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What Does the Lewis Turning Point Mean for China? A Computable General Equilibrium Analysis

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[**Abstract**] We apply a computable general equilibrium framework to assess likely impacts of the Lewis turning point on China and the rest of the world. Modeling results suggest that China will probably transition from an abnormal economy to a normal economy with somewhat lower growth but higher inflation, which requires significant revision to the macroeconomic policy framework. China would lose competitiveness in labor-intensive activities, its current account surplus should fall but overinvestment risk could rise. These changes in China should help improve other counties' current accounts and boost low-cost countries' production. The Lewis turning point, however, does not provide automatic solutions to some of the key challenges, such as service sector development and innovation capability. China will need to make serious policy efforts to avoid the so-called 'middle income trap'.

Key words: Lewis turning point, labor shortage, general equilibrium analysis, normal economy, middle-income trap

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What Does the Lewis Turning Point Mean for China: A Computable General Equilibrium Analysis

Introduction

With 1.3 billion people, China is known for abundant labor, especially rural surplus labor. And 'unlimited labor supply' has been one of the key factors contributing to China's unusual economic performance during the reform period (Sachs and Woo 2001). By shifting large number of farmers into non-agricultural jobs every year, China is able to achieve extraordinary productivity growth and at the same time keep inflation stable. Low labor cost is a cornerstone of China's global manufacturing center.

But the history of economic development suggests that no country can rely on cheap labor forever. Arthur Lewis pointed out that, as the modern sector of a low-income country continued to expand, rural surplus labor would eventually disappear (Lewis 1958). This transition from a labor surplus economy to a labor shortage economy is now popularly known as the Lewis turning point (Minami 1968). The Lewis turning point often signals the beginning of more rapid wage increase and, therefore, has important implications for economic growth and economic structure.

China saw the first waves of labor shortage in 2004, when employers in very dynamic Pearl River Delta and Yangtze River Delta experienced difficulties in recruiting enough migrant worker shortage (Huang 2004). But labor shortage situation eased later as faster rises in wage rates increased supply from inland provinces. In 2009, however, shortage of migrant workers again hit the country, although the economy was still suffering from damages of the global financial crisis (Kroebor 2010).

These dramatic changes in labor market conditions made some economists reckon if China is already approaching the Lewis turning point (Garnaut and Huang 2006; Cai 2007). However, the exact timing when this turning point will occur remains a controversial subject. One common counter-argument is based on the fact that the country still has about 350 million agricultural workers. More rigorous analyses compared productivity and real wages in agricultural and non-agricultural sectors to judge the extent of surplus labor in the agricultural sector (Minami and Ma 2009; Yao and coathur 2010).

For non-labor economists, perhaps a more critical question is potential implications of the Lewis turning point for the broad economy, including macroeconomic conditions and international economic relations. Leaving aside the interesting debate about the exact timing, the Lewis turning point will arrive sooner or later. And transitioning into a labor shortage economy can bring about profound transformation to the economy. A good understanding of these likely changes is critical for better preparing both the government and the corporate sector adapting to new economic conditions.

Earlier studies about the Japanese experience reveal important structural changes around its Lewis turning point. Existence of 'unlimited labor supply' may boost growth through high household savings, large corporate profits and low labor cost. Growth could decelerate after surplus labor disappears. Meanwhile, the Lewis turning point may improve income distribution due to faster increases in wages, especially wages for unskilled workers (Minami 2010).

A more fundamental question driving our interest in the Lewis turning point issue is if China is able to avoid what the World Bank called 'middle income trap' (Gill and Kharas 2007). Many countries, primarily those in Latin America and Middle East, were able to raise their income initially but were then stuck in the middle-income range. When China hits the Lewis turning point, whenever that might be, it will be a middle income country. Its past growth model relying on cheap labor input will no longer work. Can China find a new growth model and continue its rapid growth? We may not be able to provide a complete set of answers in this study. But we hope to at least shed some lights on what new challenges China will face.

In this paper, we apply a general equilibrium framework, the GTAP model, to assess economy-wide effects of the Lewis turning point for China. To simulate the labor market transition, we implement three shocks: a 10 per cent reduction in unskilled labor supply, a 5 per cent reduction in skilled labor supply, and a combination of the above two. We are aware that the Lewis turning point is not necessarily equivalent to reduction in labor supply. However, in a static model, this is the best we could implement to simulate tighter labor market conditions. We may think of the shocks as 'slower increases' instead of 'outright declines' in labor supply.

