently. The contribution of input quality in agriculture is more than compensating the output loss due to the decrease in labor and capital input stocks. I do not observe this trend in China’s economic development from 1978 to 2015. I think the TFP or productivity increase in agriculture is important, but I think we also need to understand this increase in a broader trend of economic development. For example, this increase of
TFP coincides with other sectors’ output increase that mainly drives by the increase of input stocks. I think that the increase of output in other sectors is more demand-driven since TFP growth only explains 13% of the output growth, while the increase of aggregate input explains the rest 87%. Within this 87% attributing to aggregate input growth, the contribution of input stocks explains 87.3% and input quality explains only 12.7%. Thus, I think the output growth in other sectors is mainly demand-driven, since both input quality (12.7% * 87% = 11%) and TFP growth (13%) do not explain much of the output growth. This mainly input-stock-driven output growth in other sectors out of agriculture is an interesting finding that I expect to observe in other developing and developed countries such as Germany, Japan, Korea, and China. Another interesting finding in this paper is that 82% of the agricultural output growth is due to TFP growth. For the rest 18% attributing to the aggregate input, the decrease of input stocks of agricultural labor and capital actually leads to losses in total agricultural output and the increase of input quality makes a contribution of 27% and compensates the 9% loss from input stocks. I do not observe a fast increase in per capita productivity in agriculture in China. I think this paper is very helpful and points out more potential avenues in considering the relative development of agriculture to other sectors. Also, I aware that Caselli and Coleman (2001) points out that the U.S. prewar seems to indicate that farm TFP growth might have been slightly slower than nonfarm TFP growth. This observation could be more relevant to the stage of economic development of China today.
The Golden Age of European Growth Reconsidered

Peter Temin (2002)

This is Temin’s second paper on The Golden Age of European Growth series. The paper’s main argument is that after the Second World War, “the countries in Europe have too much labor in agriculture for their level of income and stage of development. The disequilibrium added to other more ordinary forces to produce unusually rapid economic growth.”

My comments:

I agree with Temin’s logic of agricultural transition and the rapid economic growth accompanying the agricultural transition. The author makes comparison between UK and Germany by attributing Germany’s faster growth rate to the transition of its larger agricultural labor force after the Second World War. The evidence is shown in the following quoted graph (Temin, 2002, P. 10).

Comparative labor productivity in Germany and the United Kingdom (UK=100)

Table 3

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870</td>
<td>60</td>
<td>93</td>
</tr>
<tr>
<td>1913</td>
<td>78</td>
<td>119</td>
</tr>
<tr>
<td>1959</td>
<td>66</td>
<td>96</td>
</tr>
<tr>
<td>1973</td>
<td>112</td>
<td>119</td>
</tr>
<tr>
<td>1989</td>
<td>116</td>
<td>105</td>
</tr>
</tbody>
</table>
The figure shows that the productivity of a Germany manufacturing worker does not increase relatively to that of UK, but its aggregate GDP increased from 60% to 116% of UK. The author states that in 1950, Germany has 24% of its labor force in agriculture and UK has 5%, and he believes the post-war transition of German agricultural workers into manufacturing sectors is the main reason of Germany’s fast growth rate after the World War II, and Germany’s fast growth slows when the transition reaches its end. With other countries’ economic development following the same logic of resource reallocation of agricultural labor force, the author argues that oil crises and other events are not the main reason for the European economic slowdown in the 1970s. I agree with Temin’s logic of Germany’s economic catch-up with UK. Germany has a larger population than UK, and a larger transition of German agricultural labor force is enough to make Germany GDP surpass that of UK. In 1960, Germany and UK’s population are 73 and 52 million, respectively. I believe the author’s analysis is clear and convincing. I appreciate the author’s study and its contribution to my understanding of economic development.
The “flying geese” model of Asian economic development: origin, theoretical extensions, and regional policy implications.

Kojima (2000)

This paper provides a comprehensive review of the flying geese (FG) model and its regional policy implications since 1930s.

