ADBI Working Paper Series

THE MIDDLE-INCOME TRAP AND THE MANUFACTURING TRANSFORMATION OF THE PEOPLE'S REPUBLIC OF CHINA (PRC): ASIAN EXPERIENCE AND THE PRC'S INDUSTRIAL POLICY ORIENTATION

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No. 752
June 2017

Asian Development Bank Institute

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Suggested citation:

Huang, Q., G. Liu, J. He, F. Jiang, and Y. Huang. 2017. Middle-Income Trap and Manufacturing Transformation of the People's Republic of China (PRC): Asian Experience and the PRC's Industrial Policy Orientation. ADBI Working Paper 752. Tokyo: Asian Development Bank Institute. Available: https://www.adb.org/publications/middle-income-trap-and-manufacturing-transformation-prc

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Abstract

The People's Republic of China (PRC) has been undergoing marvelous industrialization and manufacturing development in the past decades, which has promoted its fast economic growth and has reached a level of middle-income in recent years. It is widely accepted that the PRC's status as the "world's factory" has roots in its comparative advantage of cheap factors and production. As the PRC becomes a middle-income economy, the established development pattern of manufacturing needs to be transformed. This paper investigates the experience of high-income Asian economies with a focus on the size and productivity of manufacturing, when they were in and out of the middle-income stages. We find that (1) the share of manufacturing value added in GDP of those selected economies, at a constant price, keeps on increasing as per capita income grows, which is different from the trend of secondary industry as proposed by the Petty-Clark Theorem; (2) besides the relative size, the drastic improvement in the productivity of manufacturing by industrial restructuring is also prominent. The PRC is facing the risk of "premature deindustrialization" because of declining industrial share and growth rate of productivity, which are potentially weakening the PRC's capability to avoid the middle-income trap. The PRC needs to reinvent its industrial policy by adjusting its policy focus, optimizing policy formulation and implementation, and adopting more policy measures to boost manufacturing productivity.

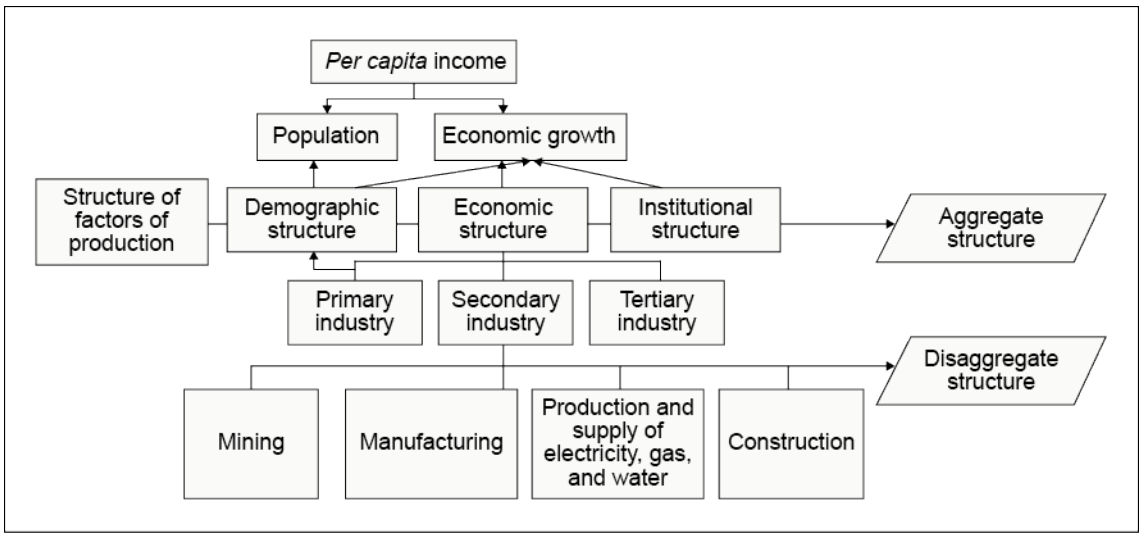
JEL Classification: O14, N15, L16, O25

Contents

1. INTRODUCTION

An increasing concern on the "middle income trap" among researchers and policy-makers reflects anxiety about the economic and political consequences of dreary economic growth potential. In recent years, some emerging economies that are now the powerhouse of global economic growth are approaching the threshold of the middle income trap, generating great national and international consciousness. Recently, the People's Republic of China (PRC) launched a new development agenda to catch up with the moderately developed countries by 2050. The PRC's performance in the middle-income stage is the key stepping-stone.

Figure 1: Major Issues Regarding the Middle-Income Trap



Source: Prepared by the authors.

The term "middle-income trap" itself, however, has not been precisely defined in literature and has led to different explanations. In theory, this term describes a stagnating equilibrium of per capita income for a long period and the failure to grow to the level of advanced countries. Suppose the demographic structure is predictable and rather stable in the long-term; the stagnation of per capita income is mainly the consequence of the decelerating economic growth. In this regard, the task for researchers of the middle-income trap is three-fold: to identify the stalled driving force of an economy, to reload alternative engines of future economic growth, and to work on the policy that facilitates the transition.

Regarding the driving force of the PRC's marvelous long-term growth, it is widely accepted that "China's miracle" is delivered by a structural shift. However, they are different structural shifts. Some researchers concentrate on the demographic structure and labor structure. Firstly, some influential studies suggest that the PRC's economy may have reached the so-called "Lewisian turning point," which means that the disguised rural unemployment is exhausted and the unlimited labor supply is no longer unlimited (Cai, 2010; 2012a, 2012b, 2016; Cai and Lu, 2013). Second, some others focus on the economic structure, or the changes in the relative share of primary, secondary and tertiary industries in GDP. Based on the classic *Petty-Clark Theorem* and statistical phenomenon of developed economies, many observers claim that economic structural (in terms of output or employment) shifts from primary industry to

secondary is likely to take one economy out of the poverty trap and reaches the middle income stage. Afterwards, in order to escape from middle income trap, economic structural should shift from the secondary industry towards tertiary industry. Third, some others stress the changes in the structure of factors of production and pre-longed economic growth (Lin, 2013), and the institutional structure (Xu, 2011). Recent studies pay attention to the "supply side reforms" following the PRC's latest economic policy highlights (e.g., Cai and Lu, 2016). In general, some insightful implications for the PRC's middle income trap have been produced (Zhuang and Vandenberg, 2012; Lewin *et al*., 2016).

Besides those aggregate structural changes, there are some disaggregate structural shifts during the PRC's decades of fast growth. The PRC has been undergoing fast and continuous industrialization for decades, which has transformed the PRC from an agricultural dominated economy to be one of the world's most attractive foreign investment destinations, the "world's factory" and the world's top exporter of hundreds of sorts of industrial products, ranging from low technological products, such as footwear, garments, toys and furniture, to technologically sophisticated products like steel, cars, personal computers and cell phones. Based on Huang (2015), the PRC has accomplished an upper-middle level of industrialization by the end of the 12th Five Year Plan,[1] and is predicted to fulfill industrialization by 2020. Industrialization is a process of "creative destruction" in the industrial structure by reshaping an economy's advantage and competitiveness in the dynamic industrial global competition, and finally, an increased per capita income. To our knowledge, the role of industrial structural change has not been fully recognized in the middle-income trap study of the PRC.

Figure 2: Industrialization Index of the People's Republic of China

PRC = People's Republic of China.

Source: Chen *et al.* (2012).

[1] The Industrialization Index of the PRC was 84 out of 100 in 2014.

In this present work, we investigate the PRC's industrial transformation by revisiting the classic theory of industrialization and its modern implication for the middle-income trap research. We then present some experiences of manufacturing transformation of Asian high income economies when they were in and out of the middle income stage. First, we find that the shares of manufacturing at constant prices in GDP of those Asian economies were rather stable. Second, real manufacturing growth rates kept on growing for a long time even after they escaped from the middle-income trap. These findings are the opposite of the prediction of declining share of the secondary industry based on aggregate economic structure analysis. Third, total factor productivity (TFP) of those economies kept on growing regardless of income levels by restructuring towards technological intensive industries, which is likely to be a very important source of industrial competitiveness. The experience of high-income Asian economies implies that the structural adjustment within the secondary industry is another important structural change that has not been fully discussed in literature.

