

Chapter 2

Forecast and Prospect of Industrial Economics Operation in the Second Half of the Year 2016

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Variations in the industrial economics operation may take place in tendency and cycle. Since the year of 2010, the growth rate of China's industrial economics seemingly has the tendency towards slowing down. While the tendency variable factors played a leading role in the slowdown of industrial economics operation, the cyclical factors played a key role. Main factors acting on tendency variation included: (i) capital accumulation, (ii) variation in labor force and its qualities, and (iii) technical progress. Cyclical variation was largely subject to short-time simulative monetary and fiscal policy and to variability of requirement space. Currently, due to declining marginal rate of capital return, there would be a downturn in the pace of capital accumulation. Variation in labor force and its qualities took little effect in a short term, but technical progress would hopefully become a supporting factor for this round of industrial economic growths. The drop-offs in global demand and domestic investment constituted a realistic basis for the government to implement a proactive fiscal and monetary policy.

In this report, the time sequence model is used to simulate the growth rates of industrial economics under various circumstances. According to the simulation results, (1) the slowing down tendency will continue; (2) the proactive financial and monetary policy plays a significant role in easing the fluctuations of industrial economics growth; and (3) the technical progress will be the main supporting force for industrial economic growth.

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2.1 Analysis of the Industrial Economics Prosperity in 2016

To get an intuitive understanding of the industrial economics development, this report has synthesized the available original data including industrial economics development to derive a composite indicator that reflects the situation of industrial economics, i.e. the composite index. According to the composite index, the industrial economics grew significantly in the first quarter of 2016, unlike the trend that remained lower last year. According to the prosperity index, the first quarter of 2016 witnessed a significant rise in prosperity index of industrial economics as compared to the previous year, but the lagging index indicates that this high trend seems feeble and the leading index indicates that this trend will continue.

(1) Formation of the composite index

Processing of original data: the composite index needs to eliminate the “redundant” information (or information irrelative to our purpose) from the original data. To eliminate this “redundant” information, it can be differentiated from original data. Firstly, the original data include high-frequency and low-frequency data, and the former contains daily, weekly and monthly data. What is needed in this report is the monthly data, so daily and weekly data are “redundant” to us and all data are necessarily subject to de-frequency processing. Secondly, the original data contain output data and value quantity data, and the value quantity data may lead to incomparability inside data sequence under the influence of changing prices; therefore, the incomparable data caused by changing prices need to be removed in order to accurately describe the trend of industrial economics development. Thirdly, it is the influence of movable holiday effect. Unlike the statistical data that are calculated in accordance with the solar calendar, the traditional Chinese Spring is always celebrated in accordance with the lunar calendar, so the Spring Festival usually takes place in different solar months. As a public holiday in China, the Spring Festival has strong holiday effects: suspended production, additional leisure time, sharp rise in consumption, and abnormality in all economic activities. As a result, some “redundant” information such as “holiday effect” is included in monthly data. When the data are relevant to growth rate, the above three kinds of information are redundant information that needs to be removed in this report. Thanks to coincidence between seasonal information and holiday information, however, the movable holiday information is usually eliminated earlier than is the seasonable information. In this report, the three kinds of redundant information will be eliminated by de-frequency adjustment, price adjustment and movable holiday adjustment methods.

Index selection: index is selected to acquire original data that can reflect the most of industrial economics trend. The three types of index are required to have an concordance index that reflect the condition of industrial economics development, a leading index that predicts the concordance index, and a lagging index which this report is most concerned with. So far, there are a number of methods for index

selection, such as the peak valley alignment method, the cross correlation coefficient method, the K-L information quantity method and the regression analysis method. In this report, the cross correlation coefficient method is used for index selection.

Correlation analysis is a statistical method commonly used in research on closeness among various variables and in research on the degree of correlation between two or more variables and the mutual relation of phenomena with certain functions. The correlative relation means the stochastic relation of change in two phenomena values that are not completely determined, or a kind of dependence relation that is not yet completely determined, often abbreviated as correlative relation, which is the object of study in correlation analysis. The closeness of correlative relation describes the degree of association among variables through calculation of correlation coefficient, i.e. the correlation coefficient is the statistical magnitude that describes the degree and direction of linear relation between two variables, usually expressed as r , without unit, value of which ranges between -1 and $+1$. The closer to r the absolute value is, the greater the degree of linear correlation between two variables will be. If r is greater than 0, it is a positive correlation and variable Y will increase as variable X increases; if r is less than 0, it is a negative correlation and variable Y will decrease as variable x increases.

Based on the principle of correlation coefficient, the cross correlation coefficient method has broken the sequence of two variables' correlation coefficient arranged by time limit according to time variable. This sequence may give the mutual relation between two variables at different times; accordingly, the maximum cross correlation coefficient is used to determine whether this index is a leading index, concordance index or a lagging index.

Synthesis of index: the composite index may be coded in different ways, e.g. the composite index method of the US Department of Commerce, the composite index method introduced by the Economic Planning Agency of Japan, and the composite index method of the UN Organization for Economic Cooperation and Development (OECD). The Japanese Economic Planning Agency's composite index method agrees with the US Department of Commerce in basic idea but differs slightly in method while the OECD's composite index method is developed specific to the leading composite index and seems simpler than the former two methods. In this report, the US Department of Commerce's composite index method is adopted as an internationally common method. It is basically used in the literature of Chinese development of prosperity index.

Step 1: Determine and standardize the symmetrical change rate of index

- (i) Let index Y_{ijt} be the value of j index in i index group at t time, where $i = 1, 2, 3$, representing the leading, concordance and lagging index groups respectively, $j = 1, 2, 3, \dots, k_i$, representing indexes in three groups, and k_i means the number of indexes in i index group. First determine symmetrical change C_{ijt} of Y_{ijt} , where $t = 2, 3, \dots, n$.

- (ii) To prevent greatly variable indexes from producing significant impact on composite index, the symmetrical change rate C_{ijt} of each index is standardized to make its average absolute value equal to 1. First determine the normalized factor A_{ij} and then standardize C_{ijt} with A_{ij} to obtain standardized change rate S_{ijt} , where $t = 2, 3, \dots, n$.

