China & World Economy / 1–14, Vol. 21, No. 2, 2013

Population Change and Resulting Slowdown in Potential GDP Growth in China

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Abstract

As a result of the shrinking working age population (aged 15 to 59 years), all factors that have driven China's rapid economic growth over the past 30 years tend to diminish from 2010. The present paper estimates the average annual growth rate of potential output to be 7.2 percent over the 12th Five-year Plan period and 6.1 percent over the 13th Five-year Plan period. Future sustainable growth requires furthering economic reform in related areas to enhance potential growth. This paper simulates two scenarios in which both an increase in labor force participation and improvement in total factor productivity can significantly enhance the potential GDP growth rate. Relevant policy implications are discussed.

Key words: labor force participation, population change, potential GDP growth rate, total factor productivity

JEL codes: C53, J21, O47

I. Introduction

The unprecedented economic growth in China over the past 30 years can be attributed largely to the demographic dividend. That is, growth of the working age population guarantees an adequate supply of labor; a decline in the dependence ratio (the ratio of the dependent population to the working age population) helps to maintain a high savings rate, which is the condition for capital formation; and an unlimited supply of labor prevents return on capital from diminishing, which allows heavy investment to be the main source of GDP growth (Cai and Zhao, 2012).

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As is well documented in the economics literature (e.g. Bloom and Williamson, 1998; Williamson, 1998), the demographic dividend is not derived from population size or the growth rate of the population, but from a specific feature of the population age structure. Simply put, an increase in the proportion of the working age population in the total population and a decline in the dependence ratio provide a country an opportunity to situate themselves so that a high savings rate, heavy investment and rapid economic growth can be obtained; the country thus benefits from the demographic dividend. Over the period of fast growth, few would consider the population age structure as a constraint of economic growth in China.

However, the population age structure is ever-changing. As a result of population aging, the working age population stops growing and the dependence ratio no longer decreases; eventually, the demographic dividend will cease to exist. Labor shortage, diminishing return on capital and a decline in the savings rate will lead to a slowdown in economic growth. This is what has occurred in China in recent years, particularly since 2004.

The potential GDP growth rate is determined by supply-side factors, including labor, capital and total factor productivity (TFP). In a growth accounting equation, holding constant the labor force participation rate and the natural unemployment rate (i.e. the non-accelerated inflation rate of unemployment (NAIRU)), a reduction in the working age population will directly reduce the potential GDP growth rate. In addition, the reduced supply of labor, which causes diminishing returns to capital, and the increase in the dependence ratio, which causes a decline in the savings rate, do not support the fast growth of capital formation. Therefore, holding the other factors constant, a reversal of the growth trend of the working age population in China will inevitably slow its economic growth.

In fact, the process of demographic transition has taken place in China much more rapidly than anyone could have expected, and the number of people aged 15 to 59 years has already decreased.[1] Based on the data of the 6th National Census, the China Development Research Foundation (CDRF, 2012) predicts the trend of the population age structure to change, and show that the working age population, when assumed to be aged 15 to 59

[1] In this study, we assume that people aged 15 to 59 years make up the working age population instead of people aged 15 to 64 years. The reason is twofold. First, the official retirement ages are 60 years for male workers and 55 years for female workers. Second, for China's working age population, the older the person, the lower the educational level. For example, the average years of schooling drop from 9 years for people aged 20 years to 6 years for people who are 60 years old (Wang and Niu, 2010). Both reasons indicate that, at present, there is little chance for people older than 60 years to successfully remain in the labor force.

years, started to decline in size in 2011, while the population dependence ratio calculated based on the working age population (aged between 15 and 59 years) began shrinking in the same year. This trend will not be reversed even if there is a moderate relaxation of the one-child policy. Given that the population factor has had such far-reaching impacts on the determinants of China's economic growth, including labor supply, the savings rate, the marginal return on capital and total factor productivity, such a change in the population age structure is bound to reduce the potential GDP growth rate in China.

Based on the latest population data, the present paper simulates a decline in the average potential GDP growth rate from 9.8 percent over the period from 1995 to 2009 to 7.2 percent during the 12th Five-year Plan period (2011–2015) and 6.1 percent over the 13th Five-year Plan period (2016–2020). Therefore, determining how to sustain economic growth is an important challenge facing China. In light of the properties of the potential growth rate and the experiences of China and the rest of the world, we make the following two suggestions.