Based on the theoretical and comparative analysis, we turn to the issue of the PRC's manufacturing productivity rather than its size. We find that the PRC's manufacturing productivity has been deteriorating in recent years, which exaggerates the risk of "premature deindustrialization" of losing traditional industrial competitiveness while failing to foster new competitiveness. Finally, we propose some general points on the PRC's industrial policy reorientation from growth in size to productivity increase, in which innovation policy is highlighted.

2. INDUSTRIALIZATION THEORY AND ITS IMPLICATIONS FOR THE MIDDLE INCOME TRAP

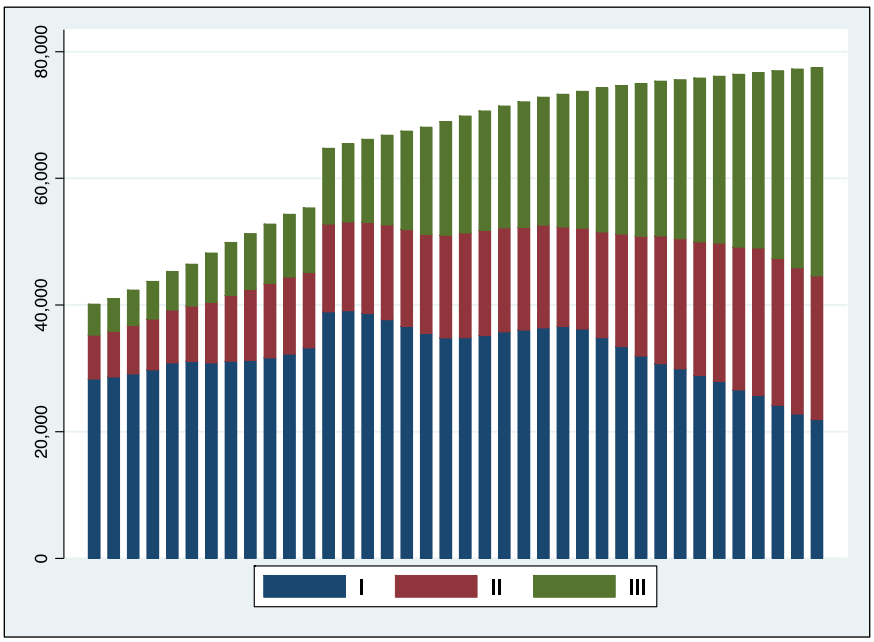
Modern industrialization theory can be traced back to the 1940s. During and after the Second World War, even some of today's developed European countries were less-developed compared to the few industrialized world powers. Those less-developed countries encountered the structural problem of dozens of millions of agrarian excess laborers with the slow pace of improvement in living conditions. How to utilize those "wasted" human resources and improve their well-being was a major policy issue. Rosenstein-Rodan (1943) proposed a solution, which was deemed the "genesis" of structuralism of classic development economics. There were two solutions in a policy-maker's toolkit: either transporting residual labor towards capital, or the reverse. The two solutions could be generalized as two basic development models for less developed countries (LDC): the emigration model or the industrialization model. Since mass emigration and resettlement would cause a great number of economic and social side-effects, it was viewed as a high cost model. Alternatively, industrialization was an acceptable model for development. Since then, "industrialization" has been a synonym for economic development.

Regarding the driving force of the PRC's marvelous long-term growth, it is widely accepted that "China's miracle" is delivered by a structural shift. However, they are different structural shifts. Some researchers concentrate on the demographic structure and labor structure. Firstly, some influential studies suggest that the PRC's economy may have reached the so-called "Lewisian turning point," which means that the disguised rural unemployment is exhausted and the unlimited labor supply is no longer unlimited (Cai, 2010; 2012a, 2012b, 2016; Cai and Lu, 2013). Second, some others focus on the economic structure, or the changes in the relative share of primary, secondary and tertiary industries in GDP. Based on the classic *Petty-Clark Theorem* and statistical phenomenon of developed economies, many observers claim that

economic structural (in terms of output or employment) shifts from primary industry to secondary is likely to take one economy out of the poverty trap and reaches the middle income stage. Afterwards, in order to escape from middle income trap, economic structural should shift from the secondary industry towards tertiary industry. Third, some others stress the changes in the structure of factors of production and pre-longed economic growth (Lin, 2013), and the institutional structure (Xu, 2011). Recent studies pay attention to the "supply side reforms" following the PRC's latest economic policy highlights (e.g., Cai and Lu, 2016). In general, some insightful implications for the PRC's middle income trap have been produced (Zhuang and Vandenberg, 2012; Lewin *et al*., 2016).

The PRC has been following this industrialization model for about four decades. From 1978 to 2015, employment in the secondary industry increased from 49.4 million to 226.9 million, and the share of secondary employment in total employment grew from 17.3% to 29.3%. According to the National Bureau of Statistics, there were 273.95 million migrant workers in 2014, 22.2% of whom were employed in the manufacturing sector. This process is often interpreted as the PRC following its comparative advantage in abundant labor in the global division of labor. However, as total dependency ratio started to increase since 2010, the PRC approaches the Lewisian turning point and loses its industrial comparative advantage of low costs. A concern on the disappearing "demographic dividend" could be explained as a risk of sustainability of the PRC's industrialization model.

Figure 3: Employment by the Three Strata of Industry (1978–2015)
(10,000 persons)



Note: "I," "II" and "III" denote the primary, secondary and tertiary industry, respectively.
Source: National Bureau of Statistics.

Figure 4: The People's Republic of China's Dependency Ratio (1996–2015, %)

Source: National Bureau of Statistics.

However, the economic feature of "industry" in classic theory refers to a sector of high productivity. In a pre-industrialized low-income economy, the non-agricultural sector is more productive than the agricultural sector, once factors of production are allocated towards industry in favor of development. This process would be termed as "the productivity principle." In spirit of this principle, when a country like the PRC reaches a middle-income stage after the initial industrialization driven by a demographic dividend, if there are higher productive sub-sectors within the non-agricultural sector and channeling factors of production by industrial restructuring, it is still favorable to further development. In this way, the PRC's industrial comparative advantage would shift from low factors cost to high productivity.

A stream of literature concerns the structural dividend of the PRC between the secondary industry and tertiary industry.[2] A general argument of those studies is that the PRC should abandon its established policy towards the secondary industry and construct a new growth model, which puts the tertiary industry as the new driver of economic growth. However, the secondary industry is a sophisticated sector that includes certain sub-sectors with significant differences. In a broad sense, the secondary industry covers mining and quarrying, manufacturing, production and the supply of utilities (electricity, gas and water and construction). For each single economy, the structure of the secondary industry is different. For example, in 2011, the share of the PRC's manufacturing industry in the secondary industry was 71.3%, construction was 13.2%, mining and the supply of utilities was 9.5% and 6.0%, respectively. Even if we accept the proposition that middle income economies should undergo an economic restructuring process towards the tertiary industry, we still face the problem of the structural adjustment within the secondary industry. Among others, manufacturing is the most vibrant industry with the greatest potential for productivity

[2] Many of these studies take the experience of the economic structural change of developed economies as the benchmark for PRC's economic restructuring, regardless of the productivity principle of development.

growth. Firstly, the manufacturing industry is the major carrier of product and process innovations, which are important drivers for productivity growth. Secondly, the manufacturing industry provides new intermediated goods for other industries, and thus promotes upgrading of the global value chain. Thirdly, the manufacturing industry is the basis for international competitiveness and the focus of policy in both industrialized and industrializing economies. [3]

3. MIDDLE INCOME TRAP AND INDUSTRIAL EXPERIENCE FROM NEWLY INDUSTRIALIZED ECONOMIES

3.1 Definition: Absolute or Relative?

As mentioned above, the "middle income trap" requires a technical definition (Im and Rosenblatt, 2013). Prevailing definitions of the middle income trap can be categorized into two measurements. The first definition is based on absolute per capita income thresholds, or the "absolute trap." For example, 3,000~10,000 US dollars per capita is a rule of thumb. The World Bank classifies a country as a middle-income country if its income per capita is greater than 1,005 US dollars and less than 12,275 US dollars. Based on this classification, 55% of all economies are in the middle-income level by 2010. Eichengreen *et al.* (2011) proposed that when a fast-growing economy's per capita income reaches around $17,000 US in year 2005's constant international prices, the growth rate downshifts by at least 2 percentage points. When a middle-income country lingers around this level, it can be treated as locked in the "middle income trap."