Step 2: Determine standardized average change rate of each index group

- (i) Determine average change rates of the leading index, concordance index and lagging index group, with $R_{i,t}$ of $i = 1, 2, 3$ and $t = 2, 3, \dots, n$.

Where W_{ij} is the weight of j index in i index group. The equal weight is usually used to set weight in composite index. The scoring system may be used to determine weight so that each index is given a score according to its economic importance, statistical adequacy, historical concordance and publishing timeliness, and then each index is weighted. If this step is not followed, the weight will be not as desirable as equal weight due to its strong arbitrariness and subjectivity. In order to keep consistent the numerical values of composite index in three index group, the standardized average change rates of all three index groups need to be calculated by dividing the average change rates of all index groups by normalized factor among index groups.

- (ii) Work out the normalized factor F_i , where $i = 1, 2, 3$.
- (iii) Figure out the standardized average change rate $V_{i,t}$, where $t = 2, 3, \dots, n$.

Step 3: Calculate composite index

- (i) Let $I_i(1) = 100$, then $i = 1, 2, 3$ and $t = 2, 3, \dots, n$.
- (ii) Synthesize a composite index with 100 as benchmark year, where I_i is the average value of $I_{i,t}$ in the benchmark year.

Follow above step in aggregating and synthesizing indexes of three index groups, and then figure out the composite index of the leading index, concordance index and lagging index.

(2) Analysis of prosperity index in the first half of 2016

It is indicated by the leading index and concordance index that the first half of 2016 greeted a slow pickup trend of prosperity from a low level. In January and February 2016, the prosperity of leading index fell into the range of negative values under the influence of sluggish prosperity in 2015 but assumed a constant pickup trend, and it further recovered above zero in March 2016. The concordance index presented a trend ascending year over year and descending month over month. In Fig. 2.1, the prosperity of concordance index ascended for a time to about 0.4 of that in January and descended afterwards to almost zero, but it picked up in March 2016, generally higher than the prosperity in the same period last year, regardless of a descending

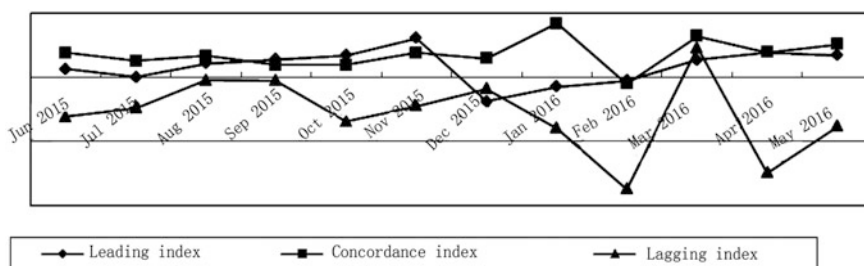


Fig. 2.1 Composite Index of IIE Prosperity Indexes

trend that took place later. The lagging index (mainly including export information and price information) indicated some risks in such growth. In 2016, exclusive of March and June, the prosperity of lagging index remained below zero with a greater degree of fluctuation. For some time in the future, there will be increasing uncertainties about growth of industrial economics.

According to prosperity indicators, (1) the fringe market improved greatly; the PMI of American manufacturing industry bounced back over the threshold; the PMI of Eurozone manufacturing industry maintained above the threshold and assumed an uptrend. The economic situation of developed countries would eventually have effect on China's export trade; despite a substantial decline in China's general trade export volume in the first quarter of 2016, the export volume grew 20% year on year in March; but there had been no substantial growth in the export volume of general trade as the domestic market of China remained in adjustment; (2) the real estate market witnessed brisk trades. In the first half of 2016, the area sold of real estate grew rapidly. From January to June 2016, it reached 643.02 million square meters, growing 27.9% year on year; the sales of real estate amounted to RMB 4.8682 trillion, growing 42.1%. The investment scale of real estate development maintained a moderate-rapid rate of growth; from January to June 2016, it grew 6.1% year on year, indicating a limited role of real estate market in driving industrial growth; (3) there was a slowdown in growth of fixed asset investment and a notable decline in industrial fixed asset investment. From January to June 2016, the fixed asset investment in China amounted to RMB 25.836 trillion (excluding peasant households), with nominal year-on-year growth of 9% (it was actually 11% after adjusting for inflation). The investment in the secondary industry amounted to RMB 10.1702 trillion, growing 4.4%, 16.7 and 7.7 percentage points lower than the primary industry the tertiary industry respectively, where the industrial investment amounted to RMB 9.9594 trillion, growing 4.2% year on year, and the manufacturing investment amounted to RMB 8.2261 trillion, growing 3.3% only; (4) under the influence of overcapacity and inventory adjustment, the outputs of industrial products saw an uneven year-on-year growth, e.g. the outputs of cast iron, crude steel and coke kept sagging while those of ethylene and aluminum products kept growing; and (5) the money supply M1 grew rapidly while M2 slowed down. In response to the downturn risks of industrial economics, Chinese government

exercised proactive monetary policy, resulting in a significant growth in money supply; nevertheless, the growth rate of money supply M2 tended to slow down due to the risk of the rising non-performing loan ratio (Table 2.1).

The steady rise in leading indexes predicted a quarter-long slow growth of the industrial economics for some time in the future, but the industrial economics would be under big downward pressure as it remained in growing pains of rebalance. Specifically, firstly, the ex-factory price index of industrial products remained within a negative range, the industrial overcapacity failed to improve in real sense, and the main industrial products trading market was not as active as expected; secondly, this round of growth of industrial economics was still dependent heavily on pickup of real estate market, and there would be limited space for growth in the future as the real estate market entered the period of adjustment; thirdly, the fixed asset investment remained a main force in supporting this round of slow growth of industrial economics, and the main sectors that could drive growth of fixed asset investment were infrastructure investment and real estate market investment while the manufacturing fixed asset investment remained at a low level; and fourthly, the loose monetary policy played a positive role in promoting pickup of real estate market, but the exit of the loose monetary policy would inevitably restrain the growing trend of the real estate market and further compromise demands of industrial products. Generally, this round of industrial economics growth as a continuity of the old investment-driven development pattern failed to result in any new growth points. Considering the transition of China's economic development from the industry-driven pattern to the service-driven pattern, there would be an irresistible trend of rapid growth of the service industry and slowdown of industrial growth.

