

TFP and labor productivity: empirical facts of China's macro-economy and issues for long-run economic growth

Research Group of Cutting-edge Study on China's Economic Growth^{*}

The empirical facts of China's Macro-economy from 2013 to 2014 show the rate of investment and scale of import and export are approaching a maximum and there is an increasing fluctuation in investment and trade; deflation in real economy and the real estate market bubble go hand in hand; and efficiency imbalances between industries and regions become acute. The phase of growth driven by investment and wealth is approaching its end and the economy has entered a crucial period of structural adjustment. The economic growth rate is anticipated to be 7.4% in 2014, and stand between 6.4% and 7.8% over the next five years. Steady growth and high efficiency become the new requirements during the slowing-down of economic growth. In the process of investment-driven growth transforming into efficiency-driven growth, it is well worth paying attention to the establishment of a long-term mechanism for consumption-driven growth. The balance between investment and consumption in the sense of demand management is rendered unhelpful to establishing a path for sustainable growth in China; the report aims to deliver a new perspective by pondering the dynamic efficiency of consumption in the transformation of investment potential into consumption-driven growth.

Keywords: economic growth, TFP, labor productivity

1. Situation and problems of China's macro-economy in 2013 and 2014

China's growth rate was 7.4% in the first quarter of 2014—a new low. This resulted from an economic environment where domestic investments were tepid and exports were stagnant. Currently, China's macro-economy has the following new characteristics. First, the proportion of service industry in GDP exceeds that of the secondary industry for the first time. The labor

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force from rural labor transfer and those left over due to sluggish secondary industry performance have been taken in by tertiary industries, which further consolidates the service industry's position as the main channel of employment, but this also lowers the growth rate of service industry labor productivity. The imbalance of efficiency between the secondary and tertiary industries has become acute. Second, the investment rate and trade scale are approaching their limits and investments and exports have peaked. This has weakened the two carriages' growth driving force and caused major instability. Third, with the two driving carriages of investment and exports slowing down, consumption in the first quarter of 2014 provided a driving force for steady growth; however, there is still a lack of long-term mechanisms for consumption-driven growth. Fourth, PPI continues to drop and housing prices are falling, which brings down entrepreneurial confidence; the mismatch of funding maturity is getting serious and the differentiation between real economy and real estate markets is becoming aggravated, which is increasing economic downside risks. The continuing economic slowdown that appeared in 2010 is different in nature from the one that happened between 1998 and 2000 (see Figure 1). Though the economic slowdown in the two periods all happened with external economic downturn, the economy between 1998 and 2000 suffered from short-term and cyclical impacts, but the strong demand of investment and huge potential of exports soon turned the situation around. The economic slowdown that began in 2010 has had more structural properties and this round of economic slowdown is not a reversible interlude, but instead a prelude for a long period structural slowdown. This round of economic slowdown also means the end to China's investment-driven and wealth-driven (real estate) growth phase which has lasted for years.

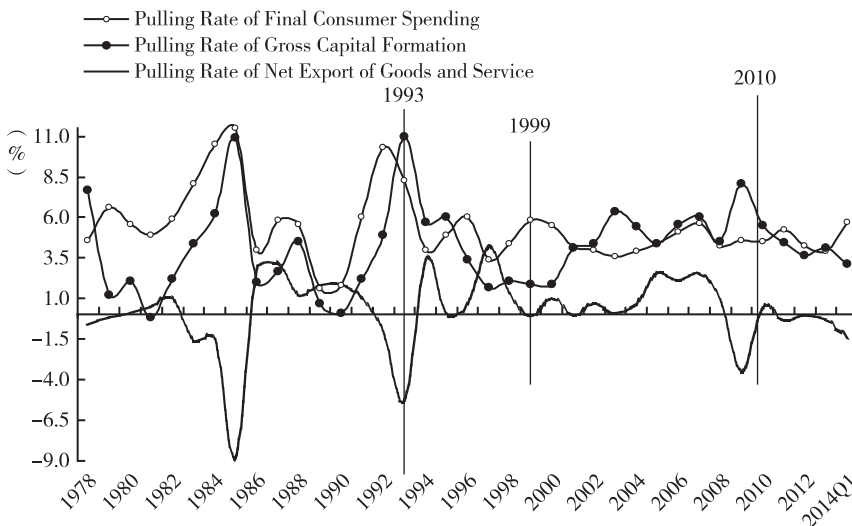


Figure 1. Growth driving rates of the three key demands in China from 1978 to 2013 and in the first quarter of 2014
Source: CEIC.

1.1. The three key demands

1.1.1. The total import and export trade volume of goods is approaching the boundary, reducing space for scale expansion

Since becoming ranked first in export volume of goods in 2009, China's total import and export trade volume of goods reached 4.16 trillion dollars in 2013 and China has become the largest goods trading nation (WTO,2010;WTO Documents Online). From 2013 to 2014, China's import and export trading has taken on the following new properties: the trade scale boundary appears and trade fluctuation is sensitive to internal and external economic changes. As is shown in Figure 2, after years of continuous, rapid expansion (especially after trade promotion in 1993), China's imports and exports have been approaching the top of the Sigmoid Curve since 2013, and the space for scale expansion of goods trade has been largely reduced. On the other hand, because the scale is reaching its peak, China's trade has entered a period for high-order adjustment and adaptation and with the impact of internal and external economic environments, it is the downward fluctuation of trade scale that takes the upper hand, the so-called phenomenon of being "lonely at the top." Currently, the risks of downward adjustment of goods trade come from the inherent limitation of the present industrialization model and phase of growth, which shows that the industrialization stage over-dependent upon exports and quantity expansion is about to end. A sustainable, efficiency-oriented trade structure has not yet been established, however. China's industrialization has just evolved into a phase in which economic growth is supported by processing finished products and a conventional model characterized by high raw material and energy consumption, which has caused imports to be over-dependent upon external raw material markets.

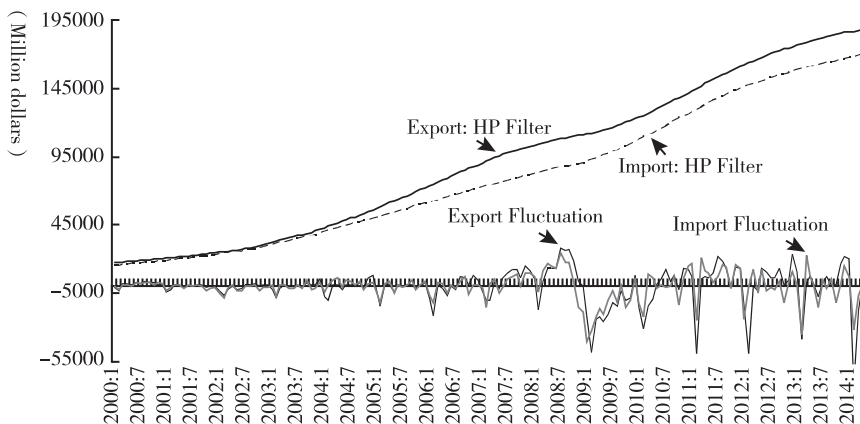


Figure 2. Trend and fluctuation of China's import and export trade of goods from January, 2000 to April, 2014

Source: CEIC.