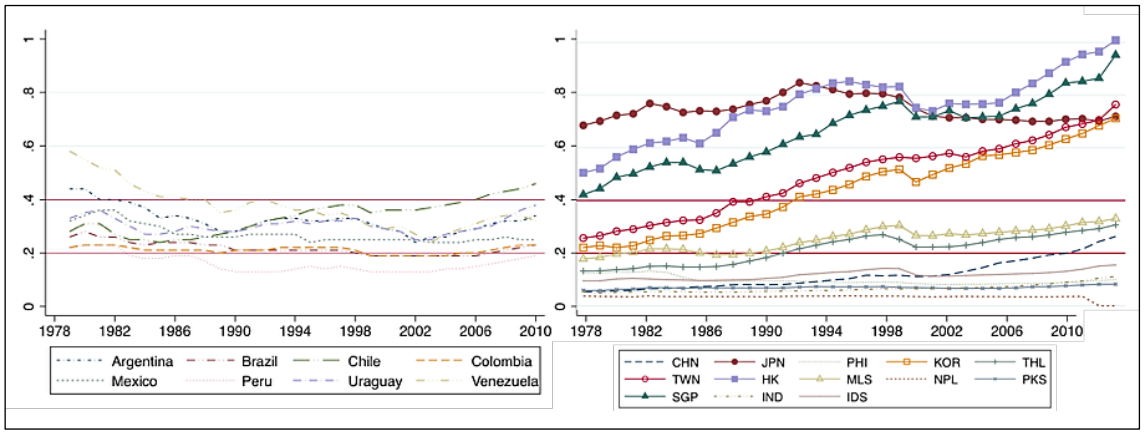
The second definition is based on relative income, or the "relative trap," which describes an economy's relative "catch-up" with rich countries, such as the US (Woo, 2011; Lin and Rosenblastt, 2012; Park, 2012). When per capita income of an economy relative to the US income remains in a range for a long time and shows no trend of convergence, it can be defined as falling into the middle-income trap. It is believed that the relative trap is likely to avoid the controversial subject of the absolute definition (Park, 2012). However, how to define the relative levels is disputable as well, since Latin American economies and Asian economies are often cited as opposite examples in middle income trap studies. The technical definition of relative middle income is normally made by comparing the relative per capita income level of Latin American and Asian economies to that of the US. Based on the existing studies, 20% is generally accepted for the lower threshold of the middle income trap, while the upper threshold ranges from 30% to 55%.

In this paper, we adopt the definition of relative trap. The main reason lies in the relation between late industrialization and economic development. Most of the economies escape from the low-income trap through a process of initial industrialization. Normally, they climb up the global value chain that is dominated by the advanced industrialized countries, through imitating the product and process of industrialized counterparts. The performance of industrial *catch-up* with advanced industrialized countries determines their *relative* level of economic development. Hence, it would be appropriate to define the middle-income trap in a relative way.

[3] In recent years, the US, Germany, Japan and the PRC have renewed policies for manufacturing development.

We compared the relative per capita income of Latin American economies and Asian economies based on the database of Groningen Growth and Development Center (GGDC). From the 1970s to 2010, per capita income (constant price) of most of Latin American economies, including Argentina, Brazil, Chile, Colombia, Mexico and Uruguay, as ratio of US income levels, have stagnated in the range of 20–40%. Before 1978, the ratio of per capita income of Venezuela and Argentina relative to the United States was once higher than 40%. In recent years, Chile has shown a strong catch-up potential when compared to other regional members, and the ratio of per capita income relative to the US exceeded 40% in 2006. The ratio of per capita income of Peru was below 20% level relative to US for almost two decades. In general, although the absolute per capita income kept on growing, most Latin American economies show no sign of convergence to the income level of the US.

Figure 5: Income of Latin American and Asian Economies as Percentage of US Income



Source: Calculation based on GGDC data.

The story in Asia is quite different. In 1978, when the PRC launched the Open and Reform Policy, there were only a few Asian economies (such as Japan; Hong Kong, China; and Singapore) with relative per capita income higher than 40% of the US income. The ratios of per capita income of most of the East Asian economies, such as Republic of Korea, Taipei,China, Malaysia, Thailand, Nepal, Pakistan, India, Indonesia and the PRC, relative to the US, were lower than 40% or even 20% of the US. However, the relative per capita income of Taipei,China and Republic of Korea exceeded a ratio of 40% of the US income in 1989 and 1991. Afterwards, those two economies kept on narrowing the per capita income gaps with the US. The per capita income of Malaysia and Thailand passed the 20% threshold of the US in the 1980s, but remained lower than 40% of the US income for nearly two decades. The per capita income of India, Indonesia, Pakistan, Nepal and the Philippines had not exceeded 20% of US income. Based on the comparison above, we would make a technical definition of the middle-income trap as the ratio of an economy's per capita income relative to the US in a range of 20–40% for a prolonged time.

After nearly 30 years of fast growth, the ratio of the PRC's per capita income relative to the US grew from 5.3% in 1978 and pierced the 20% level around 2007. That means that the PRC has entered the middle-income stage. In 2010, the ratio of the PRC's per capita income relative to the US was 26%, equivalent to that of Japan in the late 1950s, Taipei,China in the late 1970s, Republic of Korea in the early 1980s, Malaysia in the early 1990s and Thailand in the early 2000s. We also take the absolute trap as a

reference. In 2010, the PRC's nominal per capita income surpassed US$ 4,000, which also indicates that the PRC is now a middle-income country. In terms of purchasing power parity (thereafter, PPP) per capita income, the PRC has reached US$ 7,000, a level by which Morgan Stanley estimated as the threshold for the middle-income economy or an economic slowdown point (Park, 2012). In general, the PRC is facing the challenge of the middle income trap.

3.2 Size: Nominal or Real?

To understand the experience of industrial transformation of those newly industrializing economies, we calculated the shares of manufacturing value added in GDP in various ways by groups of economies.

First, we divided major Asian economics into a high income group and middle income group based on the relative definition. There are four successful escapees from the high income group: Japan, Singapore, Taipei,China and Republic of Korea. Meanwhile, there are three economies trapped in the middle-income level, including Malaysia, Thailand and the PRC. India was selected as a representative of a low income economy.

Second, different from the conventional comparison based on nominal statistics, we calculated the share of manufacturing value added in GDP at both current national prices and constant 2005 prices for each economy. In so doing, we tried to wipe out the effects of short-term macroeconomic fluctuations and identify the middle-long term structural changes.

Third, we divided the development process into two stages for each group of economies. For the high-income group, there are stages in and out of the middle income trap, to identify whether there was a structural shift for sustainable growth. For the middle-income group, there are stages of low income and middle income.