Like any quantitative tools, this model has a number of limitations. The model is static and financial aspects of the economy are not well represented. We should, therefore, interpret modeling results with caution. But it is a global model with detailed sector disaggregation. It enables us to gauge not only the economy-wide impacts of the shocks for China but also the likely economic consequences for the rest of the world.

Despite possible deficiencies of the framework, quantitative analyses in this study reveal some interesting findings. The Lewis turning point or emergence of labor shortage will most likely lower China's GDP growth but lift its inflation. Growth of wage rates, especially those for unskilled workers, may accelerate. This should impact competitiveness of Chinese manufacturing sectors and trigger significant structural changes. These, in turn, may cast shadow over China's position as the global manufacturing center. Surprisingly, modeling results suggest that China's external imbalances might improve but internal imbalance could worsen.

Labor shortage in China should also have important implications for the rest of the world, although magnitudes of the impacts are sometimes tiny. GDP growth may also slow in other countries but their inflation may fall as a result of lower aggregate demand. India represents a special case compared with other countries, probably because of its similarities with China. World economic structure, especially structure of manufacturing production and trade, could experience significant adjustments. As China graduates from labor-intensive industries, other low-cost countries may benefit.

All these findings have very important policy implications for China and the world. The central message from this paper, however, is that China may transition from an abnormal economy during the first thirty years of economic reform, with unusually high growth and unusually stable inflation, to a normal dynamic emerging economy. This means China may have to learn to live with slightly lower growth and slightly higher inflation. And this calls for significant reconfiguration of China's current policy frameworks.

The remainder of the paper is organized as follows. In the next section we introduce the GATP model and explain the simulations conducted for this study, including the model closure and the shocks. The third section discusses the economy-wide consequences of the Lewis turning point for the Chinese economy. The fourth section looks at the likely impacts on the rest of the world. The fifth section discusses some of the qualifications for

the results, summarizes the key findings and draws some policy implications. And the final section concludes the paper by shed some lights on the question if China will be able to avoid the so-called 'middle-income trap'.

The GTAP model and experiments

The Global Trade Analysis Project (GTAP) is a multiregion, multisector, computable general equilibrium model of the global economy, with perfect competition and constant return to scale (Hertel 1997). It is widely used in analyses of economic and policy issues such as trade liberalization and environmental protection. The GTAP framework consists of a system of multi-sector economy-wide models linked at the sector level through trade flows between commodities and factors of production.

GTAP is a comparative static equilibrium model. In the GTAP model the activities of economic agents — consumers, producers and government — are modeled according to neoclassical economic theory. Consumers are assumed to maximize utility and producers to maximize profits. Markets are assumed to be perfectly competitive. Production exhibits constant returns to scale. Different regions and economies are linked through trade.

Being a static model, however, GTAP is unable to model the transition process how a new equilibrium is reached after a shock. Rather it provides the results of the new equilibrium. This may be an important deficiency. However, our focus in this study is primarily the new equilibrium after the Lewis turning point occurs.

The latest database (version 7) of the model has a detailed treatment of the world economy – 113 countries and 57 sectors (Narayanan and Walmsley 2008). For the purpose of this study, we aggregate the countries and sectors into 10 country/country groups and 10 broad sectors (see Table 1).

For regional disaggregation, we separate out a list of Asian country groups, Japan, India, ASEAN, NIEs and rest of Asia, in addition to US and EU. Our rationale is that these country groups are different from one another in terms of income levels and comparative advantages. And they might react to China's labor market transition differently. For instance, as China moves up the industrial ladder, India and rest of Asia could see more opportunities, while Japan and NIEs may feel more competition pressure.

The sector disaggregation is standard in GTAP application. Our focus will primarily be placed on the three manufacturing sectors. Most importantly, changes in the textile and wearing apparel sector are of particular interest. But we are also interested in seeing potential impacts on service sectors, which are now the new policy focus for the next stage economic development.