1.1.2. The boundary of investment rates appears and the problems with investment structure and investment efficiency become acute

Following the decline in growth rate of investments in the past three years, China's investments, in the first quarter of 2014, contributed only 3.1% to economic growth; the reason lies in the fact that China's investment driving mode met with boundary constraints. Figure 3 shows the investment rate and its fluctuation from the first quarter of 1995 to the first quarter of 2014 and the general trend is that the quarterly investment completed/quarterly GDP between 2013 and 2014 was approaching the top of the Sigmoid Curve and at the same time, the investment rate reached its peak and had large wave-amplitude. This reflected the increased instability in investment. This instability is not only influenced by trade, but is also linked with the periodical characteristics of the service industry in China and the conclusion of wealth (real estate) driven phase.¹ The service industry that continues today is subject to the development characteristics of the industrialization process, including its low efficiency and speculation-based traits. The typical manifestation of speculation is the disorderly expansion of the real estate industry. Between 2003 and 2010, investment in real estate accounted for 25% of the total investment of the whole society and 45% of tertiary industry; these figures were further elevated to around one third and 50% in 2013, respectively.

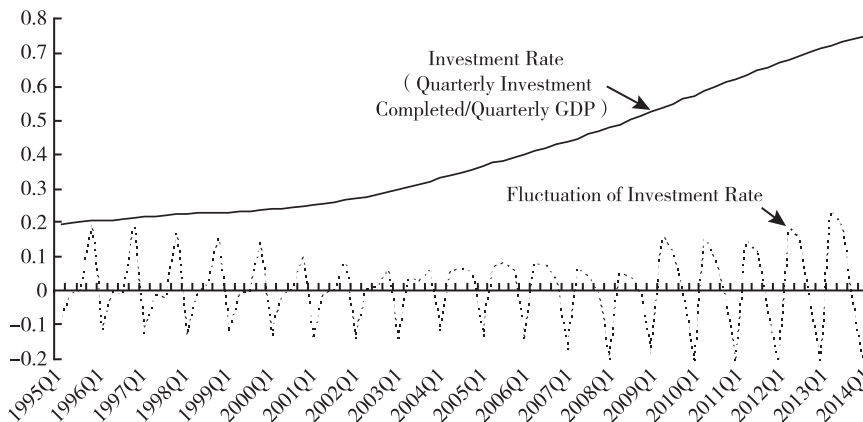


Figure 3. Investment rate (HP Filtering) and its fluctuation in China from the first quarter of 1995 to the first quarter of 2014

Note: Quarterly investment rate shown in Figure 3 equals quarterly investment completed/quarterly GDP.

Source: CEIC.

¹ According to the comparison between trade fluctuation in Figure 2 and investment fluctuation in Figure 3, the downward fluctuation trend of investment is not as acute as the reduction of import and export and the reason is some domestic stimulating factors for investment curbed the excessive decline of investment.

1.1.3. There is a lack of endogenous mechanisms for consumption driven economic growth

In 2013, the final consumption rate and household consumption rate were 49.8% and 36.2%—a slight rise over the previous year. The rise of consumption rates between 2013 and the first quarter of 2014 was generated in the background. Trade and investments were approaching their limits and the driving force of these two carriages weakened; however, the problems of weak consumption growth are still significant. For the year-on-year growth rate of accumulated retail sales of consumer goods (on an inflation-adjusted basis), it was 12.1% in 2012, 11.5% in 2013, and 10.9% in the first quarter of 2014. The current depressed consumption is owed to the following aspects. First, because consumption demand can rebound on the basis of raising the anticipated income, the anticipated structural slowdown will rub salt on wounds. Second, high-rising housing prices and uncertainty in future rises of anticipated income have inhibited the residents' propensity to consume. Third, the sluggish macro-economy and fluctuation in financial markets have reduced the wealth effect and residents' demand for money increases, putting restraints on real consumption.

1.2. *Structure distortion and market risk*

Since February, 2012, PPI has continued to decline and that trend has lasted through 2014. If we put the trend into the frame of two approximating boundaries for analysis, we can conclude that saturation of the international market for industrial goods and inadequate demand for industrial goods from China's domestic market caused industrial production overcapacity. Given China's industrialization model of processing and manufacturing, the production overcapacity actually means huge waste for industrial investments—the core matter behind this is investment inefficiency. Just because of that, more and more investments are brought into real estate, the long-term investment which turns out to bear more inefficiency and huge risks.

The problem of mismatched funding maturity caused by irrational investment structure cannot be well handled in a short period of time. One of the typical characteristics of investment structure distortion is excessive investment in real estate industry. The escalation of the money shortage in 2013 verified the mismatch between funding maturity from one side and the interest rate rise resulting from the short-term liquidity shortage from the second quarter of 2013 to the first quarter of 2014, with each quarter's interest rate standing at 6.91%, 7.05%, 7.2%, and 7.18%, respectively. However, those were just official interest rate levels and if we took financing for domestic small and medium sized enterprises into account, the burden of interest rate on borrowings for the real economy would be heavier. A large amount of funding leaves real economy for asset markets and bubble phenomena thus become intensified, meaning China's asset price rises have reached their end and the wealth driven phase has basically ended.

1.3. Predictions and outlook for 2014

With economic growth still facing the pressure of a structural slowdown and in view of the depressed import and export trade and domestic investment, in 2014 the economy is expected to maintain its growth rate at 7.4%. Because the growth rates of total retail sales of consumer goods in the first four months of 2014 were lower than those of their corresponding months in the previous year. Compounded by money creation capacity further declining, this year's price level, i.e. CPI, will be stable and stand at 2.1% and PPI will still be negative. In 2014, economic growth will still depend on the driving of investment and imports and exports; new development in the service industry will be the new bright spots for investment and consumption. 2014 will still be a year for adaptation; we should adjust structure, carry forward reform, stabilize growth, and control potential risks and challenges we will face. We must effectively mitigate the risks of local government debts and improve profitability of enterprises by cutting taxes and reducing financing cost.

Table 1

Forecast of China's major macro-economic indicators (%)

Major Economic Indicators	2013	First Quarter of 2014	Forecast of 2014
1. Increase Rate of Consumer Price Index (CPI) (On year-on-year Basis)	2.6	2.4	2.1
2. GDP Growth Rate in Real Terms (On year-on-year Basis)	7.7	7.4	7.4
3. Nominal Growth Rate of Total Retail Sales of Consumer Goods (On year-on-year Basis)	13.1	12.0	13.0
4. Nominal Growth Rate of Total Fixed Asset Investment (On year-on-year Basis)	17.6	17.3	17.6
5. Nominal Growth Rate of Total Export Volume (On year-on-year Basis)	7.6	-1	8.0
6. Year-on-year Growth Rate of M2 Money Balances (On year-on-year Basis)	13.6	12.8	13.5

Note: The source of data from 2013 to the first quarter of 2014 are CEIC and CEInet.