First, we found that manufacturing value added in GDP at constant prices of high income economies did not decrease when they escaped from the middle-income trap. In real terms, the shares of manufacturing value added in GDP even increased when Japan, Singapore and Republic of Korea got out of the middle-income trap, and only the share of Taipei,China decreased slightly. Let us consider Japan as an example. From 1970 to 2010, the share of value added of the secondary industry to GDP dropped drastically from 43.7% to 26.5%, and the share of value added of the tertiary industry in GDP grew from 51.2% to 72.4%. This shift of economic structure matches the Petty-Clark Theorem. However, the structural change of manufacturing is rather different. When Japan was in the middle-income stage (1950-1962), the annual average share of manufacturing value added in GDP at the current price was 30.3%, which was slightly higher than the annual average share after Japan escaped from the middle-income trap (1963-2010). However, the annual average share of Japanese manufacturing value added in GDP at a constant price increased dramatically from 14.8% in the middle-income stage to 23.5% after 1963. For the high-income group, the average real share of manufacturing value added in GDP grew by 3.6 percent points, from 23.5% to 27.1%. However, the average nominal share for the high-income group dropped from 29.8% to 28.0%. This finding is different from the trend of the secondary industry in general as some studies predict and advocate. It implies that it would be misleading to make a judgment on the trend of manufacturing merely by the nominal term; the real manufacturing transformation provides a picture that is different from conventional wisdom.

Table 1: Share of Manufacturing Value Added in GDP
(%)

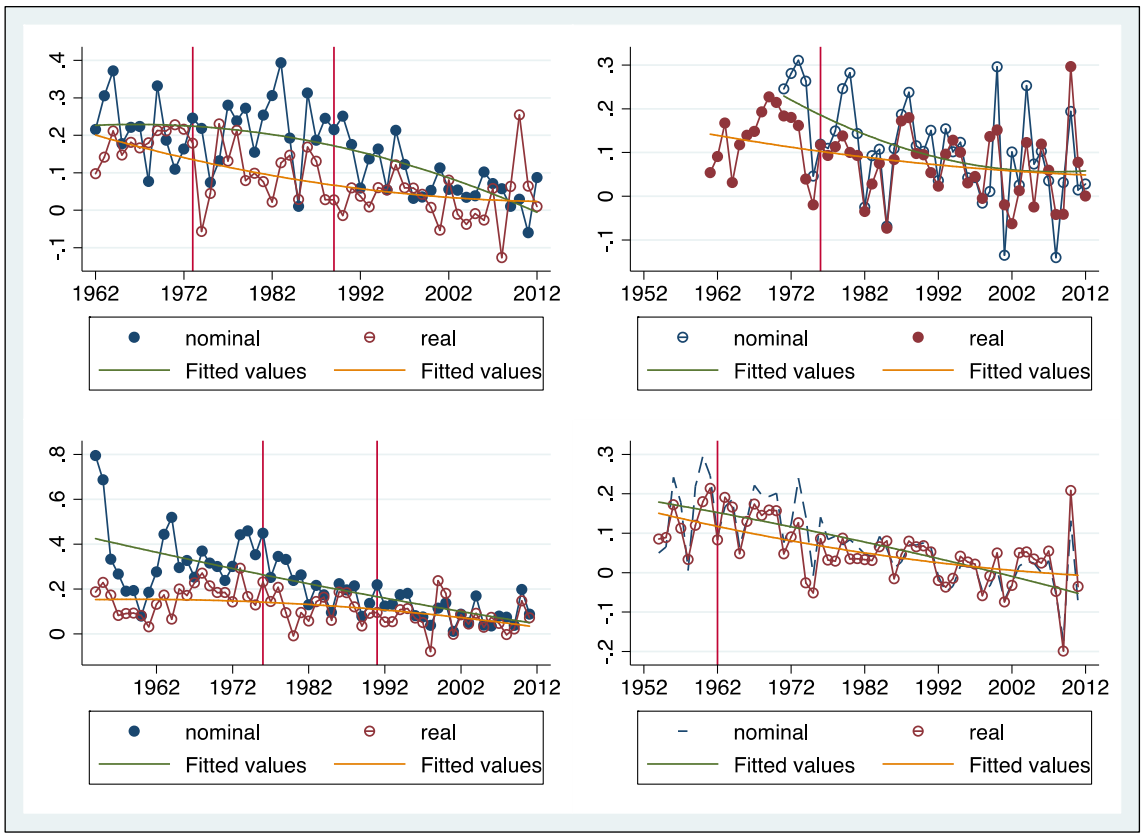
Ratio of Per Capita Income Relative to US: 20–40%	Share of Manufacturing Value Added in GDP at Current National Prices		Share of Manufacturing Value Added in GDP at Constant 2005 Prices	
Group of High Income Economies				
	Middle Income Stage	**High Income Stage**	**Middle Income Stage**	**High Income Stage**
Japan (1950[1]–62)	1953–62	1963–2010	1953–62	1963–2010
	30.3	27.5	14.8	23.5
Singapore[2] (1950–76)	1970–76	1977–2010	1970–76	1977–2010
	22.2	25.0	25.5	26.4
Taipei,China (1973–89)	1973–89	1990–2001	1973–89	1990–2001
	37.7	28.3	33.8	29.3
Republic of Korea (1976–1991)	1976–1991	1992–2010	1976–1991	1992–2010
	29.0	31.3	19.7	29.1
Mean	29.8	31.3	23.5	29.1
Group of Middle Income Economies				
	Low Income Stage	**Middle Income Stage**	**Low Income Stage**	**Middle Income Stage**
Malaysia (since 1989)	1970–89	1990–2010	1970–89	1990–2010
	20.3	27.1	14.9	26.4
Thailand (since 1990)	1951–90	1991–2010	1951–90	1991–2010
	20.6	33.5	17.8	32.9
PRC (since 2007)	1952–2007	2008–2010	1952–2007	2008–2010
	31.9	35.0	18.6	36.3
Mean	24.3	31.9	17.1	31.9
Low Income Economy				
	1950–2010		**1950–2010**	
India	16.4		14.7	

Note: (1) The database provides statistics since 1950, though some economies' relative per capita income had been higher than 20% of US; (2) relative per capita income of Singapore reached a level higher than 20% to US income in the 1950s. However, Singapore became an independent state in 1965.

Source: Calculation based on GGDC.

Second, besides the changes in the relative size of manufacturing in the national economy, we also compared the growth rates of manufacturing industries at both current prices and constant prices of Asian high income economies when they were in and out of middle income stages. We found that for Japan, Singapore, Taipei,China and Republic of Korea, the growth rates of manufacturing industries have been diminishing in the long-term, but the manufacturing industries keep on growing most of the time. This implies that even the diminishing share of the secondary industry in the GDP is "unavoidable" in the process of economic restructuring; manufacturing keeps on growing for a long period and contributes to advanced economic development.

Figure 6: Growth Rates of Manufacturing Industries in Asian High Income Economies



Notes: (1) middle income trap in shadow; (2) fitted values are quadratic form.
Source: Calculation based on GGDC.

Third, for the Asian middle income economies (Malaysia, Thailand and the PRC), the average manufacturing value added in GDP at current prices in the low-income stage was 24.3%, and grew to 31.9% for the average manufacturing value added in GDP at current prices. When those economies reached the middle-income stage, the average manufacturing value added in GDP at current prices drop to 17.1%, and the average manufacturing value added in GDP at constant prices remained stable, at a level equivalent to high income economies when they were at the middle-income stage.

3.3 Driving Force: Size or Productivity?

Along with the literature, we have investigated the changes in relative size of manufacturing in various ways. However, size seems to partially explain the structural changes of manufacturing. On the one hand, some of those middle-income economies have not passed the middle-income trap for more than 20 years, and are, therefore, now facing the potential risk of the middle income trap and comparative disadvantage. This implies that besides keeping a certain share of manufacturing value added in GDP, there are other factors that are important for middle income economies to overcome the middle-income trap. On the other hand, even most of the high income Asian economies (like Japan, Republic of Korea and Singapore) have exhausted the demographic dividend when they have gone through an aging society; their increasing shares of manufacturing in real terms demonstrates their sustainable comparative advantage for decades. This comparison shows that the size of manufacturing is a

necessary condition rather than a sufficient condition for manufacturing transformation. We need to further investigate other matters for the industrial transformation.