2.2 Factors Influencing the Trend Variation of Industrial Economics

The decline of fixed asset investment in industrial sectors would inevitably lead to a slowing growth rate of capital stock and usher in a falling trend of industrial sectors. The innovative development strategy and global technological revolution initiated by Chinese Government would be a strong support for growth of industrial economics.

- (1) Lower and lower investment return of industrial enterprises and continuous downsizing of the fixed asset investment

Since reform and opening up in 1979, the profit scale of Chinese industrial sectors had expanded constantly; especially since the year of 2002, it grew at a rate up to 20% and made it possible for industrial investment return to maintain a high level. Since the year of 2011, however, the profit growth rate of industrial sectors slowed down even to a negative rate. As the profit growth rate remained low, the

Table 2.1 Year-on-year variations of prosperity indexes (*unit %*)

Name of index		Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016
Leading indexes	Output of coke	-14.13	-2.56	-17.64	-5.11	-3.15	-0.32
	Output of aluminum products	14.37	10.51	22.86	15.20	12.05	11.07
	Output of ethylene	-5.50	4.81	16.53	10.96	19.51	16.51
	Output of cast iron	-6.88	-15.44	-5.99	-0.08	-1.80	-0.51
	Output of crude steel	-3.88	-11.66	-1.79	-1.63	0.74	0.79
	Number of new projects commenced in the current year that utilized fixed asset investment	15.65	47.50	63.98	30.80	30.01	24.48
	Total planned investment in construction projects in the current year that utilized fixed asset investment	-6.07	6.57	17.90	-17.84	18.28	-3.11
	Area sold of commodity houses	1.64	22.09	35.73	37.66	44.05	24.25
	Area of commodity houses under construction	-22.88	0.83	12.09	3.66	4.65	-1.42
	Composite index of Shanghai Stock Exchange	9.41	-14.73	-18.80	-19.85	-33.85	-36.76
	Composite index of Shenzhen Stock Exchange	14.98	-15.54	-22.63	-20.56	-31.56	-36.90
	Money supply M2	11.56	11.96	10.75	10.85	10.30	9.61%
	American manufacturing PMI ^a	48	48.2	49.5	51.8	50.8	51.3
	Eurozone manufacturing PMI ^a	53.2	52.3	51.2	51.6	51.7	51.5
Concordance indexes	Industrial value added	5.90	0.38	11.60	6.80	6.00	6.00
	Electricity production	0.16	25.35	-16.00	5.94	-0.13	1.62
	Import volume of general trade	-8.99	-23.27	-14.94	-9.23	-10.68	2.19
	Total investment in real estate development	-3.42	-3.62	6.63	7.21	7.24	4047
	M1-MO	15.50	17.22	20.75	23.20	23.81	24.78

(continued)

Table 2.1 (continued)

Name of index		Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016
Lagging indexes	Export volume of general trade	-0.25	-9.28	-30.19	20.06	-0.52	-4.47
	Ex-factory price indexes of industrial products (EFPI)	94.1	94.7	95.1	95.7	96.6	97.2
	Consumer price index (CPI) ^a	101.6	101.8	102.3	102.3	102.3	102

Notes

1. Indexes asterisked with “^{ab}” are original values while other indexes are year-on-year growth rates after price adjustment in that month

2. Indexes without January and February data are interpolated by growth rate calculation and workday calculation

investment return receded gradually. Bai Chong'en and Zhang Qiong (2014)¹ pointed out that since the year 2011 China's return on invested capital presented a constantly declining trend, i.e. 21.1, 16.6 and 14.7% respectively from 2011 to 2013. The return on invested capital of industrial sectors stayed basically consistent with that of the whole society. The former's decline would result in transfer of investment into other industries and into overseas market. Data showed that from 2005 to 2013, the fixed asset investment of industrial sectors took up all the time over 40% of the total fixed assets investment; however, since the year of 2014, the fixed asset fell back to 39.9% and presented a trend of continuous decline (Fig. 2.2).

The growth of private fixed asset investment ushered in this round of the declining trend in fixed asset investment. Over years, the growth of private fixed asset investment in the secondary industry has all the time outnumbered the growth of total fixed asset investment and thus become the main force of fixed asset investment in the secondary industry. In March 2016, however, the private fixed asset investment in the secondary industry began to present a declining trend and became a leading force to bring down the growth of fixed asset investment (Fig. 2.3).

The declining fixed asset investment in industrial sectors would inevitably lead to a slowing growth rate of capital stock and usher in a falling trend of industrial sectors. According to the new-classic growth theory, a country's output depends on its capital stock, labor and total factor productivity; capital equals last year's capital stock minus depreciation and plus investment; when the investment size is greater than depreciation, the capital stock increases annually; when the investment size is equal to depreciation, the capital stock sees a zero growth rate; when the investment

¹Bai Chong'en and Zhang Qiong: Analysis of China's Investment Return and Influencing Factors, World Economy, Issue 10, 2014.

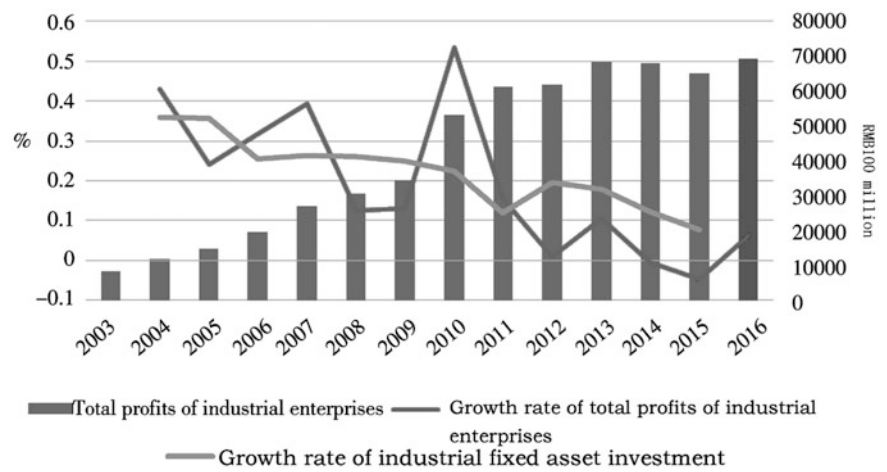


Fig. 2.2 Profits and fixed asset investment of industrial enterprises from 2003 to 2016. *Notes* 1 Data are sourced from National Bureau of Statistics. 2 Total profits of 2016 are predicted values. 3 The primary coordinate axis gives values of growth rate while the secondary coordinate axis provides values of investment size