2. Structural changes: growth trend of next five years (2014-2019)

By calculating GDP decomposition, distribution of labor productivity, and production function, we can obtain a long-term growth prediction interval of 6.4%-7.8%. A number of assumptions are implied, including population, labor productivity, and allocation effect.

2.1. GDP growth decomposition: based on labor productivity and changes in demographic structure

For the decomposition of GDP growth rate, the formula is as follows: GDP growth rate =

the growth rate of labor productivity + change rate of labor participation rate + growth rate of demographic dividend (i.e. growth rate of the proportion of work force age population in total population) + growth rate of the total population.

Table 2

Decomposition of China's GDP growth factors: based on changes in labor productivity and demographic structure (%)

	Past Records (Peak to Peak: 1985-2007)	Status Quo (2008-2013)	Prediction (2014-2019)
GDP Growth Rate in Real Terms (Yearbook Data)	10.10	9.00	7.77
Growth Rate of Labor Productivity ($y=Y/L$)	8.54	8.60	8.24
Change Rate of Labor Participation Rate (θ_L)	-0.07	-0.41	-0.33
Growth Rate of the Proportion of Work Force Age Population in Total Population	0.54	0.29	-0.40
Growth Rate of Total Population	1.03	0.49	0.26

2.1.1. Growth rate of total population and growth rate of demographic dividend

Since reform and opening up, China's rapid economic growth has benefited from a beneficial population structure. However, as the era of an aging population draws near, the window of demographic dividend is about to close. During the period of accelerated industrialization from 1985 to 2007, the annual average growth rate of total population in China was 1.03%, while between 2008 and 2013 the figure was 0.49%. Accordingly, the growth rate of demographic dividend (i.e. growth rate of the proportion of work force age population in total population) fell from 0.54% of the former period to 0.29% of the latter period. In the coming years, the trend will go from growth to decline.

2.1.2. Change rate of labor participation rate

The labor participation rate here is defined as the ratio of labor supply and work force age population. During the period of accelerated industrialization from 1985 to 2007, the annual growth rate of the labor participation rate was -0.07%, with the figure standing at 0.24% from 1985 to 1989, 0.36% from 1990 to 1999, -0.80% from 2000 to 2007, and -0.41% from 2008 to 2013. According to trend estimation, the change rate of the labor participation rate will be -0.33% from 2014 to 2019. The continuous drop of the labor participation rate since 2000 has something to do with increase of years of education for the young working population and the trend of an aging population, which will gradually become a major problem in the future stages of urbanization.

2.1.3. Growth rate of labor productivity

According to the direct decomposition of factors, the contribution rate of labor productivity in GDP was 8.5% in the period between 1985 and 2007, when the GDP growth was 10.1%. In the period between 2008 and 2013 when GDP growth was 9.0%, the contribution rate of labor productivity was about 8.6%. During over 30 years of reform and opening up and rapid economic growth, the growth rate of labor productivity in China has long maintained at 8.5% and above. If that growth rate remains, China will have a sound economic development trend.

2.1.4. Scenario analysis of population change in economic growth

Compared with the period between 2008 and 2013, the economic growth rate will be 1.2 percentage points lower in the period between 2014 and 2019; compared with the peak value of economic growth in the period between 1985 and 2007, the growth rate in the period between 2014 and 2019 will be 2.3 percentage points down; the demographic dividend has been the most direct influence. When we compare future predictions (from 2014 to 2019) with rapid growth rate during the peak value period (from 1985 to 2007), we can find that the contribution rate of demographic transformation (growth rate of population, demographic dividend, and labor participation rate) in economic growth was 20%.

2.2. *Decomposition of structural factors in labor productivity change: industrial allocation effect*

In order to observe the industrial allocation effect of labor productivity changes, we decomposed the growth rate of labor productivity into the growth rate of the proportion of added value of each industry; change rates of proportion of employment for each industry and the relevant growth rate of labor productivity (refer to appendix for the decomposition formula). The main conclusions Table 3 shows are: in the two periods of 1985–2007 and 2008–2013, the growth rate of labor productivity in secondary industries had a significant decline—from 9.2% in the former period to 7.2% in the latter period; the growth rate of labor productivity in tertiary industries declined slightly from 6.0% in the former period to 5.8% in the latter period. China's "learning by doing" effect in its large-scale industrialization process is the source of the fast growth of labor productivity, but with the formation of the service-centered industrial structure, it is inevitable that China's labor productivity as an entire society will be cut down.

2.3. *Estimation of potential growth rate: based on C-D production function and nonlinear dynamics of variables*

2.3.1. Supply of labor force

The growth rate of labor input was 1.50% from 1985 to 2007, 0.36% from 2008 to 2013, and is estimated to be -0.45% from 2014 to 2019.

Table 3

Decomposition of factors in labor productivity

	Past Records (Peak to Peak: 1985-2007)	Status Quo (2008-2013)	Prediction (2014-2019)
Growth rate of Labor Productivity ($y=Y/L$)	8.54%	8.60%	8.24%
Growth Rate of Labor Productivity in the Primary industry	4.42%	8.73%	10.00%
Rate of Change of Employment Share	-1.92%	-4.26%	-5.18%
Share of Added Value	0.18	0.09	0.09
Growth Rate of Labor Productivity in the Secondary Industry	9.21%	7.21%	7.03%
Rate of Change of Employment Share	1.35%	1.96%	1.57%
Share of Added Value	0.49	0.49	0.43
Growth Rate of Labor Productivity in the Tertiary Industry	5.99%	5.80%	6.00%
Rate of Change of Employment Share	3.11%	2.93%	2.57%
Share of Added Value	0.33	0.42	0.48

(Reference Index—1978 as the Base Period): 2013

Growth Rate of Labor Productivity in the Secondary Industry: 8.1%

Growth Rate of Labor Productivity in the Tertiary Industry: 1.2%

Note: According to the formula in the appendix, Growth Rate of Labor Productivity ($y=Y/L$)= Added Value Share of the Primary Industry $\times$ (Growth Rate of Labor Productivity in the Primary Industry + Change Rate of Employment Share of the Primary Industry) + Added Value Share of the Secondary Industry $\times$ (Growth Rate of Labor Productivity in the Secondary Industry + Change Rate of Employment Share of the Secondary Industry) + Added Value Share of the Tertiary Industry $\times$ (Growth Rate of Labor Productivity in the Tertiary Industry + Change Rate of Employment Share of the Tertiary Industry).

2.3.2. Capital input

From 1985 to 2007, the annual average growth rate of whole-society fixed asset investment was 21.5%; the whole-society capital formation ratio was 38.3%; the growth rate of capital stock was 11.1%, and the growth rate of per capita capital was 9.4%. All this fully embodied the capital driven mode of fast economic growth in the progression of industrialization.