One explanation is that manufacturing transformation generates a structural dividend that contributes to productivity growth. This proposal is supported by the experience of Asian economies. We calculated the changes of TFP of selected Asian economies, based on the KLEMS database. The growth rate of TFP is calculated by:

$$\Delta \ln TFP_{it} = \Delta \ln V_{it} - \sum_{X=K,L} \overline{v}_{Xit} \Delta \ln X_{it} \quad (1)$$

where under script *i* (*i*=1,2,……, *n*) denotes industry the *i*th industry, *t* (*t*=1,2,……, *n*) denotes year *t*; *V* is manufacturing value added, *K* is capital, L is labor; $\overline{v}$ is the output elasticity of factor of production or share of income. Note the price of factor of production as *P*. We rewrite the output elasticity of factor of production or share of income as

$$\overline{v}_{Xit} = \frac{1}{2}(v_{Xit} + v_{Xi,t-1}) \quad (2)$$

$$v_{Xit} = \frac{P_{Xit} X_{it}}{\sum_i P_{Xit} X_{it}} \quad (3)$$

We can calculate the cumulative TFP index based on annual TFP growth rate. In this paper, we set the year 2005 as the basis period t^*, and the TFP at industrial level as 100. Then the cumulative TFP index (I_{t^*+n}) of t^*+n can be calculated by

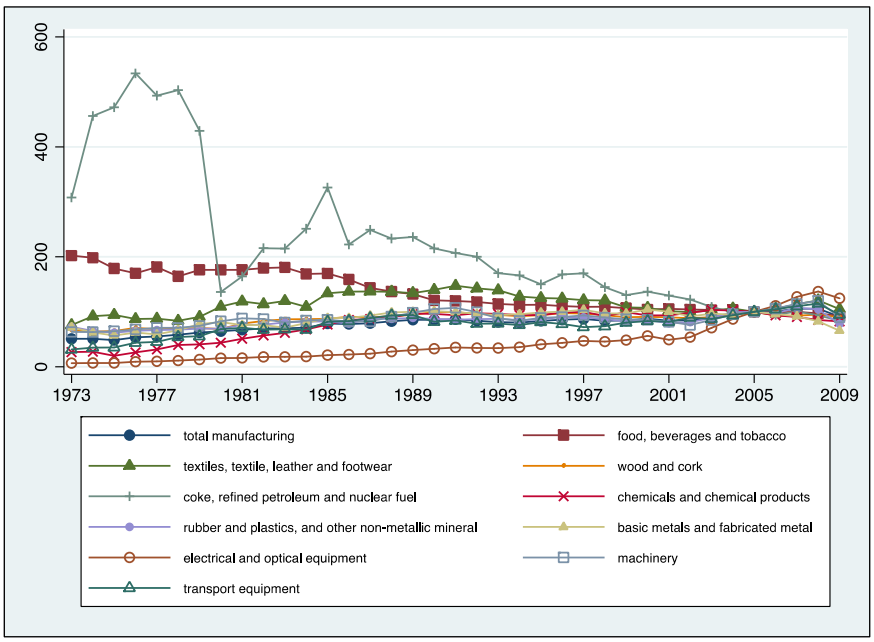
$$I_{t^*+n} = 100 + \prod_n (1 + \Delta \ln TFP_{i,t^*+j}) \quad j = 1,2,\ldots,n \quad (4)$$

The cumulative TFP index I_{t^*-n} of t^*-nth year is

$$I_{t^*-n} = \frac{100}{\prod_n (1 + \Delta \ln TFP_{i,t^*-j})} \quad j = 1,2,\ldots,n \quad (5)$$

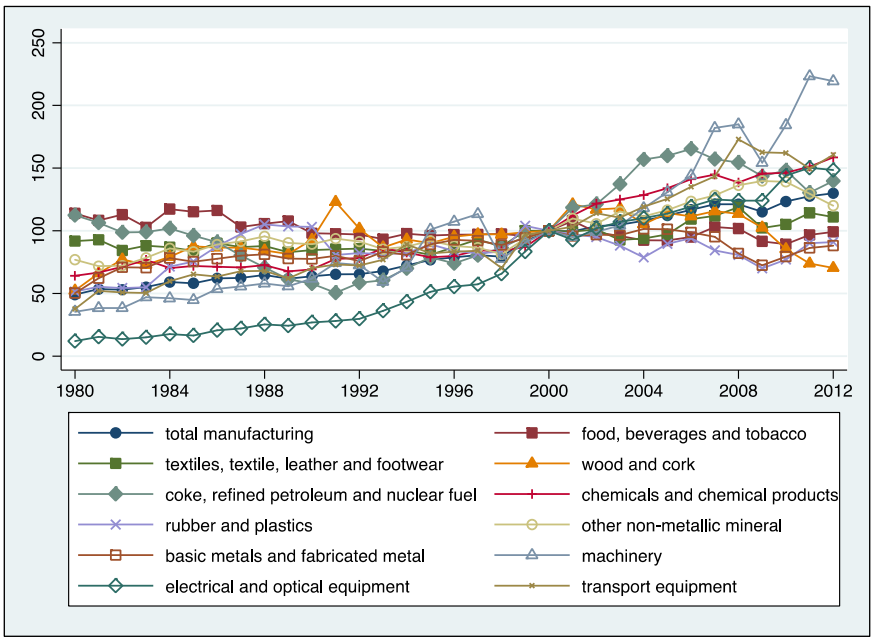
We further examine the changes of manufacturing of high-income economies. Since the 1970s, the TFP of Japanese low-technological manufacturing subsectors declined. Industries such as coke and refined petroleum products, food products, beverages and tobacco registered negative TFP growth rate. Meanwhile, the TFP of high-tech manufacturing subsectors, including electrical and optical equipment, chemicals and chemical products, transportation equipment and machinery equipment increased drastically. This structural change boosted the TFP of Japanese manufacturing to keep growing from 50.8 in 1973 to 91.2 in 2009 (2005=100).

Figure 7: Total Factor Productivity of Japanese Manufacturing



Source: Calculation based on KLEMS database.

Figure 8: Total Factor Productivity of Manufacturing in the Republic of Korea



Source: Calculation based on KLEMS database.

Republic of Korea underwent a similar manufacturing restructuring process. Since the 1980s, TFP of total manufacturing the Republic of Korea grew from 49.1 in 1980 to 129.9 in 2012 (2000=100). Among others, machinery equipment, electrical, optical and transportation equipment witnessed significant improvement in TFP. There is another feature of the Korean manufacturing efficiency change. Efficiency improvement occurred not only in the high-technological industries, but also for most low-medium technological industries. Overall manufacturing productivity improvement contributed

to industrial upgrading of Republic of Korea and avoid the middle-income trap (Park, 2012).

Based on those findings, we propose that for the PRC's future industrial adjustment, it is not only about the sizes, but also the productivity of manufacturing. However, the PRC is facing the risk of "premature deindustrialization" of decelerating manufacturing productivity.

4. DECLINING MANUFACTURING PRODUCTIVITY AND RISKS OF "PREMATURE DEINDUSTRIALIZATION"

4.1 Potential Risks of "Premature Deindustrialization"

Over the past three decades, the secondary industry has served as a key engine of the PRC's rapid economic growth and job creation. Since 2013, however, the secondary industry has been overtaken by the tertiary industry in terms of its share in the GDP. After 2009, the share of industrial value added in GDP continued to decline, down from 39.9% in 2011 to 34.3% in 2015, which is a decline by 5.6 percentage points in four years. During the same period, the value added of the tertiary industry as a share in GDP increased from 44.2% to 50.2%, up six percentage points over a span of four years.