First, the government should not seek an actual growth rate exceeding the potential growth rate. Because the potential growth rate is fixed by assuming full employment of existing factors of production, artificial stimulus aimed at lifting the actual economic growth rate above the potential rate would have unhealthy consequences. For example, frequently implemented stimulus plans could cause inflation; overactive industrial policies might result in overcapacity by inappropriately protecting inefficient enterprises and backward production capacity; and regional and industrial policies using heavy subsidies could lead to distortion of prices of production factors, and affect regional industrial structure by impacting comparative advantage.

Second, the potential growth rate can be enhanced through the application of measures to enlarge the supply of labor and capital, and to improve productivity. This requires deepening reforms in various areas, such as the household registration system reform and institutional reform. That is, economic reform is the key to sustaining China's economic growth. Kharas (2011) points out that it would take 10 years or more for China to see any obvious effects of such reforms, which implies that the Chinese Government should waste no time in initiating urgent reforms, while being ready to accept lower growth rates. However, there exist reform opportunities that could enhance China's potential growth rate fairly swiftly, which we discuss in the present paper.

While suggesting the slowdown of the potential rate of China's future economic growth in accordance with the trend of population structure changes, the present paper recommends that policy measures to stimulate economic growth so that it exceeds the potential growth rate should not be taken. Instead, two scenarios are simulated and the results suggest that an increase in the labor force participation rate and improvements in TFP can significantly expand the potential growth rate in the future.

II. Estimation of the Potential Growth Rate in China

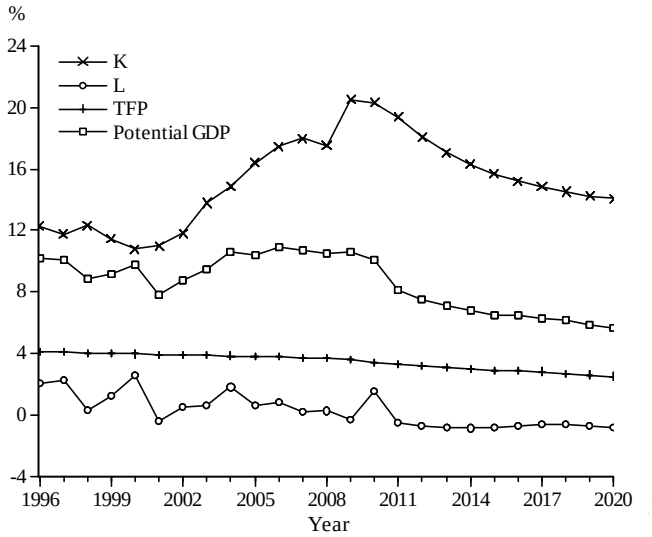
The estimation of the potential growth rate is based on a growth accounting equation:

$$\frac{\Delta Y^*}{Y^*} = (\frac{\Delta y^*}{y^*} + 1) \times (L_t^* / L_{t-1}^*) - 1, \qquad (1)$$

where $\Delta y^*/y^*$ is the growth rate of potential labor productivity, a function of the growth rate of TFP and the potential capital–labor ratio, and L_t^* / L_{t-1}^* is potential employment growth.[2] We also need to make some assumptions regarding the capital formation and TFP growth rates in the period to come. The predicted employment growth, the assumed growth rates of capital formation and TFP, and the estimated potential GDP growth rate are presented in Figure 1. In what follows, we explain the reasons for such assumptions and present detailed results from the estimation.

Assumption I: Capital formation growth will slow down in the next 10 years.
Examining the historical data, we find that the annual growth rate of fixed asset investment deflated by the price index of fixed assets was 13.43 percent in 1978 –1994 and 16.89 percent

Figure 1. Trends of Potential Growth Rate and of Its factors in China: 1996 –2020



Notes: K, assumed growth rate of fixed assets investment (capital formation); L, potential growth rate of employment; TFP, growth rate of total factor productivity.