From 2008 to 2012, the annual average growth rate of whole-society fixed asset investment was 24.8%; the whole-society capital formation ratio was 47.1%; the growth rate of capital stock was 13.5% and the growth rate of per capita capital was 13.7%. Investment in the real estate industry still played a leading role and the average proportion of fixed asset investment in the real estate industry in whole-society fixed asset investment was 24.0%; its average proportion in fixed asset investment of service sectors was 44.5%.

Marked by accelerated growth of investment in the service industry in 1992, China has quickened its pace for development of urbanization. One basic understanding is that after nearly 20 years of large-scale development, the climax of China's urban infrastructure investment has

passed. In 2011, China's urbanization rate was over 50% and its urbanization has gradually entered a mature period, so the growth rate of capital accumulation in secondary and tertiary industries will decline continuously. According to the inverted U-curve relationship between urbanization rate and growth rate of investment, it is predicted that the growth rate of capital stock in China will be 9.4% from 2014 to 2019.

2.3.3. Long-term situation of factors' elastic change

In the past 30 years, the ratio of elasticity of capital(α) and elasticity of labor($1-\alpha$) remains at about 0.6:0.4 in China's growth equation and is expected to gradually reach the level of 0.5:0.5 in the period of 2014-2019. The major impact brought by the reversal of factor elasticity parameters lies in the fact that it will overestimate the role of investment in economic growth, thus dragging down the potential growth rate.

2.3.4. Total factor productivity

Consensus has been reached among researchers of China's economy that the contribution rate of total factor productivity to economic growth is too low. From 1985 to 2013, the growth of China's total factor productivity (pace of technological progress) basically remained at around 2%, and its contribution to economic growth was 20%-30%. The low contribution rate of total factor productivity has something to do with China's capital driven mode of economic growth, because rapid economic growth was almost entirely dependent upon high investment rates and there was an essential lack of endogenous mechanisms for technological advances. From 2014 to 2019, the investment driven mode of economic growth will not have any substantial changes and the contribution rate of total factor productivity to economic growth will remain at about 30%.

3. Analysis of efficiency imbalance

3.1. Influences of labor force reallocation due to efficiency imbalance

The process of industrialization is the one in which the agricultural industry and service industry adapt to the expansion of industrial scale with their surplus labor force and ability of labor division, as has been the general experience of industrialized countries that experience structurally accelerated growth. In the modern sector particularly, the concentration of capital towards industrial sectors and the passive expansion of sectors of the service industry cause an efficiency imbalance between the secondary industry and service industry (Research Group of Cutting-edge Study on China's Economic Growth, 2012, 2013).

Table 4

Decomposition of production function and trend prediction¹

	Past Records (Peak to Peak: 1985-2007)	Status Quo (2008-2013)	Prediction (2014-2019)
[1] Three Factors of Potential Growth (Production Function Fitting)	9.72%	10.30%	6.40%
[2] Capital Input (K): Elasticity	0.60	0.6	0.5
[3] Share of Capital Contribution= $([2] \times [8]) / [1]$	68.72%	73.40%	73.50%
[4] Labor Input (L): Elasticity	0.40	0.4	0.5
[5] Share of Labor Contribution= $([4] \times [11]) / [1]$	6.17%	1.40%	-3.52%
[6] tfp: Growth Rate	2.44%	2.60%	1.96%
[7] Share of tfp Contribution= $100 - [3] - [5]$	25.11%	25.24%	30%
Factor Subdivision			
[8] Growth Rate of Capital Input ($k = dK/K$)= $[9] \times [10]$	11.13%	12.60%	9.40%
[9] (Net) Rate of Investment (I/Y)	21.32%	36.00%	
[10] Capital Efficiency (Y/K)	0.52	0.35	
[11] Growth Rate of Labor Input ($l = dL/L$)= $[12] + [13]$	1.50%	0.36%	-0.45
[12] Growth Rate of Work Force Age Population(pop_t)	1.58%	0.78%	-0.12
[13] Change of Rate of Labor Participation Rate(θ_{lt})	-0.07%	-0.41%	-0.33
[14] Growth Rate of Labor Productivity			
[15] Growth Rate of Labor Productivity ($y = Y/L$)= $[16] + [17]$	8.54%	8.60%	
[16] Growth Rate of Capital Efficiency (Y/K)	-0.89%	-4.87%	
[17] Growth Rate of Per Capita Capital(K/L)	9.43%	13.47%	
Urbanization			
[18] Urbanization Rate	33%	50.5%	0.59*

*The estimation of growth rate of capital input is based on the calculation of inverted U-curve relationship between urbanization rate and growth rate of investment.

According to further studies, the current difference of labor productivity between the secondary industry and service industry in China is derived from the growth mode of the special phase, i.e. when the service industry existed as the result of labor division of traditional heavy chemical industries. The service industry replaced agricultural sectors to be the storage reservoir for the supply and demand of a cyclical labor force and at that time the expansion of the service industry was reflected in its scale rather than its efficiency. Such a phenomenon started to emerge as early as 2003. As is shown in Figure 4, from 2003 to 2013, the annual growth rate of employment in the agricultural sector continued to be negative by a large margin (the annual

¹ From 2008 to 2013, the potential economic growth was 10.3%, higher than actual growth rate. Because in recent years, China still maintains the investment driven mode of economic growth with accelerated investment growth, excessive production capacity is caused to accumulate constantly, touching off the deflation in real economy.

growth was -10.87million people), and the sluggish economy after 2008 did not have a labor flow back to agriculture. The judgment we have for that is that sectors in service industry which have a greater share of employment had already replaced agricultural sectors to be a new storage reservoir for the labor force, and under the condition of continuing accepting the labor flow from agricultural sectors, the phenomenon of labor force flowing between the secondary and tertiary industries will be more and more significant.

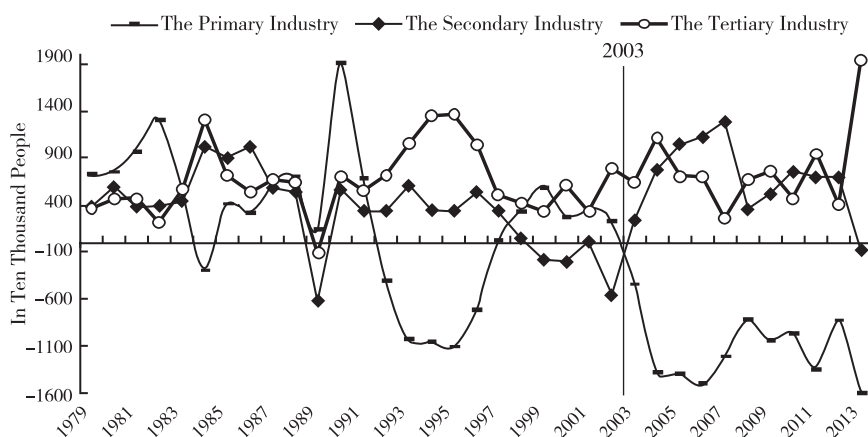


Figure 4. Year-end increments of employees in the three industries of China from 1979 to 2013

Source: Statistics Database of NBS.