It may not be prudent or appropriate to deem the declining share of the manufacturing industry in favor of the service sector as a sign of optimizing the industrial structure or to issue more supporting policies to speed up this tendency. Over the years, based on the general patterns of industrial structure shifts, the PRC has set certain targets for the output values and employment proportions of primary, secondary and tertiary industries (Huang and He, 2015). Yet as suggested by the experience of advanced economies, the pathways of industrial evolution for post-industrial countries are differentiated and follow no specific pattern in a strict sense. Given the integration between manufacturing and service sectors, it does not make much sense nowadays to use statistical proportions of industrial sectors as policy objectives. The traditional policy approach to identify optimal industrial proportions and achieve a similar industrial structure with advanced economies is increasingly unjustified and unfeasible. It may be a limited view to consider the rising proportion of the tertiary industry in the mid- and late stages of industrialization as a sign of optimizing industrial structure to be further encouraged (Huang and Li, 2015).

According to Rodrik (2016), middle and low income countries may experience premature deindustrialization, i.e. premature shrinking of the manufacturing sector, and potential adverse impacts on economic growth. Rodrik believes that the manufacturing sector is characterized by rapid technology advancement and unconditional convergence of labor productivity; it is a major employer of unskilled labor and a tradable sector. Due to these characteristics, manufacturing has become a perfect ladder for developing economies to catch up with advanced economies. Hence, he argued, premature deindustrialization is tantamount to blocking a major avenue of rapid growth. As can be learned from Rodrik's study, a declining share of the manufacturing sector in favor of the service sector may not necessarily indicate optimizing industrial structure. On the contrary, it may be a symptom of premature shrinking of the manufacturing sector and exhausting growth momentum.

Table 2: Share of Primary, Secondary, and Tertiary Industries in Gross Domestic Product

	Value Added of Primary Industry as a Share in GDP (%)	Value Added of Secondary Industry as a Share in GDP (%)	Value Added of Construction Sector as a Share in GDP (%)	Value Added of Manufacturing Industry as a Share in GDP (%)	Value Added of Tertiary Industry as a Share in GDP (%)
1990	26.6	41	4.6	36.6	32.38
1991	24	41.5	4.6	37	34.5
1992	21.3	43.1	5.2	38	35.6
1993	19.3	46.2	6.4	39.9	34.5
1994	19.5	46.2	6.1	40.2	34.4
1995	19.6	46.8	6.1	40.8	33.7
1996	19.3	47.1	6.1	41.1	33.6
1997	17.9	47.1	5.8	41.4	35
1998	17.2	45.8	5.9	40.1	37
1999	16.1	45.4	5.7	39.8	38.6
2000	14.75	45.5	5.5	40.1	39.82
2001	14	44.8	5.4	39.6	41.2
2002	13.3	44.5	5.3	39.3	42.2
2003	12.3	45.6	5.5	40.3	42
2004	12.9	45.9	5.4	40.6	41.2
2005	11.6	47	5.6	41.6	41.3
2006	10.6	47.6	5.7	42	41.8
2007	10.3	46.9	5.7	41.3	42.9
2008	10.3	46.9	5.9	41.2	42.8
2009	9.8	45.9	6.5	39.6	44.3
2010	9.5	46.4	6.6	40	44.1
2011	9.4	46.4	6.7	39.9	44.2
2012	9.4	45.3	6.8	38.7	45.3
2013	9.3	44	6.9	37.4	46.7
2014	9.1	43.1	7	36.3	47.8
2015	8.9	40.9	6.8	34.3	50.2

Source: National Bureau of Statistics (NBS)

Rodrik (2016) referred to Latin American and African countries as well as India as countries with premature industrialization. Yet such risks also confront the PRC. In 2015, the PRC's per capita GDP reached USD 7,956.84 (US dollar of 2015). According to Rodrik's study, before 1990, the mean value of per capita GDP was 47,099 international dollars (international dollar of 1990) when the share of real output from manufacturing sector peaked; after 1990, the mean value of per capita GDP was 20,537 international dollars (international dollar of 1990) when the share of manufacturing industry peaked. With the current tendency, the PRC could face rapid declines in the manufacturing sector when its per capita GDP is relatively low.

Table 3: Peak of Industrialization (around 1990)

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	Before 1990	**After 1990**	**Before 1990**	**After 1990**
Maximum proportion	21.5%	18.9%	27.9%	24.1%
Income level*	11,048	4,273	47,099	20,537
95% confidence interval	[8,785, 14,017]	[3,831, 4,735]	[19,667, 112,018]	[12,429, 34,061]

*: per capita GDP, international dollar of 1990.

Source: Rodrik (2016).

4.2 Source of Potential Risks for the People's Republic of China's Premature Deindustrialization: Falling Productivity

According to Rodrik, while the deindustrialization of advanced economies and particularly their real output results from continuous improvement of manufacturing efficiency, the "premature deindustrialization" of developing countries may have stemmed from the premature stagnation of manufacturing productivity growth. As a major manufacturer and exporter of manufacturing goods, the PRC is faced with severe challenges of rising factor cost. A significant slowdown of productivity growth presents grave challenges to the PRC's industrial development. Slowing TFP growth has also caused the industrial economy to lose steam. Wu (2013), Jiang *et al.* (2014), Liu and Chen (2016) all suggested that the PRC's industrial productivity is worsening.

Judging by the study result (see table below) of Wu (2013), the TFP of the PRC's industrial economy performed the best from 1992 to 2001, when the annual TFP growth rate reached 1.5%, and the annual inter-sectoral cumulative TFP growth rate reached 5.0%. The period of 2002–2008 saw falling TFP growth of the PRC's industrial economy, poor upstream sector productivity, negative growth of energy industry productivity, TFP growth of basic materials industry reduced to less than half compared with the previous period, and inter-sectoral cumulative TFP annual growth rate down from 5% in the previous period to the current 2.3%. After the eruption of the global financial crisis, the PRC's industrial TFP rapidly deteriorated during 2008–2010, with annual TFP growth rates down to –1.7% for the energy industry and –0.8% for the basic materials industry, overall TFP reduced to 0.3% and inter-sectoral cumulative TFP annual growth rate went down to –2.3%.

A study by Liu and Chen (2016) also suggests that since 2006, the annual growth rate of the PRC's secondary industry has been falling sharply. Jiang *et al.* (2014) and CASS IIE Research Group (2015) also indicate that the PRC's industrial TFP has been seriously worsening over recent years. According to their calculation, during 1980–2003, the PRC's TFP grew by 4.7% per annum and contributed 47.60% of industrial economy's growth. During 2004–2013, annual growth rate of TFP averaged –0.80%. To be more specific, during 2004–2008, the annual growth rate of TFP registered 0.58%; during 2009–2013, the average TFP growth rate reached –2.17%. It must be noted that the sharp declines of TFP growth rate did not start from the eruption of global financial crisis in 2008. Rather, this tendency became quite evident during 2004–2007.

Table 4: Annual Growth Rates of the PRC's Total and Sectoral Industrial Total Factor Productivity and Weighted Factor and Intermediate Inputs

	Gross Output	Labor Input	Capital Input	Intermediate Input	TFP	TFP (Domar)
			1980–1991			
Energy industry	0.9	0.4	3.5	1.9	–4.9	
Basic materials industry	7.9	0.4	2.4	5.9	–0.8	
Manufacturing of finished/ semi-finished goods	13.6	0.3	1.9	10.1	1.4	
Total industry	8.6	0.3	2.4	6.7	–0.8	–2
			1992–2001			
Energy industry	7	–0.1	3.4	4.7	–1	
Basic materials industry	11	–0.2	1.4	8	1.7	
Manufacturing of finished/ semi-finished goods	15	0.1	1.5	11.4	2	
Total industry	12.7	0	1.8	9.4	1.5	5
			2002–2007			
Energy industry	15	0.3	3.2	11.7	–0.2	
Basic materials industry	15.2	0.1	2.1	12.3	0.8	
Manufacturing of finished/ semi-finished goods	21	0.4	2	17.2	1.4	
Total industry	18.8	0.3	2.2	15.1	1.2	2.3
			2008–2010			
Energy industry	2.4	0.1	2.6	1.5	–1.7	
Basic materials industry	8.9	0.1	2.8	6.9	–0.8	
Manufacturing of finished/ semi-finished goods	15.8	0.2	2.6	12.7	0.3	
Total industry	13.3	0.1	2.5	10.5	0.3	–2.3
			1980–2010			
Energy industry	5.9	0.2	3.3	4.8	–2.4	
Basic materials industry	10.5	0.1	2.1	8	0.3	
Manufacturing of finished/ semi-finished goods	15.8	0.3	1.8	12.2	1.5	
Total industry	12.5	0.2	2.2	9.7	0.5	1.1

Source: Wu (2013).