[2] For detailed explanations on the estimation procedure, see Lu (2012).

in 1995–2009. In the latter period, the annual growth rate of fixed assets investment reached 20 percent between 2003 and 2007. In tackling the global financial crisis, the growth rate of fixed assets investment rose to 33.15 percent in 2009. Even if we eliminate the outlier of 2009, the rate was still as high as 15.64 percent in the period from 1995 to 2008.

Such rapid growth of fixed assets would not be sustained in the years to come for three reasons. First, as a result of widespread labor shortages, marginal return to capital is declining at an accelerating pace (Cai and Zhao, 2012), which will impede such a high speed of investment growth. Second, as the population dependence ratio increases, the savings rate tends to fall, resulting in a slowdown of investment growth. Last but not least, relatively slower growth of capital formation will help China transform its growth pattern that overwhelmingly relies on domestic investment and move to a more balanced and sustained pattern of growth.

In an equation based on least squares regression, we incorporate return to capital (wK) as an independent variable to regress the dependent variable of the growth rate of total investment in fixed assets in the whole country (excluding state budgetary investment). Data used in the regression cover the years from 1982 to 2005. The estimated results are as follows:

$$I = -6.1395 + 0.9459 * wK$$
$$(19.7312) \quad (0.8422)$$
$$R^2 = 0.0542 \qquad \text{D.W.} = 0.9765$$

We put the average return to capital of 20.22 percent in 1996–2005 estimated by Bai *et al*. (2006) into the estimated equation and obtain an annual growth rate of investment of 12.99 percent. Therefore, we preset the annual growth rate of investment in fixed assets in China as 13 percent in the period from 2012 to 2020.

It is worth noting that the assumption is not actually made as a result of the above simulation but in light of theory and China's economic reality. That is, a rational response to the substantial fall in marginal return on capital with an absence of government intervention should be slower growth of capital investment. In fact, such a predetermined annual growth rate of 13 percent is still higher than the actual growth rate in the period from 1996 to 2005.

Assumption II: The working age population aged between 15 and 59 years declines.

We assume that the natural unemployment rate will remain the same as it was in 2009, namely, NAIRU = 4.132% (Du and Lu, 2011), and that the labor force participation rate will follow the trends of the labor force participation rate, which was calculated using the Hodrick–Prescott filter method. As the population aged between 15 and 59 years peaked in 2010, its annual growth rate will be –0.33 percent in 2011–2015 and –0.31 percent in 2016–

2020. This means that the annual growth rate of employment will be –0.76 percent during the 12th Five-year Plan period and –0.74 percent in the 13th Five-year Plan period. If the natural unemployment rate and the labor force participation rate remain unchanged in the following two Five-year Plan periods, the reduction in the size of the working age population will lead to a fall in the potential GDP growth rate.

Assumption III: Total factor productivity growth will be reduced but remain relatively high. Kuijs (2009) attributes the impressive increase in TFP during the period from 1994 to 2009 to the state sector restructuring, the entry to the WTO and the successful integration of manufacturing into the world economy. Those forces, however, will diminish in the years to come. Hence, he expects a reduction of 0.5–2.3 percentage points in TFP per year in the period from 2010 to 2020. Using a Hodrick–Prescott filter decomposition, we assume the trend annual TFP growth rate to be 3.10 percent in 2011–2015 and 2.70 percent in 2016–2020.

Based on the assumptions made above on the decline in the labor force and TFP growth and the slower growth of investment, we can estimate the potential growth rate of the Chinese economy for the period of 2011 to 2020. Our finding that the potential growth rate will decline and the trend will continue is not surprising because many others have reached the same conclusion (e.g. Kuijs, 2009; World Bank, 2012). However, our predicted potential growth rate is much lower than that estimated by others (e.g. see Kuijs, 2009). The potential GDP growth rate we estimate is 7.2 percent for the 12th Five-year Plan period and 6.1 percent for the 13th Five-year Plan period (Table 1). We do not consider our conclusion as any exaggeration, given that we have not taken into account the inevitable slowdown of mass labor migration from agricultural to non-agricultural sectors, which has been the main source of TFP growth.