The appearance of boundaries in investments and import and export trade caused the termination of the traditional industrialization process. When the share of the secondary industry falls, and the traditional service industry has to make up for the economic gap, the problem of efficiency imbalance will turn serious. Since industrialization scale expansion inherently contains the contradiction of efficiency imbalance, then “Using economic efficiency decreases to exchange for employment increases is not useless” (Nurkse, 1947).

3.2. Slowdown and the imbalance of labor productivity

The imbalance of industrial efficiency, a phenomenon in the advancement of China’s traditional industries, results from the excessive concentration of resources toward industrial sectors in the industrialization process and it can be reflected by disequilibrium of efficiency between the secondary and tertiary industries (or industry and service industry) in modern economic growth. Several circumstances are worth consideration:

First, for the problems that underlie an industrial efficiency imbalance, we tend to understand them with the background of a labor productivity slowdown. According to the trends and data in Figure 5 which can provide some clues for analysis, our impression over the change of industrial efficiency is this: around 1998, the labor productivity in the secondary industry in China showed very different performance. Taking eastern China as an example, we know that from 1991 to

1998, the average growth rate of labor productivity of the secondary industry was 17.0% and 8.3% from 1999 to 2010, a significant slowdown over a decade. A similar slowdown trend was shared by labor productivity of the secondary industry in the central and western regions of China.

Second, labor productivity slowdown in the service industry happened at the same time, or even in sync with the slowdown of labor productivity in the secondary industry and thus the gap of disequilibrium in industrial efficiency can be made up for; the slowdown will aggravate the disequilibrium. The advent of this situation conforms to the logic of traditional industries and traditional service trades, because at that time the existence of the service industry was the result of labor division of industrial development, and the tremor of industry would cause service trades to shake. As is shown in Figure 5, we have illustrated the growth rate of labor productivity in industries from 1991 to 2010 in four time periods. Since the beginning of 20th century, the growth rate of labor productivity in the secondary and tertiary industries first rose and then fell, presenting an “inverted U” shape and the growth rate of labor productivity from 2001 to 2010 was significantly lower than that of the peak value period. Under the condition of the double slowdown of labor productivity in industries, efficiency in service trades did not have stronger growth than that in industry, and was even slower than the growth rate of labor productivity in industry.

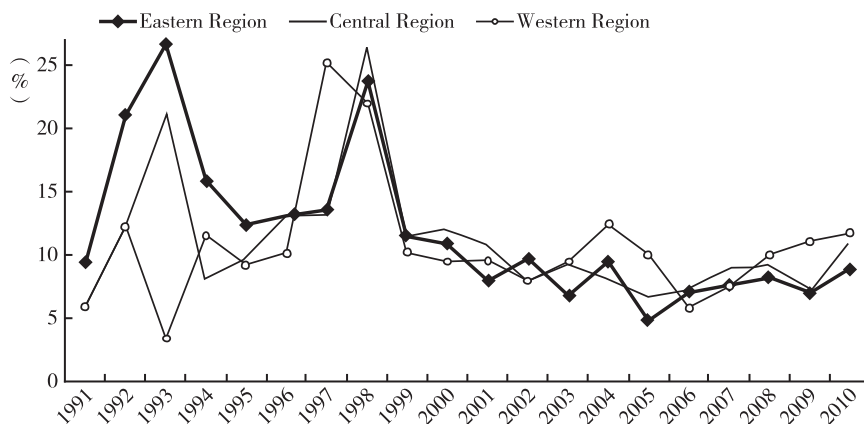


Figure 5. Regional trend of labor productivity of the secondary industry in China from 1991-2010

Source: Database of CEInet.

3.3. The change of TFP and its non-equilibrium: analysis based on city data

3.3.1. Average state of TFP growth of 264 cities across the nation

Indicated in Figure 6-A and Figure 6-B are the changes of total factor productivity and technological advances of 264 cities. From 1990 to 2011, the average growth rate of the total factor productivity of 264 cities in China was 1.4% and the contribution rate of TFP's growth to economic growth was 11.66%. If we decompose Malmquist Index into technological efficiency changes and technological progress, we can find that the annual average growth rate of technological advance is 0.1% and the technological efficiency change rate is 0.4%. So it is

the technological efficiency that plays the major role in total factor productivity growth, while technological progress plays a complementary role.

Table 5

East, central and west region growth rate of average labor productivity in the secondary and tertiary industry in different periods(%)

	East Region		Central Region		West Region	
	The Secondary Industry	The Tertiary Industry	The Secondary Industry	The Tertiary Industry	The Secondary Industry	The Tertiary Industry
1991-1995	17.1	5.9	11.4	2.3	8.5	1.6
1996-2000	14.6	9.8	15.2	9.2	15.4	9.2
2001-2005	7.8	6.4	8.6	7.7	9.9	6.9
2006-2010	7.7	7.0	8.7	7.6	9.2	9.0

Source: Database of CEInet.

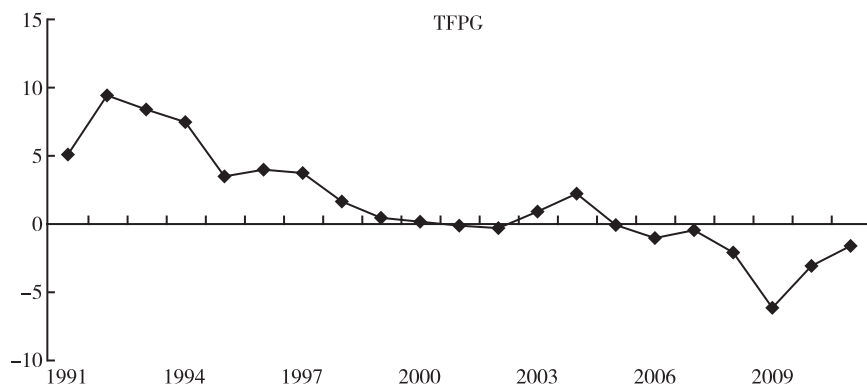


Figure 6A. Average growth figure of TFP of cities in China

Note: TFPG means Total Factor Productivity Growth (%).