Wu (2013), Jiang *et al.* (2014) and CASS IIE Research Group (2015) also suggest that the marginal productivity of capital (MPK) of the PRC's industrial sector rapidly deteriorated in recent years. Wu (2013) suggests that the MPK of export-oriented manufacturing sectors of finished goods and semi-finished goods dropped swiftly from 2005 or so; for the energy industry, extremely low MPK such as 0.1 has persisted for 15 years, which further declined to around 0.05 with the eruption of global financial crisis. Jiang *et al.* (2014) and CASS IIE Research Group (2015) indicate that the PRC's marginal yield of capital reduced rapidly after 2002 by a margin of over 50%. In 2013, each unit of capital input could only bring about an output of 0.244 units, which is close to the pre-1978 level (before reform and opening-up).

Table 5: Growth Accounting of the People's Republic of China's Industrial Economy Between 1980 and 2013
(%)

	TFP Contribution	Capital Contribution	Labor Contribution	TFP Contribution Rate	Capital Contribution Rate	Labor Contribution Rate
1980	8.97	0.09	2.96	73.24	0.72	24.16
1981	0.97	0.07	1.36	40.35	2.82	56.60
1982	3.98	0.07	1.66	69.02	1.26	28.75
1983	7.70	0.61	1.51	77.17	6.12	15.12
1984	9.60	0.90	4.81	60.84	5.69	30.50
1985	7.07	2.39	3.87	51.38	17.36	28.13
1986	1.44	5.03	4.22	13.28	46.51	39.01
1987	–0.42	5.19	2.43	–5.93	72.78	34.10
1988	2.90	4.58	1.92	30.32	47.96	20.11
1989	–8.01	3.18	–0.24	149.28	–59.18	4.54
1990	–10.06	3.63	9.49	–627.91	226.50	592.33
1991	7.03	3.41	0.38	63.65	30.91	3.45
1992	14.54	3.33	0.66	76.23	17.46	3.47
1993	6.26	3.04	1.67	55.61	27.00	14.86
1994	9.96	4.36	0.21	66.82	29.29	1.44
1995	5.30	4.83	1.09	46.24	42.15	9.49
1996	4.91	5.78	3.57	33.40	39.35	24.28
1997	5.26	5.31	1.29	43.38	43.75	10.66
1998	2.21	5.09	0.43	28.54	65.68	5.56
1999	4.20	4.36	–0.58	52.41	54.39	–7.25
2000	5.10	4.03	–0.61	59.40	46.95	–7.11
2001	7.41	3.10	–0.36	72.00	30.11	–3.47
2002	9.80	3.98	–2.43	86.87	35.29	–21.53
2003	5.63	7.14	0.28	42.54	53.91	2.14
2004	1.09	8.45	2.36	9.20	71.30	19.93
2005	–0.69	10.70	3.23	–5.33	82.92	25.04
2006	0.02	11.95	3.15	0.14	80.79	21.33
2007	2.54	11.58	3.23	14.57	66.48	18.57
2008	–0.04	10.15	0.55	–0.34	99.13	5.33
2009	–2.64	12.91	0.49	–27.06	132.47	5.03
2010	0.95	11.29	0.79	7.55	89.25	6.22
2011	–3.69	12.41	2.86	–34.73	116.76	26.87
2012	–3.68	11.67	0.75	–47.30	150.03	9.71
2013	−1.82	10.99	−0.80	–24.10	145.32	–10.56
mean	3.05	5.75	1.65	29.20	55.01	15.08

Note: Contribution refers to absolute contribution to industrial economy's growth; contribution rate refers to relative contribution to industrial economy's growth.

Source: Jiang *et al.* (2014).

Serious deterioration of the TFP and MPK clearly suggests that under the existing pattern of development, the PRC's industrial economy has approached its growth limit. Under the existing development model, the PRC's economy is vulnerable to the risks of "premature deindustrialization." Liu and Chen (2016) also demonstrate that with the declining share of industrial value added and growing proportion of the service sector, the PRC's cross-industry economic allocation efficiency decreased to negative values, which is indicative of the possible appearance of "Baumol's cost disease" in the PRC.

4.3 The People's Republic of China Urgently Needs to Promote Productivity of its Industrial Economy

With the exhaustion of industrial growth potential, the PRC must explore new avenues of growth. Shifting to service-oriented economic growth is one of the possibilities. Producer services such as IT and finance are highly productive and tradable and may replace the traditional role of manufacturing as a ladder for the PRC to catch up with advanced economies. Nevertheless, unlike manufacturing, these service sectors are generally skills-intensive and cannot absorb low-skilled labor abundant in low-income and medium-income economies (Wu, 2013). Moreover, the demand for producer services is generated by manufacturing, which determines the potential and competitiveness of producer services; rapidly declining manufacturing sectors may erode the foundation of service upgrades and drag the premiumization of the service sector (Lliu and Chen, 2016).

Wu (2013) also noted that most service sectors are either not technically vibrant or not tradable. This implies that their abilities to expand are limited by the income (and productivity) of other domestic economic sectors. Moreover, it also needs to be noted that manufacturing is always the most vibrant sector with the most abundant innovation resources in an economy. By creating new materials, tools, equipment and knowledge, manufacturing is the foundation for the spread of technology innovation to other sectors. Technology progress of agriculture and the service sector must also rely on the technology innovations in the manufacturing sector (Huang and He, 2015).

The PRC urgently needs to promote efficiency improvements and unleash potential for its industrial economy. Specifically, the PRC must promote sectoral and cross-sectoral allocation efficiency, facilitate the upgrade of industrial sectors towards higher-value links, and enable resources to move to more efficient sectors. The PRC must also speed up the creation of a fair and competitive market environment, remove administrative hurdles to certain sectors, promote financial development and engage the decisive role of market in resource allocation. Upgrading the industrial structure (toward higher-value and more efficient value chain links or emerging industries) is limited by the lack of core competence. Such limitations cannot be overcome with market mechanisms alone. The government must issue favorable policies to induce continuous improvements in manufacturing capabilities, especially in areas of core competence.

5. INDUSTRIAL POLICY RE-ORIENTATION

The PRC is striving to transition from an investment-driven to an innovation-driven pattern of industrial development. In this context, the PRC must adjust and optimize its future industrial policy to avoid current problems of policy design and implementation. One approach of policy optimization is to draw upon international practices. Regarding policy design and choice of policy instruments, the PRC may follow proven

international practices in formulating its own industrial policies with the same or similar policy objectives such as support to high-tech SMEs. In drawing upon international experience, the PRC should design its industrial policy according to its national conditions and industrial development. In addition, the PRC should also introduce innovative industrial policies in a few specific areas or adapt international practices to its own reality.

First, redirect industrial policy towards generic technology. Industrial policy should be directed at new "technologies" and "products" rather than new "industries." In fine-tuning its industrial policy, the PRC must channel policy resources towards general and generic technologies and encourage investment in innovation rather than production. A traditional growth-centered policy must give way to an innovation-centered policy. The manufacturing sector is evolving from a key engine of economic "growth" to a key engine of economic "development." Relative to primary and tertiary industries, manufacturing is unique and important in terms of the complexity of its activities and products. Hausmann *et al.* (2014) demonstrated through an empirical study that it is the complexity rather than scale of manufacturing that determines a country's long-term economic growth.