My comments:

The flying geese model is very helpful in my understanding of the economic development of latecomers including Japan, Korea, Taiwan, China, etc. I think that the flying geese model is a simpler and earlier form of Wen’s stage theory of economic development. It emphasizes the circle of imports, domestic production, and exports of manufactured goods in a sequence of labor-intensive goods, capital-intensive goods and skill-intensive goods. Labor-intensive goods include textile and other goods in the first industrialization. Capital-intensive goods include steel, chemical, and other goods in the second industrialization. The flying geese model also lists machinery as a special capital-intensive good that develops after labor-intensive light industries and heavy and chemical industries.

All the theories of the flying geese model and updated versions of the flying geese model are based on the observations and data from the economic development of Japan and the spillovers of Japan’s economic development in the form of FDI into Korea, China,
Thailand, Malaysia, Indonesia, etc. Therefore, the flying geese model is mainly about the economic catch-up of newly industrialized Asian economies.

In some aspects, this model deepens my understanding of economic development. For example, I was confused and had mixed feelings about the role played by FDI in the process of a developing country’s industrialization. Now, I understand the logic of FDI in some industries such as textile, auto, etc. According to the flying geese model and its successive models, the reasoning behind FDI is that some industries in a more-developed country become uncompetitive as wages keep increasing with its industrialization and production. Thus, exporting and relocating its experience and management skills in such industries into a much less-developed country with much lower wages is a natural choice from the respective of a manufacturing firm. This is how Japan makes these reallocations of experience and management skills into Taiwan and Korea after 1960 and Taiwan makes the same reallocations into Mainland China since 1980s. I think this logic is the essence of FDI in manufacturing industries. I believe that by investing FDI to a less-developed country, a firm in a more-developed country could extend its profitability span from two sources 1) remaining its competitiveness by exploiting the low-wage workers in a less-developed country and 2) utilizing the growing markets within a less-developed country.

However, this is no to say that FDI will just go to a less-developed country with no prerequisites. As I mention in my thesis and in Wen’s 2015 study, I believe that FDI only chooses “safe places” that give FDI a relatively high probability of success. Usually, the
features of these safe countries include a spontaneous industrialization, a stable and reliable government, and relatively open markets. I think that a spontaneous industrialization means an internal stimulation of a transition from an agricultural society to an industrialized economy by producing manufactured goods in a given sequence. I mention this sequence many times in my study and I believe this sequence represents a natural order of utilizing, training, and reallocating the agricultural workforce of a less-developed economy. In other words, I think this sequence incorporates the entire process of learning by doing for both workers and entrepreneurs. I think this sequence also fits the evolvement process of capital accumulation in a less-developed country, and this feature is represented by the $K/L$ term in Lin’s 2015 model.

Finally, I appreciate Akamatsu and his followers’ contribution on the flying-geese model. I think their studies are very relevant to the research of the economic development of newly industrialized Asian countries.
This paper presents a study of the U.S. structural transformation and regional convergence. It documents the decline of agriculture and the convergence of southern to northern average wages in the U.S. from 1880 to 1980. This paper also provides a model that assumes 1) the South has a comparative advantage in producing unskilled labor-intensive agricultural goods, and 2) declining relative cost of acquiring nonagricultural (manufacturing) skills over time. This model fits the trends of labor share, relative wages of agriculture labor force, and the convergence of wages between the South and the North.

My comments:
This paper focuses on the U.S. agricultural transformation happened from 1880 to 1980. Main observations are illustrated in the following quoted graph (Caselli & Coleman, 2001, p. 585).

Table 4

<table>
<thead>
<tr>
<th></th>
<th>Structural Transformation and Regional Convergence in the United States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1880</td>
</tr>
<tr>
<td>A. Structural Transformation</td>
<td></td>
</tr>
<tr>
<td>Farm share of GDP</td>
<td>0.27</td>
</tr>
<tr>
<td>Agricultural share of employment</td>
<td>0.50</td>
</tr>
<tr>
<td>Farm relative price</td>
<td>1.20</td>
</tr>
<tr>
<td>1967=1</td>
<td></td>
</tr>
<tr>
<td>Agricultural relative wage</td>
<td>0.20</td>
</tr>
<tr>
<td>B. Regional Convergence</td>
<td></td>
</tr>
<tr>
<td>South/North relative wage</td>
<td>0.41</td>
</tr>
<tr>
<td>Midwest/North relative wage</td>
<td>0.82</td>
</tr>
<tr>
<td>West/North relative wage</td>
<td>1.28</td>
</tr>
</tbody>
</table>
It shows consistent declines in both farm share of GDP and agricultural share of employment. Agricultural relative wage increases from 20% to 69% of the nonagricultural wage. Farm relative price first increases and then decreases back to 1 between 1920 and 1940. The regional convergence is an important phenomenon in the U.S., but I do not observe this trend in my study of China.