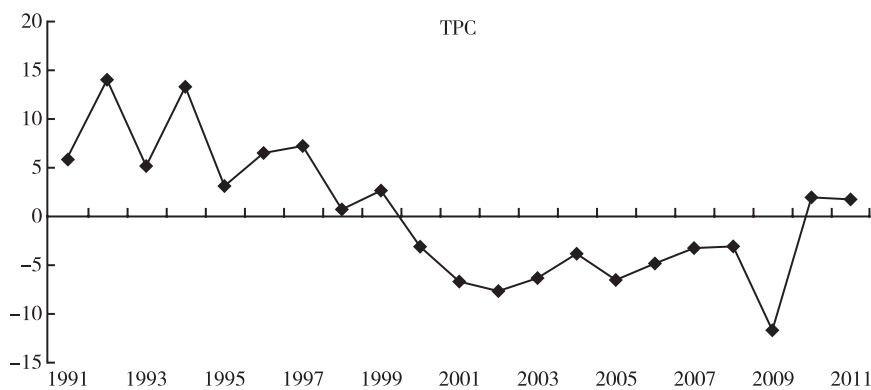


Figure 6B. Average technological progress of cities in China

Note: TPC mean Technological Progress Change (%).

3.3.2. Regional TFP contrast

TFP: As is shown in Table 6, the fastest growth of total factor productivity happened in China's eastern region, with an annual average growth rate of 3.0% and the contribution rate of the eastern region's *TFP* growth to economic growth was 23.4%. Standing in the second position is the central region, with an annual average *TFP* growth of 1.3% and a *TFP* growth contribution rate of 11.3% to economic growth. The western region came in last, with an annual average *TFP* growth of 0.8% and a *TFP* growth contribution rate to economic growth to be only 6.9%.

Technological Progress Rate: The technological progress rate of the nation, eastern, central, and western regions are 0.6%, 1.3%, 0.1%, and 0.2%, respectively. The technological progress across the nation stays at a low speed with the eastern region faster than the central and western regions, with the western region slightly faster than the central region. The contribution rates of the nation, eastern, central, and western regions to economic growth through their technological progress are 5.1%, 10.3%, 1.0%, and 2.0%, respectively—all being at very low levels.

Technological Efficiency: The technological efficiency of the nation, eastern, central, and western regions are 1.5%, 2.0%, 1.5%, and 0.9%, respectively. The change of technological efficiency went faster than that of technological progress, but the eastern region was faster than the central and western regions, with the central region slightly faster than the western regions. The contribution rate of the nation, eastern, central, and western regions to economic growth through their technological efficiency changes were 12.7%, 15.4%, 13%, and 7.7%, respectively, higher than that of technological progress to economic growth. So, the change of technological efficiency plays a major role in *TFP* growth and technological progress plays a complementary role in *TFP* growth.

Table 6

TFP subentries of 264 cities in different regions and their contribution rates to economic growth (%)

	Growth Rate of TFP	Contribution Rate of TFP	Technological Progress Rate	Contribution Rate of Technological Progress	Change of Technological Efficiency	Contribution Rate of Technological Efficiency
China	1.8	15.2	0.6	5.1	1.5	12.7
Eastern Region	3.0	23.4	1.3	10.3	2.0	15.4
Central Region	1.3	11.3	0.1	1.0	1.5	13.1
Western Region	0.8	6.9	0.2	2.0	0.9	7.7

3.3.3. Correlation between GDP and TFP

In view of the entire period from 1990 to 2011, there was a negative correlation between *GDP* growth trend value and *TFP* growth trend value across the nation, as well as in the central and western regions. In the eastern region, the *GDP* growth trend value and *TFP* growth trend value

showed a weak positive correlation.

We divided the period from 1990 to 2011 into three phases with 1990-1999 as the first phase, 2000-2007 as the second phase and 2008-2011 as the third phase. In the first phase, the *GDP* growth trend and *TFP* growth trend were remarkably correlative across the nation, as well as in the eastern and western regions with correlation coefficients standing at 0.982, 0.990, and 0.926, respectively, while the central region showed a weak correlation of 0.354. In the second phase, the *GDP* growth trend and *TFP* growth trend showed a highly negative correlation across the nation as well as in the eastern, central, and western regions. In the third phase, the *GDP* growth trend and *TFP* growth trend presented a highly negative correlation across the nation, as well as in the central and western regions. Only in the eastern region was there a positive correlation—as high as 0.996 between the *GDP* growth trend and *TFP* growth trend.

Table 7

Correlation coefficients between *GDP* growth trend and *TFP* growth trend

	Across the Nation	Eastern Region	Central Region	Western Region
Average	-0.765	0.090	-0.914	-0.835
After 2000	-0.966	-0.771	-0.996	-0.997
1990-1999	0.982	0.990	0.354	0.926
2000-2007	-0.995	-0.984	-0.998	-0.997
2008-2011	-0.997	0.996	-1.000	-1.000

4. The issue of efficiency compensation: efficient supply and transformation of economic growth mode

Investment and exports are approaching their boundaries and the conclusion to the phase of wealth driven economic growth signifies that the current capital driven mode cannot continue. The slowdown of labor productivity and weak contribution of *TFP* signifies the necessity and difficulty of efficiency improvement. China's sluggish macro-economy in recent years is mainly caused by structural problems accumulated during its long-term growth. If we want to understand the essence of debates over Chinese economic problems and the transformation direction of the economy, we should first understand the importance of efficiency compensation as a link in the process of structural transformation of the economy.

4.1. The raising of questions

Why could Japan successfully complete industrialization after World War II and also successfully achieve transformation from industrialization with economic growth driven by investment into an era of mass consumption? Why were most of the Latin American countries that have better economic bases than Japan during the accelerated industrialization period caught

in the instability of economic growth in the phase of urbanization? Why could consensus not be reached in the debates over the roles investment and consumption play in China's structural slowdown? In this section, according to some facts of domestic and international economic growth, we come up with an important link in the transformation of an investment driven mode of economic growth into consumption-and-service led economic growth, i.e. efficiency compensation. A typical case of efficiency compensation is Japan's economic growth. As is shown in Figure 7, first, from 1956 when the economic recovery was completed to 1973 when the period of structural acceleration ended, the growth rates of capital formation (including net exports), GDP, and final consumption in Japan were 14.7%, 9.2%, and 7.8%, respectively. During that period of time, when hyper growth of investment and trade served as the absolute force for maintaining sustained accelerated economic growth, it could be categorized as a period of investment stimulating the national economy and the growth of consumption. Second, from 1974 when economic growth began to slow (because urbanization had reached a period of maturity) to 1989 when the economic bubble burst, the growth rates of capital formation (including net export), GDP, and final consumption in Japan were 4.0%, 3.7%, and 3.6%, respectively; consumption played a significant role in stimulating economic growth. Third, from 1990 to 1998, the growth rates of capital formation (including net exports), GDP, and final consumption in Japan were respectively 1.7%, 1.8%, and 1.9%, respectively, and during the "lost decade," it was consumption that served as the main force for maintaining economic growth.