Table 1. Estimated Results for Potential Inputs and Outputs in China, 1978–2020

Growth rate (%)		1978–1994	1995–2009	2011–2015	2016–2020
Actual output		10.06	9.90		
Potential output		10.29	9.83	7.19	6.08
Actual employment		2.45	0.97		
Potential employment		3.23	0.90	–0.76	–0.74
Actual labor productivity		6.55	8.84		
Potential labor productivity		6.85	8.86	8.02	6.87
	TFP	0.78	3.89	3.10	2.70
	K/L	10.38	13.29	18.21	15.43

Notes: TFP, total factor productivity; K, assumed growth rate of fixed assets investment (capital formation); L, potential growth rate of employment.

We do not propose that policy-makers pursue achieving actual GDP growth exceeding the potential rate, but in what follows we recommend ways to enhance the potential growth rate through increasing the labor force participation rate and the TFP growth rate, which require a deepening of economic reforms.

III. Increasing the Labor Force Participation Rate

Data from the 6th National Census show that the labor force participation rate was 70.80 percent for population aged 16 years and above and 77.26 percent for population aged between 16 and 64 years in 2010. A further look at geographic distribution shows that the labor force participation rate for population aged 16 years and above was 62.20 percent in cities, 67.32 percent in towns and 77.62 percent in rural areas. For population aged between 16 and 64 years, the labor force participation rate was 68.18 percent in cities, 73.27 percent in towns and 84.92 percent in rural areas. The labor force participation rate at present is lower than in the 1990s, and it is likely to be even lower if we consider the following two factors.

First, the exclusion of the agricultural labor force from the calculation would result in a lower labor force participation rate. Because there is no retirement age in agriculture, when the number of workers engaged in agriculture is counted, as is the common practice in statistics, the labor force participation rate tends to be overestimated. At the present stage of economic development in China, economic growth is accompanied by a constant decline in the agricultural share in terms of both output value and employment. Thus, the participation rate of the non-agricultural labor force is a better indicator of the real situation of the labor market.

Based on data of the 6th census, we recalculate the labor force participation rate by excluding agricultural sectors and find it to be much lower than that calculated by including agriculture (Table 2). For example, for the 20–25-year age group, the participation rate of the non-agricultural labor force is 72.55 percent, which is 9.79 percentage points lower than the participation rate of the total labor force. This implies that as the agricultural share of the labor force further declines in the future, the labor force participation rate will drop much faster than what previous statistics would suggest.

Second, the extension of years of schooling would lower the labor force participation rate. As is shown in Figure 2, the labor force participation rate distribution by age can be characterized by a reverse U-shaped curve. That is, for lower age groups, more people are still in school, which makes labor force participation low; labor force participation substantially increases when people enter their thirties and forties; and labor force

Table 2. Labor Force Participation Rates in China by Age Group and By Sex (%)

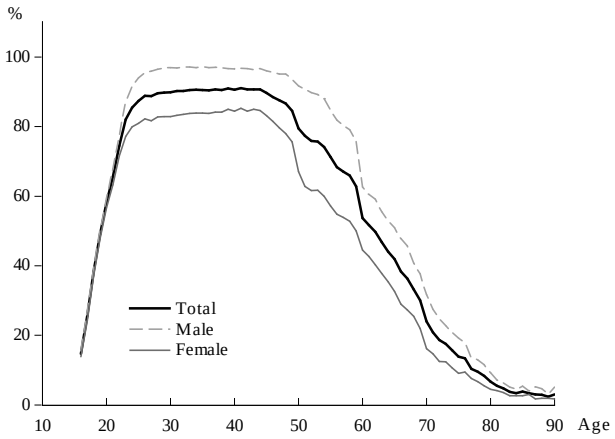
Age groups	Total LFPR (including agriculture)			LFPR of non-agriculture		
	Total	Male	Female	Total	Male	Female
16–20	32.44	33.06	30.72	21.78	22.53	21.31
20–25	72.55	76.66	69.70	62.76	68.91	58.95
25–30	88.88	95.73	82.10	84.33	94.01	74.61
30–35	90.30	97.01	83.47	85.98	95.73	75.79
35–40	90.62	96.92	84.18	85.53	95.36	75.02
40–45	90.73	96.63	84.74	84.43	94.50	73.41
45–50	87.73	95.06	79.58	78.49	91.64	62.87
50–55	76.31	89.90	62.62	56.99	81.62	32.19
55–60	67.29	80.41	53.71	37.57	60.88	15.04
60–65	49.59	58.14	40.11	13.80	22.41	5.89