I believe all the observations are important and relevant. I observe that China’s agricultural share of GDP decreases from 30% to 9% from 1978 to 2014, and its agricultural share of employment decreases from 70% to 30% from 1979 to 2014. Therefore, in terms of structural transformation, I think China today is in a similar stage of the U.S. some time between 1900 and 1920. I recognize that measured by the farm share of GDP, China’s 9% agricultural share is at the 1940 U.S. level, but the definition of farm of GDP is less inclusive than agricultural share of GDP. Thus I believe the comparable 1940 U.S. agricultural share of GDP should be higher than 9%. During the period between 1900 and 1920, I do observe an increasing relative price of farm goods in the U.S., and the regional convergence is not conspicuous. One important issue is that, based on my study of China, I think this increasing trend of relative price of farm goods will not stop until China removes its public-land-ownership policy and makes the agricultural industrialization feasible for investors. Another important implication from the U.S. experience is that even with relatively free market of land, it takes the U.S. 80 years to make the transition of agricultural labor force from 39% share of total employment in 1900 to 3% in 1980. I believe that even through using better transportation and information technologies and better-developed world trade markets as
accelerators, at 30% agricultural employment share today, China still has a long way to go to finish its agricultural transition and become a developed country.

From my study of the structural change, I find that it takes Korea 33 years to decrease its agricultural employment share from 34% to 6% from 1980 to 2013. It takes Japan 13 years to decreases its agricultural employment share from 10.4% to 5.9% from 1980 to 1993. It takes the U.S. 20 years to decreases its agricultural employment share from 20% to 6% from 1940 to 1960. Therefore, I do not observe an obvious accelerating trend of the agricultural transitions in different countries over time. It is possible that an issue of lagging-generations of job transition exists in this particular problem.

Therefore, it is possible that the later stage of the agricultural transition below 20% depends more on the cross-generation behavior patterns and the necessary time of training to adapt to city lifestyle than on technologies and external trade environments. This could be a potential explanation for the relatively time-invariant feature during the later stage of the agricultural transition.
Changes in the Wealth of Nations

Parente and Prescott (1993)

This paper points out that four main development facts exist during the economic development between 1960 and 1985.

1. There exists great wealth disparity among countries.
2. The range of the distribution of relative wealth is roughly constant.
3. There are development miracles and disasters.
4. The distribution of the level of wealth shifts up over time.

My comments:

I think these four development facts are helpful to my understanding of the general trend of the world economic development. I agree with the authors’ statements that theories of development should accounts for these development facts and that any theory that fails to do so is not a development theory. I think that my study of China mainly focuses on the countries that moved up quickly in the relative wealth distribution and tries to find a general path that these successful countries followed.
Early Progress on the "Problem of Economic Development"

Schmitz (1993)

This paper provides a comparison of different models of economic development based on the four developmental facts from Parente and Prescott (1993). The author compares the basic Solow model and the modifications of the Solow model with human capital (the Lucas model) and business capital (the Parente and Prescott model). The author concludes that neither of human capital model nor business capital model could explain the observed inequality of the world. This paper proposes that models that emphasize on the differences across countries in the incentives provided to an entrepreneur to create businesses and adopt new technologies could explain this inequality of the world.

My comments:

This paper is very helpful since it reviews the development of economic modeling in the field of economic development. I think that the set-up of different incentives across countries is similar to the piracy and vested interests problem mentioned in Costa et al. (2016a, 2016b). I believe this problem is a main barrier of economic development of a country.
This paper proposes a theory that classifies countries according to their stages of growth. The authors conclude that by adopting the technologies and managerial practices of economic leading countries such as Japan or U.S., a poorer country with inefficient institutions and policies can achieve rapid growth, and this rapid growth rate will decline unless a poorer country establishes better and more efficient institutions and policies.