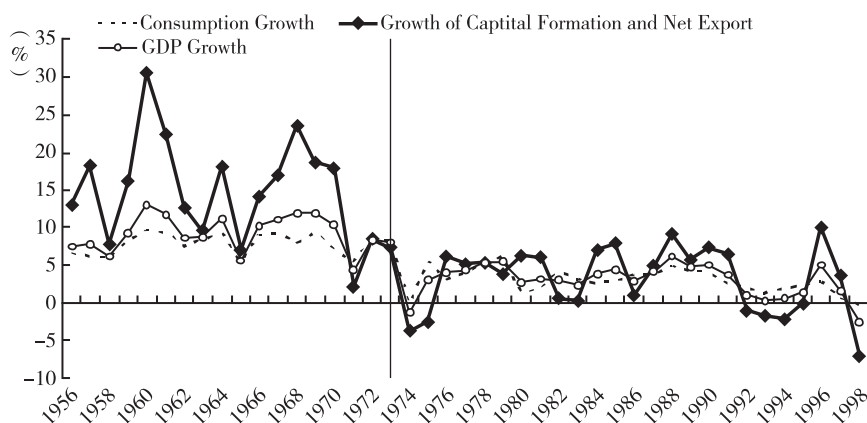


Figure 7. Growth rates of consumption, investment, net export and GDP in Japan from 1956 to 1998

Source: Bureau of Statistics of Ministry of Internal Affairs of Japan.

4.2. The sequence of efficiency compensation

According to the contrast of the facts of Japan's economic growth in the two periods of 1956 to 1973 and post-1974 (and economic growth experience of other developed countries after World War II), we can say that as for the normal economy (sustained and steady growth), the establishment of the long-term mechanism of consumption driven growth generally happens in

the stage of urbanization slowdown, when labor productivity stays at a high level. Low growth rate, high efficiency, and consumption driven are the characteristics of an advanced economy. First, the high level of labor productivity can write off the decline of incremental output ratio during the economic slowdown (or the rise of labor productivity growth) and ensure the consumption level in the condition of slow economic growth, because at that time there was no need for too much investment and the investment potential was translated into consumption potential. Second, the process of investment potential turning into consumption potential is in fact a process of using sustained efficiency driven growth to replace unsustainable scale expansion. So, if we want to maintain sustained economic growth with curtailed investments, there must be a link of efficiency compensation between consumption and economic growth. With that link, a circular cycle can be formed among “productivity-income-consumption”; in that cycle, consumption is not the quantitative consumption as it was during the traditional industrialization period, but rather is a complementary link for labor productivity in presenting a quality change. Third, the need of efficiency compensation for maintaining economic growth often happens when the stage of industrialization scale expansion ends and economic growth slows down. Conducting efficiency compensation has its sequence and its means in the compensation of growth-inertia caused by the wealth effect—this decline of investment efficiency when large-scale industrialization driven by investment ends is the first efficiency compensation that happens in the transition from structurally accelerated growth to structural slowdown. The raise of request for secondary efficiency compensation occurs in the period of urbanization moving towards maturity, when the economy calls for efficiency consumption as a major force to support its growth—and investment potential gradually turns into consumption potential.

4.3. Investment efficiency compensation, consumption efficiency compensation and efficient supply

Here we conclude the basic understanding of the two-time efficiency compensation in Figure 8, and follow the economic growth curve or labor productivity curve (the “inverted S shape” solid-line curve on the plane). We get the following circumstances. First, the phase of structural growth: the scale of investment driven industrialization expanded. Second, the phase of structural slowdown: on one hand, the inertia of fast economic growth calls for a high-level of investment, but the decline of (entity) investment efficiency holds back investment growth; on the other hand, in order to get a high rate of economic benefits in the inertia of rapid economic growth, some investment turned to real estate (or the stock market) and the wealth effect of rising housing prices appeared but didn’t last long. The first time efficiency compensation caused the distortion of investment structure which lead to the separation of fundamentals and asset market, and ends up with a failure. Third, the phase of equilibrium: using wealth effects to compensate for the efficiency loss caused by investment decline was not sustainable and at that time, there was a stronger requirement for economic rationalization and the instability of financial markets touched off by wealth effects should also be taken seriously. At the same time, the

economy started to gradually enter a period of growth driven by efficient investment and actual consumption simultaneously. Efficient consumption even served as the main force driving the economic growth—when the secondary efficiency compensation happened and was beneficial for sustainable economic growth.

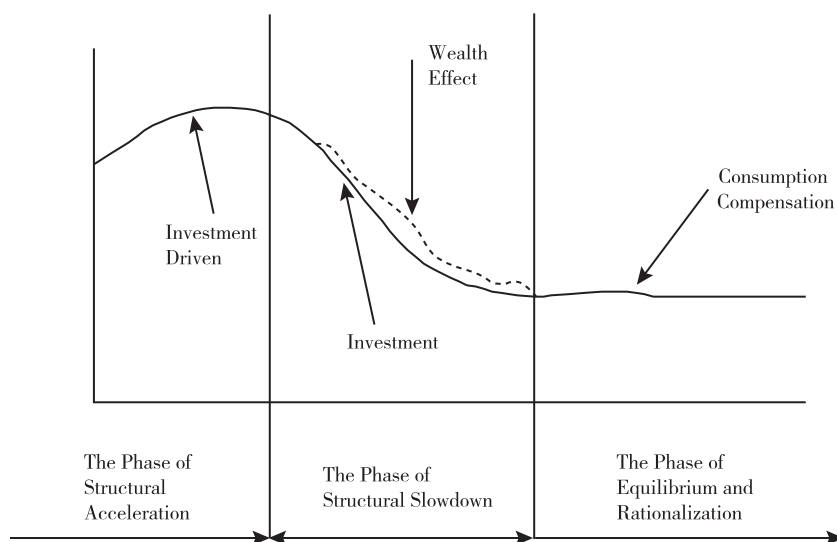


Figure 8. Link of efficiency compensation in the process of long-term economic growth

4.3.1. The first time efficiency compensation: analysis of investment efficiency compensation

In order to maintain fast economic growth, a lengthening trend of investment in infrastructure and real estate has appeared in China, so the economic efficiency improving path was led from real economy to the asset field of high speculation and risks, causing a serious distortion in investment structure. (a) real enterprises: this increased the proportion of investment properties; (b) financial enterprises: this increased the consumer's credit and real estate investment because they were getting benefits from close cooperation with the industry so that fast economic growth could be maintained; (c) government: in order to compensate for the cost of urbanization, with the condition of decline of real economic tax revenue, increased real estate related benefits, especially those of land reevaluation.

4.3.1.1. Change of investment path of China

First, the proportion of investment in real estate in the eastern region has seen fast growth since 2003—from one fifth of the total investment during the mid 1990's to one third of the total investment in recent years. Second, the proportion of investment in real estate in central and western regions was significantly lower than that of the eastern region during the mid 1990's, but since 2003 there has been strong catch-up, especially for the western region, which equaled the eastern region's in 2012.