Source: Authors' calculation based on 1‰ sampling data of 6th census.
Note: LFPR, labor force participation rate.

participation declines as workers get older, because they have either a stronger desire to retire or less sought-after skills to meet the demands of the labor market. For all age groups, the labor force participation rate for men is higher than that of women and the non-agricultural labor force participation rate is lower than the total labor force participation rate.

It is worth noting that although the present labor force participation rate in China is still high, it will change dramatically as population aging accelerates. As the size of the working age population is no longer increasing, labor force participation determines the labor supply and, therefore, constrains the potential growth rate.

Figure 2. Labor Force Participation Rate in China, 2010



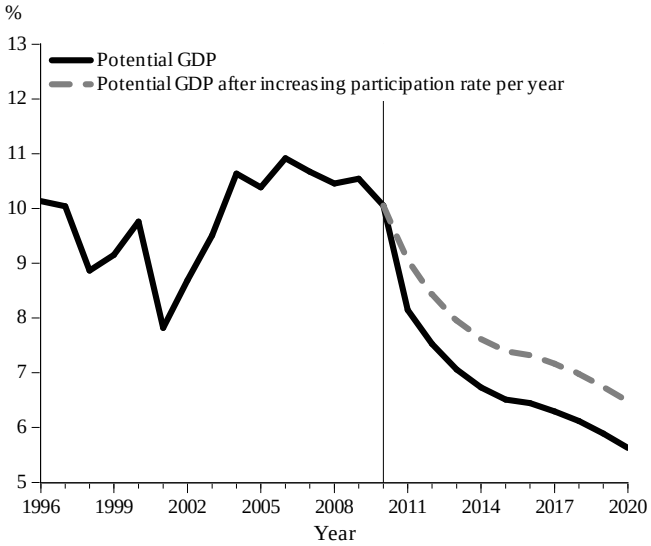
Source: Authors' calculation based on the 6th census.

After 2011, the potential employment growth rate will become negative: –0.76 percent in the 12th Five-year Plan period and –0.74 percent in the 13th Five-year Plan period. Because the root cause of this negative growth of employment, namely, the reduction of the total population aged 15 to 59 years in 2010 and the population aged 15 to 64 years in 2013, cannot be altered, the enhancement of labor force participation is the only way to increase potential labor supply and, in turn, to expand the potential output.

To test such a hypothesis, we simulate the impact of an increase in the labor force participation rate on the potential GDP growth rate. Based on the above-described growth accounting equation, we assume a scenario in which the labor force participation rate increases 1 percentage point every year in the period from 2011 to 2020. This results in an average potential growth rate increase from 7.19 to 8.09 percent during 2011 –2015 and an average potential growth rate increase from 6.08 to 6.94 percent during 2016 –2020. As a result, the potential GDP growth rate will increase by an extra 0.88 percentage points per annum in the period from 2011 to 2022 (Figure 3).

There are three potential ways for China to increase labor force participation. The first is to postpone the retirement age so that the labor force participation rate of workers at older ages can be increased. Although this measure is widely used in developed countries, it is not equally relevant for China because older Chinese workers are often not sufficiently educated to meet the labor market demand for skills and are likely to be in a vulnerable position if they postpone retiring. Therefore, this policy option should not be chosen in the

Figure 3. Effect of 1 Percentage Point Increase in Labor Force Participation Rate on Potential GDP Growth Rate



Source: Authors' simulation.

short run.

The second method is to further promote labor migration from rural to urban areas. Compared to countries with similar per capita income, China has a relatively larger share of labor in agriculture. The possibility exists for labor migration to occur so that labor force participation can be increased in non-agricultural sectors. The existing household registration or *hukou* system that segregates the labor market between rural and urban areas still prevents rural-to-urban migrant workers from settling down in urban areas legitimately and permanently. Therefore, the *hukou* reform aimed at legalizing migrant workers' citizenship in cities will significantly stabilize supply of labor, tap into the potential labor force, and, therefore, increase potential output.