My comments:
I enjoy reading this paper. I believe the authors provide very important information on economic development. The authors classify countries into four stage of economic development.

Stage 0: Malthusian trap (where economic growth is roughly the same as population growth)
Stage 1: Taking off into growth (after a country completes 25 years of at least 1% average annual growth in per capita income)
Stage 2: Catching up to the economic leader (after a country’s personal income is above 35% of that of the economic leader (U.S.) for at least 15 consecutive years)
Stage 3: Joining the economic leader (after a country’s personal income is above 65% of that of the economic leader (U.S.) for at least 15 consecutive years)

Then, the authors provide demographical evidence based on the division of these four groups of countries. In this paper, all the information is very useful and enlightening.
In my opinion, the authors of this paper do not understand the logic of economic development and the sequence of industrializations very well. For example, the authors classify China in 1966 and India in 1970 into the take off group (stage 1). After my study of industrialization and economic development, this classification does not make sense. These two countries obviously do not go through industrialization and mass production of manufactured products in 1966 and 1970. Then, the criteria of “taking off into growth” stage with more than 1% growth for 25 years does not distinguish the experience of industrialization and mass production. If China does not take reform and opening policy in 1978, the growth of China would be flat as the growth of North Korea. Why should we define China in 1966 as “taking off into growth”? I think a method of classification simply based on a consecutive growth rate would not contribute much to our understanding of economic development, especially in the case of countries like China and India that together account for around 40% of the world population. I think we need to explore deeper in a country’s economic development and apply a general logic of economic development (such as the process of industrializations) when we try to study the similarity and uniqueness of different countries. This is the reason that I do my case study of China and I think my study help my understanding of economic development in a more general way than simply classifying countries into different groups by certain consecutive growth rates.

I want to emphasize that my comments by no means criticize this paper. On the contrary, I deeply appreciate these authors’ work on economic development, even though I do not fully agree with their logic.
This is the second paper in the stage of economic growth revisited series. The authors continue using the four-stage classification to analyze economic growth. The authors hypothesize that the lack of institutional and policy change is the primary barrier for poor nations to achieve rapid economic development. The conclusions include that “China is currently reaching its limit to rapid growth” (Costa et al., 2016b, p. 1) and that “it is conceivable that South Korea, which has had high growth in recent decades, will eventually pass the United States, but, as of 2010, South Korea had a level of income per person only 64 percent of the U.S. level and still had not entered the stage of joining the economic leader. Currently, there is no major country that is the obvious candidate for the next world economic leader” (Costa et al., 2016b, p. 6).

My comments:
As in the first paper, the authors try to explore important economic issues and provide valuable economic observation and information on economic development.
I think the shortcoming of this paper is still that the authors do not understand the logic and sequence of economic development very well. For example, in my study, I think I reasonably establish the sequence of economic development of Japan, Korea, and China. I am confident to state that these countries follow a very similar developmental path, thus, the direction of growth and per capita income will be very similar among Japan,
Korea, and China. I believe there is no reason to believe that Korea could eventually pass the U.S. in terms of personal income. To make such a statement, I think that a researcher should first establish a theory that following a very similar developmental path, why Korea could pass Japan in the first place? Following the same logic, I do not think that China is currently reaching its limit to rapid growth since China’s personal GDP is only $7000. To make such a statement of China reaching growth limit, I think that a research should first establish a theory that following a very similar developmental path, why Korea could pass this $7000 threshold with no difficulty but China could not? I do not see fundamental differences between Korea and China that are important enough to make this forecast of China reaching its growth limit. I agree with the authors on the viewpoint that currently there is no obvious candidate for the next world economic leader, since China’s personal income is only around $7,000. To pass U.S. in an aggregate level, China needs to achieve a personal income level of more than $25,000. I think that even assuming everything will be smooth, it will take China at least several decades to achieve such a large increase of personal income.

To conclude, I appreciate the authors’ contribution in this second paper. I think my study of China could be an important complement to this paper series.
Learning by Doing and the Introduction of New Goods

Stokey (1988)

This paper provides an equilibrium model that goods are valued based on the characteristics they contain. The author introduces learning by doing as the driving force behind sustained growth in this model.