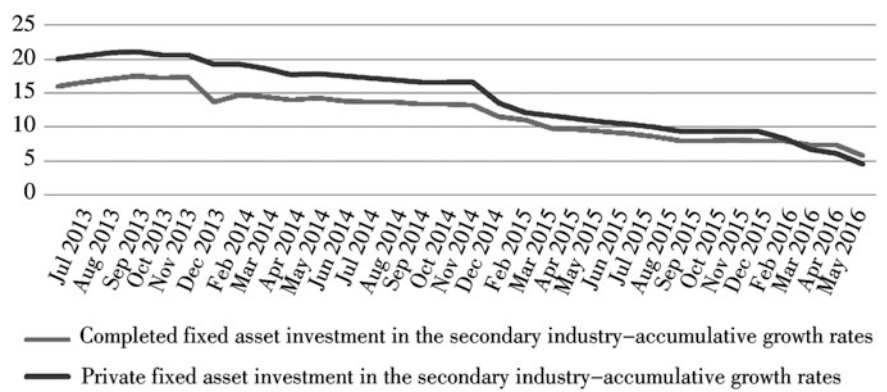


Fig. 2.3 Tendency chart for fixed asset investment in the secondary industry since July 2013 (unit %). *Source* National Bureau of Statistics website

size is smaller than depreciation, the capital stock suffers a negative growth rate; the greater the size of capital stock, the greater the size of depreciation; and a zero growth rate results inevitably when there is an unchanged investment size. Currently, however, the capital stock declines annually as the investment size shrinks annually; the capital stock moves rapidly towards a zero growth rate, even a negative one. If other production factors remain unchanged, there will be a positive correlation between capital stock and output, and a slowing or even a negative

growth rate of capital stock will lead directly to a slowing or a negative growth rate of output. The slowing growth of capital stock is an inexorable law of economic development, so the slowdown of output also suggests an inevitable trend of economic development. As the fixed asset investment in industrial sectors slows down, the slowing growth rate of industrial output becomes more apparent.

- (2) National innovative strategy implemented to provide strong support for improvement of technological level

In 2015, the “Mass Innovation and Mass Entrepreneurship” strategy was initiated by Chinese government to eliminate institutional constraints and provide support for startup of new enterprises, development of new products and expansion of new markets by all types of market entities through implementation of structural reform and institutional innovation. In the first half of 2015, Chinese government also issued *Made in China 2025*, the first ten-year action guiding document for manufacturing industry that specified nine strategic tasks for Chinese manufacturing industry, such as improving the innovation capacity, promoting in-depth integration of information and industrialization, enhancing quality brand and achieving breakthroughs in key fields. The development strategy to improve the innovation capacity of manufacturing industry underlined technology innovation and business model innovation in enterprises, with the former usually focused on breakthrough in a certain process while the latter combined advanced technology with advanced management and required enterprises to be always highly sensitive to market condition changes in order to maintain sustainable competitiveness. The integration of information and industrialization embodied services offered by manufacturers; it would be the only choice for the manufacturing industry to begin integrative development with the service industry in a certain stage; during upgrading and structural adjustment of the manufacturing industry, more enterprises opted to adopt “service outsourcing” in order to consolidate resources and make use of unique strengths; namely, enterprises tended to maintain sectors with core competitiveness and outsource such service activities as production, operation and even management usually carried out internally in the upper, middle and lower processes of production activities, thus providing development opportunities for some producer service enterprises; and the integration between producer service enterprises and industrial manufacturers helped improve the resources utilization efficiency and the industrial efficiency. A famous brand is the product of independent innovation capacity. Since the “11th Five-Year Plan” (2006–2010), the famous brand development strategy has created a large number of famous brands with strong competitiveness; as a globally influential big power in the world, however, China is currently short of self-owned famous brands with international competitiveness; therefore, building quality brand is an effective measure for China to further its independent innovation capacity and protect intellectual property. The core of the “Mass Innovation and Mass Entrepreneurship” strategy and *Made in China 2025* initiative still lies in innovation that has played a positive role in vitalizing market and starting up businesses. In the second half of 2016, all economic sectors will

issue and implement several policy measures supporting this core and specialized planning for subdivided fields to provide strong support for improvement of technological level.

(3) Global disruptive technologies developed to become an external force to propel industrial innovation

The advanced manufacturing technologies such as robot and 3D printing, the information technologies such as cloud computation, Internet of Things and big data, the new resource technologies such as renewable energy sources and advanced oil-gas exploration, the biotechnologies such as a new generation of genome, and the intelligent technologies such as auto-driving vehicles and knowledge-based office automation have exerted far-reaching influence on the world industry; in particular, these technologies have generated profound changes in the production mode, the development pattern, the industrial type and organizational form of the manufacturing industry, and pushed development of the manufacturing industry towards intelligent, service, collaborative, network and green manufacturing. Specifically, the new generation of information technology has permeated into all aspects of the manufacturing value chain, including changes in technology and manufacturing mode, and thus promoted reconstruction of the manufacturing value chain; the application of the Internet of Things has enabled manufacturers to achieve real-time acquisition of information and real-time monitoring of production process; the application of big data has enabled manufacturers to identify and solve invisible problems and predict the future development; the application of cloud computation has helped manufacturers predict market demands and consumers' individual needs and achieved precise location of target consumer group, so it has been constantly putting right the strategic direction and altering the organizational and operational patterns of manufacturers; the combination of the Internet of Things and 3D printing has promoted establishment of new manufacturers that will clone things by reading information; the development of robot technology has made production lines become more automatic, standard and refined, and may further create "unmanned factory", thus providing infinite opportunities for traditional manufacturing industry; and the steady development of advanced manufacturing technologies has resulted in effective integration of manufacturing information and intelligence. In this process, the renewable energy source technology has provided a solid foundation for green development of the manufacturing industry while the 3D printing technology that has saved more materials, improved the utilization rate of raw materials and made materials used more environment friendly when manufacturing products may push the manufacturing industry towards sustainable and healthy development. Currently, breakthroughs have been achieved in some disruptive technologies in China. In the future, with wide applications of these technologies, their economic potentialities will be released and become main driving force to improve industrial technological level.