The third approach is to raise the employment rate or to lower the unemployment rate. As China is moving away from possessing an unlimited supply of labor and towards a neoclassical labor market framework, today's employment problems show both neoclassical and dual economy characteristics. That is, while there is still surplus labor in agriculture, the more frequent emergence of cyclical unemployment, structural unemployment and frictional unemployment raise new challenges in regards to China's macroeconomic and employment policies. The manner in which such challenges are responded to can reshape potential GDP growth in the future.

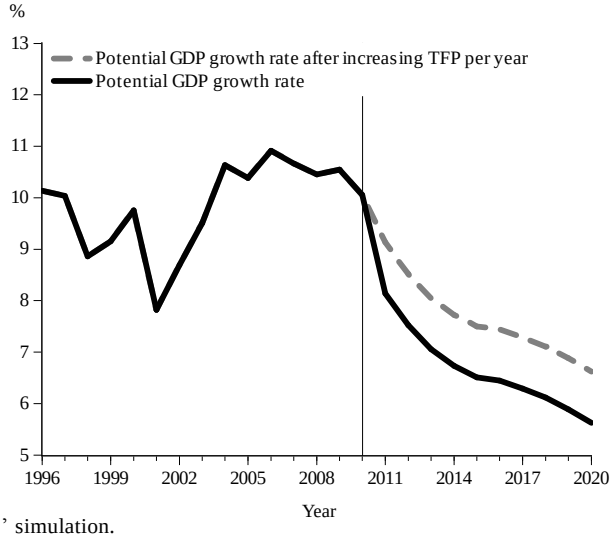
IV. Improving Total Factor Productivity

In the face of a declining potential growth rate, the central and local governments would tend to adopt industrial policies, regional strategies and stimulus plans to pursue a growth rate exceeding the potential rate. The temptation is great because those policy measures are simple for governments to implement and they generate immediate effects. However, the lessons from China's economic growth per se and from its forerunners in economic development (e.g. Japan) show that those policies are very likely to become distortionary and eventually impact on the sustainability of economic growth.

In contrast, deepening economic reform in various areas to expand the potential growth rate would require considerable long-term effort. As the returns to capital diminish, the old pattern of China's economic growth cannot continue, and the challenge to seek new sources of economic growth intensifies. According to the neoclassical theory of growth, such new sources must come from improvements in TFP.

The residual output that cannot be explained by inputs of production factors comes from TFP growth, which includes technological advancement, resource allocative efficiency, technical efficiency, and institutional and managerial innovation. In a neoclassical model of economic growth, TFP growth is the dominant, if not the only, driver of potential growth of

Figure 4. Effects of 1 Extra Percentage Point of Total Factor Productivity (TFP) Growth on Potential GDP Growth



Source: Authors' simulation.

output.

Based on the existing model, we assume a scenario in which TFP grows at a rate 1-percentage point higher per year in the period from 2011 to 2020. That is, the annual TFP growth rate would increase to 4.01 percent from the current 3.01 percent. Our simulation shows that such a higher TFP growth rate would lift the annual growth rate of potential output to 8.19 percent in 2011–2015 and 7.07 percent in 2016–2020 (Figure 4). Overall, if China could manage to accomplish an extra percentage point of TFP growth, its potential annual growth rate would increase by 0.99 percentage points in the period from 2011 to 2020.

Over the past 30 years of rapid economic growth in China, the impressive performance in TFP has been largely attributed to resource allocative efficiency through labor mobility from agricultural to non-agricultural sectors. In the course of the dual economy development with an unlimited supply of labor, such productivity gains have been like *low-hanging fruit*. As the surplus labor force has become gradually absorbed by the unprecedented expansion of secondary and tertiary sectors, the mass labor migration has slowed down, and the opportunity to gain resource allocative efficiency has decreased.

Furthermore, the arrival of the Chinese economy at a higher phase of development means that the gap in technology between China and developed countries has narrowed, which makes it relatively harder for China to increase TFP through technological advancement.