Thus, understanding the PRC's industrial restructuring must transcend arguments over the relative importance of the secondary industry versus the tertiary industry. Quantitative growth must give way to qualitative development. In the future, the PRC's industrial policy must be designed to enhance the quality, competitiveness and innovation of the manufacturing sector. The problem is that the PRC's industrial policy is still directed at specific industries or industrial areas. For instance, "Made in China 2025" identifies 10 industrial areas as priorities. Critics of structural industrial policy argue that given the uncertain industrial form of the new economy, it would be foolhardy to predict the future development directions of emerging technologies.

In comparison to the uncertainties of emerging technology, general and generic technologies are more explicit. For this reason, instead of naming a few so-called "emerging industries," the US has been vigorously developing general and generic technologies such as information networks, new materials and biomedicine. The rationale is that no matter how emerging industries develop and evolve, the origin of technology is precompetitive generic technology, the lack of which will pose barriers to their commercial development. Similarly, Germany and Japan have also focused their industrial policy resources on generic and common technologies. A key challenge facing the PRC today is a vicious cycle where the PRC keeps importing foreign technology and building industrial capacity, which ultimately leads to overcapacity. Both theoretical analysis and practical experience suggest that this vicious cycle may be resolved only by redirecting structural industrial policy and policy resources towards common and generic technologies.

Second, optimize policy formulation and implementation. The PRC should give full play to the enthusiasm of policy stakeholders, identify responsible entities, formulate science-based objectives and targets, adopt specific policy measures and instruments, refine policy formulation, implementation and evaluation and make industrial policy precise and targeted.

Enterprises, research institutions, social organizations and government at all levels should extensively participate in policy formulation, drawing upon multidisciplinary knowledge in natural science, engineering and social sciences (even the humanities). In the form of "policy programs," policy implementation should be more refined and more efficient through science-based management of formulation, implementation and evaluation.

In developed countries, a common practice is to create policy programs under industrial development strategies and assign specific project managers, performance objectives and implementation milestones for each policy program. Implementing industrial policy in the form of policy programs helps identify the specific rights and obligations of managers and programs for each policy measure, which can greatly enhance project management efficiency and implementation effect.

Third, adopt a flexible combination of policy measures with respective strengths and weaknesses, avoiding excessive reliance on a few policy instruments such as fiscal subsidies and taxes. An optimal mechanism must be environment-specific, where each policy instrument has its own advantages and limitations. Hence, a portfolio of policy instruments should be selected in a flexible manner according to the specific environment to which structural industrial policy instruments are applied. In this manner, the complementarity of different policy instruments will be brought into play, avoiding excessive reliance on a few policy instruments such as fiscal subsidies. This is an important approach to improving the system of the PRC's industrial policy instruments and enhancing science-based and effective policy-making.

In addition to putting structural industrial policy at the service of innovation, the government should also improve the public service system and innovation system to empower enterprises to innovate through collaborative and open innovation. Manufacturing transitions must be spurred on by both incentive and capability. A structural industrial policy that offers incentive must be integrated with a public service system designed to enhance capability.

Structural industrial policy is intended to promote corporate innovation through "moderate price intervention," while the public service system is designed to create and diffuse generic technologies to empower corporate innovation. For large corporations with strong R&D competence and some SMEs that excel in certain areas, the function of government is to support them with fundamental research and precompetitive technology by investing in science and technology infrastructure such as research-oriented universities and generic R&D institutions.

For a multitude of general SMEs, the function of government is to improve the public service system for SMEs. Importantly, public service systems must be enhanced to promote basic managerial capabilities, skills of industrial workers and manufacturing performance.

Instead of offering structural subsidies and preferences, industrial policy resources should focus on developing the public service system and innovation system that contribute to an improving environment and ecosystem for industrial development.

REFERENCES

Cai, F., 2010. Demographic Transition, Demographic Dividend, and Lewis Turning Point in China. *China Economic Journal*, *3*(2), pp.107–119.

———, 2012a. Is There a "Middle-income Trap"? Theories, Experiences and Relevance to China. *China & World Economy*, *20*(1), pp.49–61.

———, 2012b. The Coming Demographic Impact on China's Growth: The Age Factor in the Middle-Income Trap. *Asian Economic Papers*, *11*(1), pp.95–111.

———, 2016. *China's Economic Growth Prospects: From Demographic Dividend to Reform Dividend*. Edward Elgar Publishing.

Cai, F. and Lu, Y., 2013. Population change and resulting slowdown in potential GDP growth in China. *China & World Economy*, 21(2), pp.1–14.

———, 2016. Setting China's Growth Target Based on the Potential Growth Rate," *China Economist*, 11 (2016), pp.22–35.

CASS IIE Research Group, 2015, Study on Industrial Transition: An Efficiency-based Perspective, Research Report.

Chen, J., Q. Huang, T. Lv, and X. Li. 2012. *The Report on China's Industrialization (1995-2010)*, Social Science Academic Press China.

Eichengreen, B., Park, D. and Shin, K., 2011. *When Fast Growing Economies Slow Down: International Evidence and Implications for China* (No. w16919). National Bureau of Economic Research.

Hausmann, R., Hidalgo, C.A., Bustos, S., Coscia, M., Simoes, A. and Yildirim, M.A., 2014. The Atlas of Economic Complexity: Mapping Paths to Prosperity. MIT Press.

Huang, Q. 2014. New Normal, Late Stage of Industrialization and New Momentum of Industrial Growth. *China Industrial Economics*, 319(10), pp.5–19 (in Chinese).

Huang, Q., and J. He. "Core Competence, Functions and Strategies of China's Manufacturing Industry." *China Industrial Economics*, 9, 2015 (in Chinese).

Huang, Q., and X. Li, Assessment of China's Industrial Development in the 12th FYP and Strategies for the 13th FYP, *China Industrial Economics*, 9, 2015 (in Chinese).

Huang, Q., Jiang, Y., Li, F., 2015. *'The Belt and Road' National Industrialization Process Report*, Social Science Academic Press China (in Chinese).

Im, F.G. and Rosenblatt, D., 2015. Middle-Income Traps: A Conceptual and Empirical Survey. *Journal of International Commerce, Economics and Policy*, *6*(03), p.1550013.

Jiang, F., X. Li and P. Wu, 2014. Shifting Growth Momentum of China's Industrial Economy. *China Industrial Economics*, 314(5), pp.5–17 (in Chinese).

Lewin, A.Y., Kenney, M. and Murmann, J.P. eds., 2016. *China's Innovation Challenge: Overcoming the Middle-Income Trap*. Cambridge University Press.

Lin, J.Y. and Rosenblatt, D., 2012. Shifting Patterns of Economic Growth and Rethinking Development. *Journal of Economic Policy Reform*, *15*(3), pp.171–194.

Liu, M., Y. Chen, 2016. “Current Status, Problems and Countermeasures of China’s TFP.” *Comparative Studies*, 84 (3), pp.18–53 (in Chinese).

Park, B., 2012, “Economic Transformation to avoid the Middle Income Trap: Lessons from Korea's Experience.” *Proceedings in the 6th trilateral workshop of CASS-KIEP-PRI*.

Rodrik, D., 2016. Premature Deindustrialization. *Journal of Economic Growth*, *21*(1), pp.1–33.

Rosenstein-Rodan, P.N., 1943. Problems of Industrialization of Eastern and South-Eastern Europe. *The Economic Journal*, *53*(210/211), pp.202–211.

Woo, W.T., 2011. Understanding the Middle-Income Trap in Economic Development: The Case of Malaysia. *World Economy Lecture delivered at the University of Nottingham, Globalization and Economic Policy*.

Wu, H.X., 2013. Measuring and Interpreting Total Factor Productivity in Chinese Industry. *Comparative Studies*, *69*, pp.1–28 (in Chinese).

Xu, C., 2011. The Fundamental Institutions of China's Reforms and Development. *Journal of Economic Literature*, *49*(4), pp.1076–1151.

Zhuang, J., Vandenberg, P. and Huang, Y., 2012. *Growing Beyond the Low-Cost Advantage: How the People's Republic of China Can Avoid the Middle-Income Trap*. Asian Development Bank.