2.3 Factors Influencing Cyclical Variation of Industrial Economics

The cyclical fluctuation of industrial economics in the future will be subject to factors such as global economic recovery and changes in both national and international demands, and will therefore lead to cyclical variations of industrial economics. Various uncertainties will likely result in drastic fluctuation in the future industrial economics.

(1) Sluggish global economy recovery and significant global trade slow down

Since the year of 2008, the growth of global international trade slowed down under the influence of financial crisis. Despite various incentive policies that simulated economic growth in 2010 and 2011, the zero or even negative growth trend remained unchanged (see Fig. 2.4).

Economic differentiation continued in main economies of the world. The American economy saw a steady recovery and assumed a trend of slight growth. The European economy was recovering from European debt crisis and moving towards stabilization. The emerging economies witnessed obvious internal differentiation; India maintained a steady economic growth while Russia and Brazil suffered a negative growth. On the whole, the international economic situation has slightly improved, but the global economic growth still featured a too slow, fragile and unbalanced recovery. The US dollars appreciation and continuous decline of international oil price added more uncertainties to global financial markets and global economic recovery, such as intensification of global trade protection,

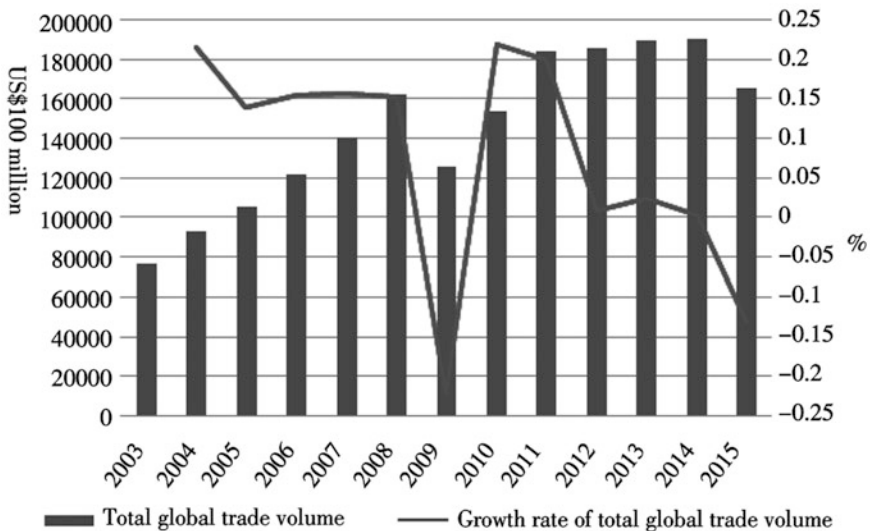


Fig. 2.4 Global trade scale since the year of 2003

expansion of exchange rate fluctuations, local economic upheaval and geopolitical tensions. Continuous changes of the world economic pattern have brought about huge risks and impact on China's foreign trade and restriction on China's external demands. In addition, the "Road and Belt" strategy involves many sensitive regions in Western Asia and Eastern Europe, so the geopolitical tensions may have adverse effects on China's overseas investment under the background of the Belt and Road Initiative and to some extent compromise industrial growth that should be stimulated by the Belt and Road Initiative.

(2) Challenges facing China's industrial goods trade though its competitiveness improves constantly

In the international trade pattern, China's industrial goods took up an increasingly high proportion. In 2003, China's industrial goods only took up 5.7% of global goods trade, but the proportion rose to 13.8% in 2015, steadily increasing in more than ten years. Under the influence of shrinking global trade, China's export growth rate slowed down and trade scale also withered, but China's trade competitiveness witnessed a rising trend year by year; it is predicted that the rising trend of trade proportion will persist in 2016.

The comparative advantages of China's industrial development are under various threats and interruptive risks. The competitive advantages of China's industrial enterprises have over years depended on low-cost advantages based on low-level production factors. With the loss of demographic dividend, the rise of domestic factor cost, the intensification of resource and environment pressure and the expansion of economic scale, however, this low-cost advantage is diminishing little by little and the dividend in trade that uses low cost as the main competitiveness basically comes to an end. In addition, new advantages based on the high-level product factors can hardly be established in a short time and may interrupt competitive advantages, resulting in depression of industrial goods export, slowdown of economic growth rate and decline of enterprises' international competitiveness. In contrast, some emerging economies, such as Southeast Asian and African countries, have lower labor cost than China, and the comparative advantages of labor force in these countries have come into market, tending to supersede China's traditional advantages. In addition, the advanced manufacturing technology, information technology, biotechnology and energy technology spread quickly over the world and are widely used by developed countries to exploit potential markets and realize "backflow of manufacturing industry" and "reindustrialization". The "backflow of manufacturing industry" and "reindustrialization" strategy of developed countries has enabled them to slow down overseas transfer of their manufacturing industries, especially the high-end manufacturing industries. The development of China's hi-tech industries depends largely on the international market, so it will be more difficult for China to borrow technologies from developed countries; instead, China will rely on its financing cost, logistics cost and tax cost as well as the technological gap.