My comments:
The author proposes that a consumer problem \( U(q) = \int_0^\infty u(q(z))dz \), where \( q \) is the allocation of characteristics, and \( q(z) = \int_z^\infty x(s)ds \). \( z \) is the index of a continuum of characteristics, \( x(s) \) is the density of goods allocation, and \( s \) is the index of a continuum of potentially producible goods and good \( s \) provides one unit of each of the characteristics \( z \in [0, s] \). In this setting, the author breaks down the quantity of goods and introduces a notion of quality ranking for each good. Then, the author further designs the cost of a good \( p(s, k) \) as an increasing function of its quality ranking, where \( k \) is the level of knowledge and it increases due to learning by doing. There is no capital in this model. With a labor endowment \( y \), a consumer’s problem is

\[
\max_{x \in X} \int_0^\infty u \left( \int_z^\infty x(s)ds \right)dz
\]

subject to

\[
\int_z^\infty p(s, k)x(s)ds - y \leq 0,
\]

\( x(s) \geq 0, \) all \( s \)

With further assumptions about \( x, p, u, s, z \), a sustained growth driven by learning by doing is achievable. Learning by doing in this model refers to the relation of cost for
good s, p(s,k), the accumulation of knowledge k as production continues over time, and a consumer’s preference about quality q.

Adding in agricultural sector, a traditional sector in which there is no learning by doing, the problem becomes

$$\max_{x, U \geq 0} V(a, U)$$

subject to $a + E(U, k) - y \leq 0$,

Where $E(U, k)$ is the expenditure function for manufactured goods, and $a$ is the agricultural good.

Based on the assumptions on preferences, functional shapes, and the accumulation of knowledge from production over time, the model delivers a transition of manufactured goods that makes higher quality goods entering each period and lower quality goods dropping out.

This model is similar to Lin’s model that I use in my study in the sense that both models describe the idea that industries or manufactured goods are upgrading over time. The driving force in this model is the accumulation of knowledge and the ranking of qualities of different manufactured goods, and there is no capital in this model. The driving force in Lin’s model is capital per capita (K/L), and the use of Leontief production function further simplifies the analysis. I interpret capital $K$ in Lin’s model as a mixture of physical and human capital since I believe that human capital is an input of production
and its accumulation tends to follow the accumulation of physical capital which forms the market demand of goods and services that use human capital as an input.

This model also points out that the accumulation of knowledge will decrease the cost of production for higher-quality manufactured goods. I agree with this statement and I think this statement is incorporated in the increasing $K/L$ term in Lin’s model.
The Rise of the Service Economy
Buera and Kaboski (2012)

This paper states that the movement of consumption into more skill-intensive output drives the growth in services, explaining the trend of the rising importance of the service sectors in the post 1950 U.S. economy. The authors also show that $9,200 is an important threshold for the growth of service sectors.

My comments:
I agree with the authors’ viewpoint that the rising of service sectors should be consumption-driven, since I also think that the common story of skill-biased technological change is not very convincing. I prefer to understand services as products for consumption and skilled labor as an important input of these products. Therefore, in my understanding, the increase of skilled workers should be demand-driven, instead of driving by skill-biased technologies.

Beyond this demand-driven logic, I think that the urbanization of the U.S. economy accompanying its industrialization provides a more fundamental explanation of the rising demand of service sectors. The U.S. urban population rate is 40% in 1900, 64% in 1950, and 81% in 2010. I believe this trend of increasing urban population itself provides the answer of the rising demand of service sectors of the U.S. economy. This trend is a transition of culture and consumption patterns that centralize the supply of previous homemade services into urban areas and ask for further specialization of skills in the
service sectors in the urban areas. With my study of industrialization process, I believe that without manufacturing-oriented industrializations, urban population rate itself is not a valid indicator for the stage of development of an economy. I agree with the authors that in the micro level, the increasing demand of skilled workers and increasing number of college educated workers are important factors in the rising of service industries, but I think these factors belong to the input side of the market of services. I think that the trend of urbanization provides a demand side story that brings up the fundamental issue of increasing demand of services as products. This increasing demand of services will drive up the price of services as products and also drive up the demand and price of skilled workers as an input of these service products. Therefore, my understanding is simply that urbanization increases, demand for services increases, and demand and price for inputs of services increases, without emphasizing what happened within the input market.
Bibliography