Therefore, China should search for new ways to improve TFP to expand its potential

growth. In fact, as China's economic growth follows more of a neoclassical framework, it will be difficult for China to add even 1 additional percentage point to its TFP growth rate. It is extremely important that the government is determined to complete the task and is aware of where the extra productivity should come from. For China, apart from the traditional sources of TFP improvement, such as technological catching-up with the developed countries and labor migration from rural to urban sectors, there is tremendous opportunity to gain allocative efficiency in the following areas.

First, given the large disparities in productivity among subsectors within, say, the secondary sector, the mobility of factors of production from the low productivity subsector to the high productivity subsector can improve the overall productivity of the economy as a whole. Second, the flow of factors of production among enterprises can also provide allocative efficiency because there are huge disparities in productivity performance among enterprises within narrowly-defined sectors. A so-called creative destruction mechanism could be created, which allows for more efficient enterprises to survive, expand and develop, and causes long-term inefficient enterprises to be eliminated. This mechanism could generate the third resources allocative efficiency.

As is well documented in the economics literature, in a mature market economy like the USA, allocative efficiency relating to entry versus exit and expansion versus contraction of firms within narrowly-defined sectors contributes one-third to a half of the productivity growth (e.g. Foster *et al.*, 2008). Based on an empirical and comparative study, Hsieh and Klenow (2007) find that by reallocating capital and labor to equalize marginal products among plants to the extent observed in the USA, China's manufacturing sector could gain a 30 to 50 percent increase in its TFP.

To gain resource allocative efficiencies in the areas described above requires a policy environment within which factors of productivity can freely flow among regions, sectors and enterprises. There still exist institutional barriers preventing investors from freely entering certain sectors where state-owned enterprises dominate, resulting in a great loss of allocative efficiency. The Chinese Government should redefine the role and function of the state enterprises to keep them within necessary and limited arenas of economic activities, while creating equal competition opportunities for all sectors and enterprises.

V. Conclusion and Policy Implications

As a result of the changes in the population age structure, the working age population (aged 15 to 59 years) stopped growing in 2010. Meanwhile, economic growth continues to generate a large demand for labor, thus absorbing the surplus labor force in agriculture. As

the surplus labor force in agriculture is substantially decreasing, the Chinese economy is entering a phase of transition from dual economy development to neoclassical growth.

According to the neoclassical theory of growth, it is unlikely that developed economies can realize growth rates comparable to their developing counterparts, still in the process of catching up. Accordingly, fast growth will eventually slow down as an economy moves to a certain turning point, as experiences worldwide suggest (Eichengreen *et al.*, 2011).

There is no need to fear the slowdown of the potential growth rate. However, the new stage of development requires China to accomplish a fundamental transformation of its economic growth pattern from sole reliance on inputs of capital and labor to greater improvements in TFP. Therefore, the key to sustaining economic growth through expanding the potential growth rate lies in supply-side factors. If the government policies wrongly focus on stimulating demand-side factors to reach a growth rate exceeding the potential capacity of production, long-term economic growth will not be healthy and will cause distortions. Instead, sound policies should be implemented bearing the following in mind.

First, the central and local governments should accept slower economic growth. Policy decisions should be made by adjusting supply-side factors rather than demand-side factors. Even an undesirable fall in the growth rate caused by shocks from demand-side factors should not be a reason for policy-makers to introduce expansionary macroeconomic policy measures. Instead, policy-makers need to determine whether growth rates have been reduced to below-potential levels. If this is not the case, a situation where export demand and investment demand are weak could be taken as a chance for the economy to accelerate its transition towards a consumption-driven pattern and to grow in a more balanced manner.

Second, economic reforms should modify the traditional growth pattern. Reforms have been a major driving force of the unprecedented economic growth over the past 30 years. A competitive environment is vital for enhancing the potential growth rate in China over the next decade or so.

Third, there is an important role for the government to play in helping improve TFP. Krugman (1994) was critical of Singapore ’s growth model. The Singaporean Government responded to such criticism by introducing a national goal of 2-percent annual TFP growth (Felipe, 1997). It is worth noting that improving TFP will also depend on China ’s reform measures.

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(Edited by Jing Qiu)