- (3) The effect of regional collaborative strategy of “Beijing-Tianjin-Hebei integration”, “Yangtze River Economic Belt” and the Belt and Road Initiative to provide huge demand space for industrial development

In March 2015, the *Vision and Actions on Jointly Building the Silk Road Economic Belt and the 21st-Century Maritime Silk Road* was issued jointly by the National Development and Reform Commission (NDRC), Ministry of Foreign Affairs and Ministry of Commerce to promote construction of the Belt and Road Initiative. In April 2015, the *Coordinated Development Program for Beijing-Tianjin-Hebei Region* was adopted at the meeting of the Political Bureau of the CPC Central Committee. In October 2015, *China's 13th Five-Year Plan (2016–2020) on National Economic and Social Development*, adopted at the Fifth Plenary Session of the 18th Communist Party of China (CPC) Central Committee, proposed formation of the lengthwise and crosswise economic axial belt along the coast, the river and the line guided by the Belt and Road Initiative construction, Beijing-Tianjin-Hebei coordinated development and Yangtze River Economic Belt construction and based on the overall strategy of regional development, and formation of city clusters including the northeast region, the central plains region, the middle reaches of the Yangtze River region, the Chengdu-Chongqing region and the central Shaanxi region through prior development of such city clusters as Beijing-Tianjin-Hebei, the Yangtze River Delta and the Pearl River Delta.

The new demand space for China's industrial development provided by the regional coordinated development strategy along with its policy effect has brought indefinite opportunities for China's industrial development in the next year. Firstly, the strategy has driven the balanced development in these regions. For a long time, Chinese government's focus on coastal regions for economic development has create many economic hot spots in the eastern regions with most advanced economic development and most sufficient utilization of funds; in contrast, the central and western regions, especially the western regions, saw a rather low fund utilization rate and a narrow extent of opening up to the outside world due to their location, which laid severe restrictions on economic development but indicated potential industrial demands. The formation of city clusters has led to industrial cluster effect and creation of an industrial development pattern in which the growth poles of Beijing and Shanghai will drive economic growth in surrounding provinces, favorable for optimization of urban spatial layout, coordination among industrial sectors and expansion of environmental capacity and ecological space; in particular, the “Yangtze River Economic Belt” covering 11 provinces and cities has linked together the eastern, central and western regions to form a coordinated development belt that allows interaction and cooperation among the eastern and western regions and drives economic development in the western region, has fundamentally changed the location conditions of the western regions as many provinces along the Belt and Road Initiative are located in West China, has broadened the opening-up extent in China's northwestern and southwestern regions and provided opportunities for these regions to carry out foreign trade and foreign investment activities and achieve leap-forward development. Then, the strategy has

driven investment in infrastructure construction. In the regional coordinated development strategy, the infrastructure construction is the foundation and top priority as it provides convenience for inter-regional communication. In the *Coordinated Development Program for Beijing-Tianjin-Hebei Region*, it was proposed that RMB 4.2 trillion investments be put into Beijing-Tianjin-Hebei integration in the future six years, with most of which will be invested in infrastructure construction. Huge demand of infrastructure investment in western countries along the Belt and Road Initiative will inevitably drive China's investment in infrastructure construction. Meanwhile, severe overcapacity problems of Chinese industry in capital construction, such as cutthroat competition among enterprises, have led to waste of enormous resources and a series of social problems. The advancement of the Belt and Road Initiative has found new outlets for China's overcapacities so that Chinese enterprises will have to promote industrial transformation and upgrading, improve industrial competitiveness and adjust industrial structure when they decide to "go out".

(4) Debt risks accumulated to pin down industrial operation

Local debt risk remains high. During economic deceleration, the fiscal revenue growth will slow down and the expenditure will rise moderately under the influence of economic fundamentals, enlarging the scale of deficit and debt. Furthermore, the fact that local governments may execute debt financing on various financing platforms to maintain goals of local economic and social development and to accelerate infrastructure construction will initiate a new mode to stimulate economic growth by governments' leveraging investment. When the government no longer provides any guarantee for these debts, some of the debts will be transferred by financing platforms to debts payable by the government; as a result, the debts payable by the local government will increase. According to the results of national debt audit at the end of 2015, RMB 1.9 trillion debts payable by the government fell due in 2015. Excessive debt ratio of the local government will put local government under heavy pressure to discharge debts and will also easily lead to crisis of local government debts; in addition, due to different rates of local economic growth and different debt burden of provinces, it is likely to incur local debt crisis. Excessive local government debts may also lead to risk of local government's bankruptcy and place strict restrictions on local government's further financing and on continuous investment in infrastructure construction and thus compromise the growth of industrial economics.

Potential risk in industrial sectors remains high. In May 2016, the debt-to-asset ratio of industrial enterprises above designated size was 56.8%, 0.6 percentage point higher than December 2015, and the leverage ratio reached up to 131%, which increased the operating risk of industrial sectors. It is noted that the excessively high leverage ratio of Chinese enterprises was questioned as the leverage ratio of foreign enterprises maintained at around 70%. In effect, the leverage ratio of Chinese enterprises has been extremely high for many years, for it was closely related to Chinese economic reality: (i) high saving rate that means relatively adequate supply of capitals in China, and (ii) high leverage that results from two

realistic bases—relatively lagging development of China’s capital market and credit financing used as the main financing channel by China’s industrial sectors. However, these two bases are slowly collapsing as the consumer savings declines and the capital market expands and plays more financing functions. In recent years, the de-leverage ratio of industrial enterprises has paced up, reducing from 178% at the beginning of 1998 to 128% at the end of December 2015. The current uptrend of leverage has no realistic base. Furthermore, the local government’s debt risks are constantly discharged. China as a whole suffers a very high debt ratio, so the increasing leverage will intensify the risk pressure.

2.4 Prediction of Industrial Growth Trend

HP filtering method adopted in this report separates the growth trend of industrial value added year on year from cyclical factors to analyze roles of different factors in industrial value added. According to the results, the growth rate of industrial economics has slowed down since the year of 2010; the slowing growth rate has continued in the first half of 2016 but the decreasing amplitude was narrowing; and it is predicted that the industrial growth will highly likely hit the bottom in the second half of 2016.

(1) Data source and interpolation of missing values

In this report, the value added year-on-year growth data of industries above designated size are used as observing indicators of industrial growth, with the samples ranging between January 2008 and June 2016. Data are sourced from National Bureau of Statistics website. The industrial value added year-on-year growth rate is: (i) calculated by comparable prices, independent of price factors and free from price adjustment, and (ii) value added growth data of industries above designated size with January growth data missed, which needs interpolation. The traceability method is adopted in this report to interpolate data. Specific steps are as follows.