4.3.1.2. Change of cash flow of listed companies

Since 1998, negative free cash flow appeared among enterprises, which was caused mainly due to constant expansion of investment activities. During that period of time, China's real estate market rapidly expanded, causing larger negative free cash flow after 2010. Correspondingly for cash flow of investment activities, the ratio of investment real estate and total assets came at a very high level, which from one perspective manifested the flow of enterprise investment toward the real estate market.¹

4.3.1.3. The accelerated growth of housing prices out of the line of fundamentals

First, China's economic slowdown didn't only happen in the eastern region where industrialization was developed in the first place, but it also occurred in the central and western regions. Second, the stability or decline of China's CPI and PPI formed a stark contrast with the sharp rise of housing prices. Third, relative to the asset expansion of the real estate market, the real economy has landed in the predicament of slow efficiency growth.

4.3.2. The second time efficiency compensation: analysis of consumption efficiency compensation

When the efficiency of real sectors falls down during the period of economic slowdown, if we can provide compensation by establishing the cycle of consumption/growth, we can get steady economic growth and don't have to take on the potential risks brought about by investment in real estate. However, in view of the experience of emerging industrialized countries, most developing countries are not able to establish such a model. The reason is that the connection between efficient consumption and economic growth are not as close as that between investment and economic growth. Say if a large amount of investment can promptly pull up economic growth, then the effect of efficiency compensation generated by consumption needs a long time to show up. So, we have come up with a basic conclusion from this analysis.

The effect of increasing consumption purely depending upon demand management methods is short-lived and can decrease investment as a cost. The pure number trade-off of investment/consumption against economic aggregate is not helpful to long-term efficiency improvement, because according to the basic assumptions of Keynesian economics, in the short-term, production technology is constant. So, we propose to return to the thoughts of traditional development, where the real demand (purchasing power), instead of the money demand (effective demand) is valued.

Strictly speaking, besides the few countries like Japan which completed the catch-up in a short period of time, there are few emerging industrialized countries that have reached the phase of consumption efficiency compensating economic growth. The realization of consumption efficiency compensation requires the establishment of a positive interaction mechanism for consumption structure and production structure, and human capital accumulation based on

¹ Source: CCER.

income growth is a critical link. However, emerging industrialized countries, for various reasons, have delayed that process, causing the improvement of economic efficiency of actual consumption. A typical example is the Latin American countries, which have been influenced by long-term inflation and unequal distribution of income. Though they have had high consumption rates, most consumption went to either basic necessities or luxuries. “Unfortunately, at the time when Latin America’s education scale expanded, its education quality declined and its education system lacked efficiency” (Hofman, 2000), so consumption-based structural distortion caused production-based structural distortion and ultimately the decline of overall economic efficiency.

4.3.3. Supplementary explanation of factor decomposition of growth and efficiency in Table 3 and Table 4

The two-time compensation for efficiency caused China to realize the urgency of the transformation of its economic growth mode. Using the expansion of asset markets to compensate for the loss of real economic efficiency decline in order to maintain high growth can only cause greater macro instability; the phase of wealth driven growth is near its end, but the implied problem is the unfolding debt risks. On the other hand, the previous low cost growth mode which was heavily dependent upon real investment also promoted the role of real consumption in future economic growth. From the perspective of long-term economic growth, consumption is not purely a concept of quantity, but a concept of efficiency. Economic efficiency exists in efficient growth during the stage of economic slowdown in a form that is more beneficial to human capital. If we can clarify that relationship, then factors like investment and urbanization in the neoclassical accounting framework can be summarized with efficient supply. Perhaps, that is the key to understanding China’s economic transformation.

5. Policy suggestions

5.1. *To transform the ideas on economic management*

The major problem of China’s economic transformation from fast growth to steady and sustained growth is the pattern of transformation that is over dependent upon investment; the ideas on economic management should be transformed. For the issue of management of investment demand and consumption demand, the idea should be transformed from the past scale balance of investment/consumption in a static sense to fostering long-term consumption mechanisms. In Keynes’s sense of demand management, the balance between investment and consumption is just black or white and the rise of consumption means decreasing investment at the same time, causing a further drop in the economic growth rate. From the perspective of dynamic efficiency, what consumption means to steady and sustained economic growth is mainly reflected in the promotion of labor productivity by growth of consumption, with consumption’s function on health and human capital as a typical example.

5.2. To attach importance to improving income distribution and fostering human capital

The worsening of income distribution conditions results in the slowdown of economic growth, which has been manifested significantly in Latin American countries. The unequal distribution of income influences sustained economic growth in the following ways. The first way is that most of low-income residents apply most of their income to basic expenditures like food and the accumulation of human capital slows down; the second way is that the few high-income residents pursue luxury consumption and that causes domestic production structure distortion which is not favorable for the establishment of a sustained growth path. Currently, the problem of unequal distribution of income has been acute and the wealthy people's pursuit of luxuries, including real estate (whether for investment and speculation or other motives), has become the impetus for production structure distortion. Low-income people, impacted by the high living costs of the city, hold back the enthusiasm for human capital investment, and it is disadvantageous to China's sustained economic growth during its period of transformation. China has already expanded low-quality labor for over thirty years, and because of that, dependence on growth has been formed. So, the secondary human resource development surrounding human capital as the core is an important task that should have great importance attached after an economic slowdown.

5.3. Re-understanding of the path of industrialization and urbanization of central and western regions

The end of the investment and wealth driven phase has not only increased the costs of production and living in China's eastern region, but has also caused increases in the central and western region. And together with the rise in labor cost, the development of traditional industries, and a traditional service industry in central and western regions has been seriously weakened. Facing this situation, we should adjust development strategies in the central and western regions. Furthermore, the idea of purely depending on the transfer of a "wild goose chase" of industries needs to be altered.

Appendix: Formula derivation of whole-Society labor productivity growth rate

Let the growth rate of whole-society labor productivity from t to $t+1$ be η_{t+1} ; let growth rate of labor productivity in each industry be $\eta_{i(t+1)}$; let the employment share of each industry in whole-society employment be $\zeta_{i(t+1)}$; let value added share of each industry in GDP be γ_{it} ; and then the relationship between the growth rate of whole-society labor productivity and the growth rate of labor productivity in each industry from t to $t+1$ is:

$$\eta_{t+1} = \gamma_{1t}(\eta_{1(t+1)} + \zeta_{1(t+1)} + \eta_{1(t+1)} \cdot \zeta_{1(t+1)}) + \gamma_{2t}(\eta_{2(t+1)} + \zeta_{2(t+1)} + \eta_{2(t+1)} \cdot \zeta_{2(t+1)}) \\ + \gamma_{3t}(\eta_{3(t+1)} + \zeta_{3(t+1)} + \eta_{3(t+1)} \cdot \zeta_{3(t+1)})$$

When the cross-term gets smaller, we have:

$$\eta_{t+1} = \gamma_{1t}(\eta_{1(t+1)} + \zeta_{1(t+1)}) + \gamma_{2t}(\eta_{2(t+1)} + \zeta_{2(t+1)}) + \gamma_{3t}(\eta_{3(t+1)} + \zeta_{3(t+1)})$$

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