Firstly, the monthly year-on-year growth rate data and the monthly accumulative growth rate data of industrial value added as well as the monthly actual data in 2005 of industrial value added² are obtained from National Bureau of Statistics website. Secondly, the monthly industrial value actually added in 2005 is used to figure out the monthly accumulative growth rates of industrial value added in 2005. Thirdly, the monthly accumulative industrial value added in 2005 and the monthly accumulative growth rates of industrial value added in 2006 are used to calculate the monthly accumulative industrial value added in 2006, and by analogy get the monthly accumulative industrial value added from 2007 to 2016 with January data missed. Fourthly, the monthly industrial value actually added in 2005 and the

²Data source: China Monthly Economic Indicators, January 2016.

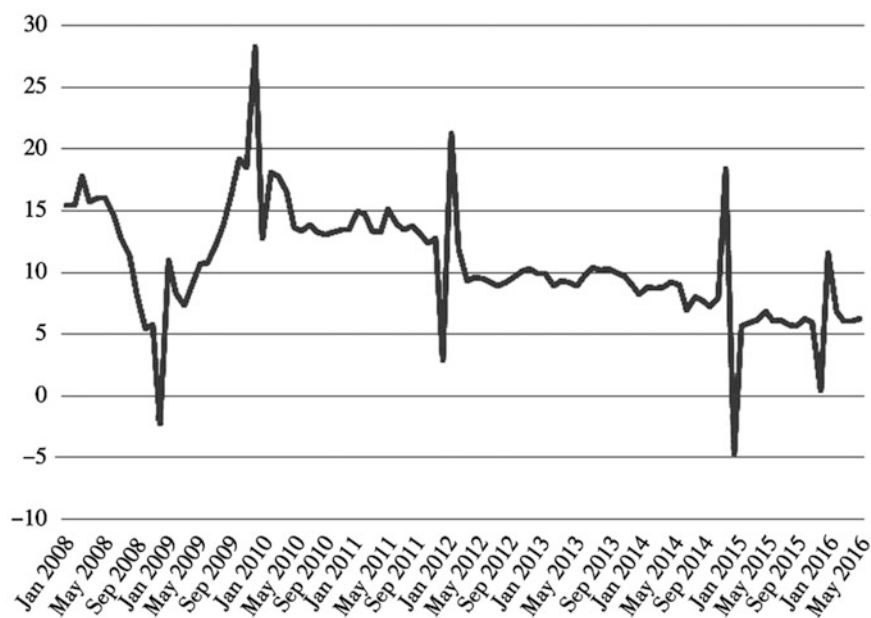


Fig. 2.5 Industrial value added year-on-year growth rates of industries above designated size (%).
Data source Reckoned from National Bureau of Statistics Website and *China Monthly Economic Indicators*

monthly year-on-year growth rates of industrial value added in 2006 are used to figure out the monthly industrial value actually added in 2006, and by analogy get the monthly industrial value actually added from 2007 to 2016 with January data missed. Fifthly, the industrial values actually added in January from 2006 to 2013 are obtained by the accumulative number in February of industrial value added from 2006 to 2016 with January data missed minus the actual industrial value added in February from 2006 to 2016. Finally, all monthly data calculated above are used to directly get the missing January data about the monthly year-on-year growth rates of industrial value added (Fig. 2.5).

(2) Trend components and fluctuating components of industrial growth separated by HP filtering method

In order to separate the long-term trend factors from the cyclical (irregular) factors of industrial growth and obtain estimation of unobservable potential factors, either the moving average method or the frequency domain estimation method may be used for the original data of single time sequence; the filtering method has a unique advantage, i.e. simple, intuitive and easy for implementation, and can also avoid the problem caused by production function method, i.e. whether the product function can be stable in the economic transition period, and the problem caused by variable structure decomposition method, i.e. whether there exists the Phillips curve of

conventional form in China. Therefore, the HP filtering method is adopted in this section to predict the growth trend of industrial economics.

The HP filtering de-trending method may regard economic operation as a certain combination of potential growth and short-term fluctuations and use metrological technology to decompose the actually output sequence into trend components and cyclical components; the former means potential output while the latter means output gap or fluctuation. For growth rate of industrial operation, the time sequence y_t consists of industrial operation trend g_t and industrial operation fluctuation c_t , namely:

$$y_t = g_t + c_t \quad t = 1, \dots, T \quad (2.1)$$

Hodrick and Prescott (1980, 1997)³ designed HP filter by following the logarithm data moving average method. The filter can obtain a smooth sequence g_t from the time sequence y_t , i.e. trend component, and g_t is the solution to the formula below:

$$\text{Min} \left\{ \sum_{t=1}^T (y_t - g_t)^2 + \lambda \sum_{t=1}^T [(g_t - g_{t-1})(g_t - g_{t-2})] \right\} \quad (2.2)$$

where, $\sum_{t=1}^T (y_t - g_t)^2$ represents fluctuations, $\sum_{t=1}^T [(g_t - g_{t-1})(g_t - g_{t-2})]$ represents trend, and λ is smooth parameter with a positive value used to adjust proportions of fluctuation and trend. Selection of the smooth parameter λ is an important problem in the HP filtering method. Different smooth parameters mean different filters that determine different fluctuating modes and smoothness. According to Hodrick and Prescott (1980, 1997), the value of smooth parameter is taken as 100 in processing annual data, as 1600 in processing quarterly data and as 14,400 in processing monthly data. According to Ravn and Uhlig (2002),⁴ the smooth parameter should be 4th power of the observed data frequency, i.e. 6.25 for annual data, 1600 for quarterly data and 129,600 for monthly data. In this report, the data used are growth rates of industrial value added from January 2010 to September 2015, sourced from National Bureau of Statistics website. It is important to note that the missing data on growth rates of industrial value added in January on National Bureau of Statistics website are supplemented by point linear interpolation in this report. Above two types of filters are selected for use in this report: $\lambda = 14,400$ and $\lambda = 129,600$.

After quarterly adjustment of data, two filters with smooth parameters $\lambda = 14,400$ and $\lambda = 129,600$ (hereinafter referred to as Filter 1 and Filter 2) are used to filter the natural logarithm of China's industrial value added growth rates and then get the trend components and fluctuation components therein, as illustrated in Fig. 2.6.

³Hodrick, R., and Prescott, Edward C. (1980, 1997), "Postwar U.S. Business Cycles: An Empirical Investigation", *Journal of Money, Credit, and Banking*, 29 (1): 1–16.

⁴Ravn, M., and Uhlig H. (2002), "On Adjusting the HP Filter for the Frequency of Observations", *Review of Economics and Statistics*, 84 (3): 71–75.

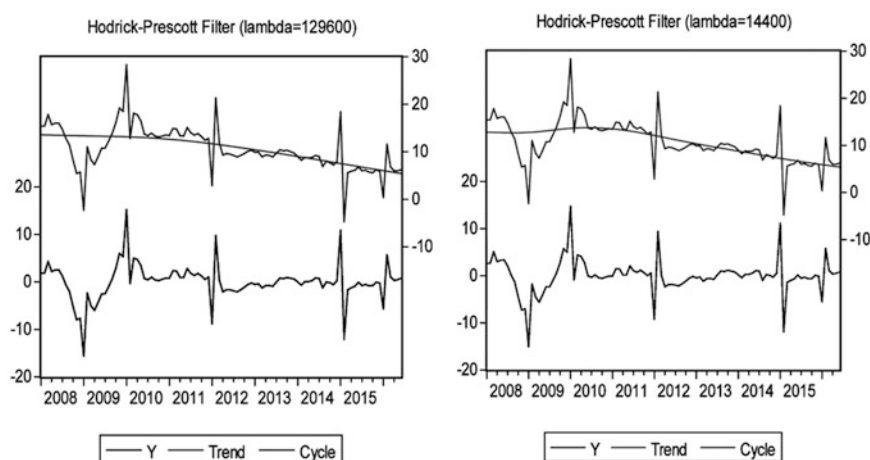


Fig. 2.6 Filtering results of different filters. *Picture source* Eviews 5.0 output result

According to Fig. 2.6, there is no significant difference in trend sequence and fluctuation sequence achieved by two filters, and there is no difference in two trend sequences and two fluctuation sequences as both passed t test of 95% confidence level. Intuitively from the tendency of trend sequences, the potential growth rates of China's industrial operation has been on a curve declining trend all the time since the year of 2008.

(3) Growth forecast and scenario analysis of industrial economics

With the current technological level, China's industrial economics will be highly likely to maintain a slow-down growth rate from the second half of 2016 to the first half of 2017, providing the current monetary and fiscal policies remain unchanged. According to the model prediction, the growth rate of China's industrial economics will reduce to 5.7% at the end of 2016 and to 5.6% in June 2017. Under the influence of moving holidays, obvious fluctuations will occur in industrial growth in January and February 2017; in remaining months of 2017, the industrial economics will operate smoothly.

Benchmark: The quantities and qualities of labor force remain unchanged; the fixed asset investment maintain current development trend; the technical level remains unchanged; and the fiscal and monetary policies remain unchanged.

Scenario 1: The quantities and qualities of labor force remain unchanged; the fixed asset investment maintain current development trend; the technical level remains unchanged; and the fiscal and monetary policy strength is 20% lower than the current level.

Scenario 2: The quantities and qualities of labor force remain unchanged; the fixed asset investment maintain current development trend; the technical level remains unchanged; and the fiscal and monetary policy strength increases 20% over the current level.

Table 2.2 Forecast of industrial growth rates under different scenarios

Year-on-year growth rates of industrial value added (%)						
	Trend value	Fluctuating value	Benchmark	Scenario 1	Scenario 2	Scenario 3
Jan-16	5.9	−5.5	0.4	0.4	0.4	0.4
Feb-16	5.8	5.8	11.6	11.6	11.6	11.6
Mar-16	5.7	1.1	6.8	6.8	6.8	6.8
Apr-16	5.6	0.4	6.0	6.0	6.0	6.0
May-16	5.5	0.5	6.0	6.0	6.0	6.0
Jun-16	5.4	0.8	6.2	6.2	6.2	6.2
Jul-16	5.3	1.3	6.6	6.3	6.8	7.6
Aug-16	5.2	1.2	6.4	6.1	6.6	7.4
Sep-16	5.1	1.1	6.2	6.0	6.4	7.2
Oct-16	5.0	1.0	6.0	5.8	6.2	7.0
Nov-16	4.9	1.0	5.9	5.7	6.1	6.9
Dec-16	4.8	1.0	5.7	5.6	5.9	6.7
Jan-17	4.7	0.9	5.6	5.4	5.8	6.6
Feb-17	4.6	0.9	5.5	5.3	5.7	6.4
Mar-17	4.5	0.9	5.4	5.2	5.5	6.2
Apr-17	4.4	0.9	5.2	5.1	5.4	6.1
May-17	4.2	0.9	5.1	4.9	5.3	5.9
Jun-17	4.1	0.9	5.0	4.8	5.1	5.8

Data source Based on Eviews 5.0 output results

Scenario 3: The quantities and qualities of labor force remain unchanged; the fixed asset investment maintain current development trend; the fiscal and monetary policies remain unchanged; and the technical level increases 20% over the current level (Table 2.2).

According to the results, (1) the industrial growth rate will reduce to 5.7% at the end of 2016 and to 5.0% in June 2017, providing the technical level and investment scale remain unchanged and the current fiscal and monetary policies are maintained; (2) the industrial growth rate will reduce to 5.6% at the end of 2016 and to 4.8% in June 2017, providing the technical level and investment scale remain unchanged and the negative fiscal and monetary policies are implemented; (3) the industrial growth rate will reduce to 5.9% at the end of 2016 and to 5.1% in June 2017, providing the technical level and investment scale remain unchanged and the proactive fiscal and monetary policies are implemented; and (4) the industrial growth rate will reduce to 6.7% at the end of 2016 and to 5.8% in June 2017, providing other factors remain unchanged and the technical level has significantly improved.

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