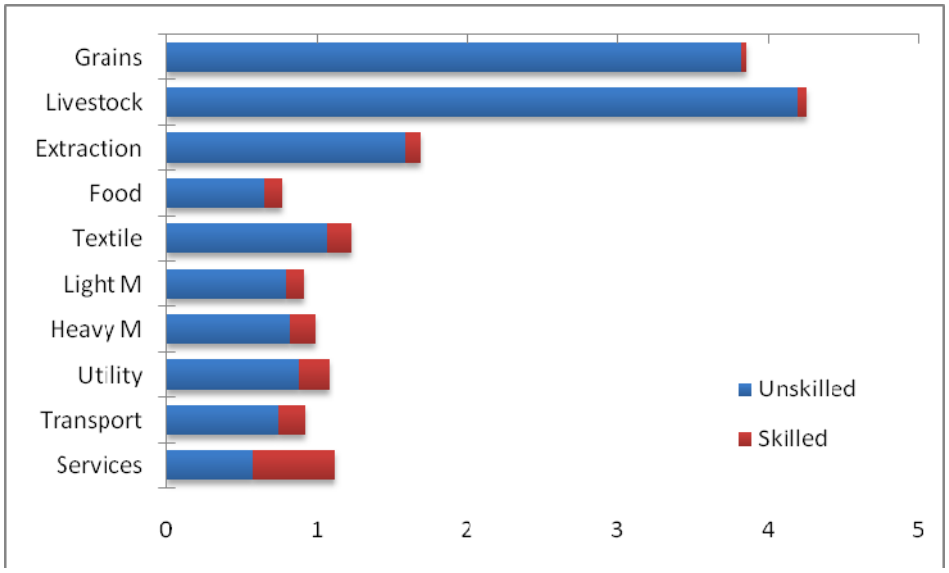
Table 1. Country and Sector Aggregation of GTAP Model

Country/Country Group	Sector
China	Grains
Australia	Meat and livestock
Japan	Mining
Newly Industrialized Economies (NIEs)	Food processing
India	Textile and wearing apparel
ASEAN excluding Singapore	Light manufacturing
Rest of Asia	Heavy manufacturing
United States	Utility and construction
EU-25	Transport and communication
Rest of the world	Other services

Note: NIEs include Hong Kong, Korea, Singapore and Taiwan.
Source: GTAP Database 7 (Narayanan and Walmsley 2008).

It is useful to first look at different labor-capital ratios across sectors in China (see Figure 1). The labor-capital ratio is defined as the ratio between total wages and total capital returns. It's an indicator on how intensively labor is used relative to capital. In principle, the higher the labor-capital ratio, the more significant the impacts of the Lewis turning point.

Figure 1. Labor-Capital Ratios of Chinese Sectors

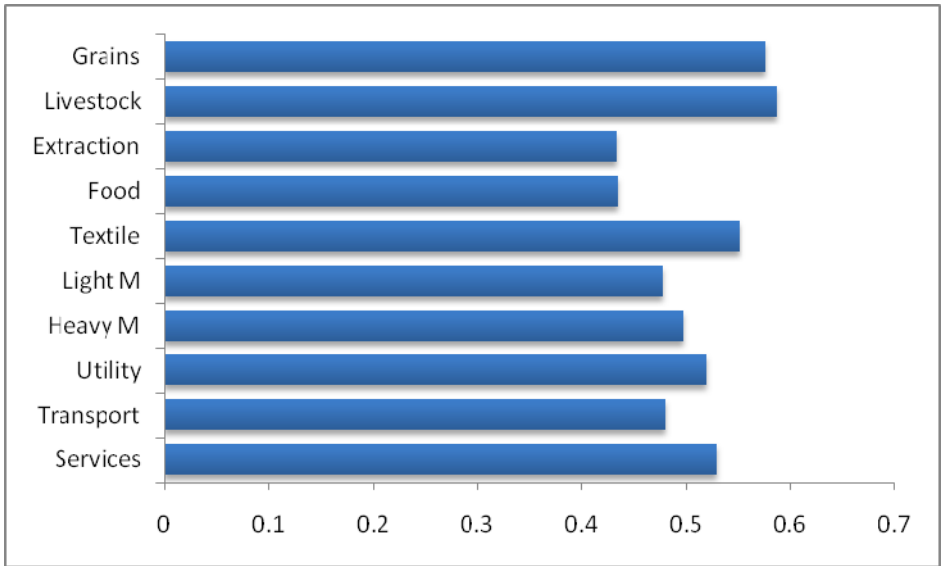


Note: Labor-capital ratio is the ratio of total wage to total capital return.
Source: GTAP Database 7 (Narayanan and Walmsley 2008).

It turns out that the agricultural sectors have the highest labor-capital ratio. The mining industry (resource extraction) also has relatively high labor-capital ratio. This is certainly at odds with general impression, as normally we think the mining industry is quite capital-intensive. But these three primary industries also require land and natural resources for production, in addition to labor and capital.

Therefore, it should be useful to look at the share of labor in total value-added for each sector, which may present a pattern conforming to conventional perception. In fact, the labor share of the mining industry is the lowest among the ten sectors, and that of agricultural sectors is only slightly higher than that of the textile industry (see Figure 2).

Figure 2. Labor Share in Total Value-Added of Chinese Sectors

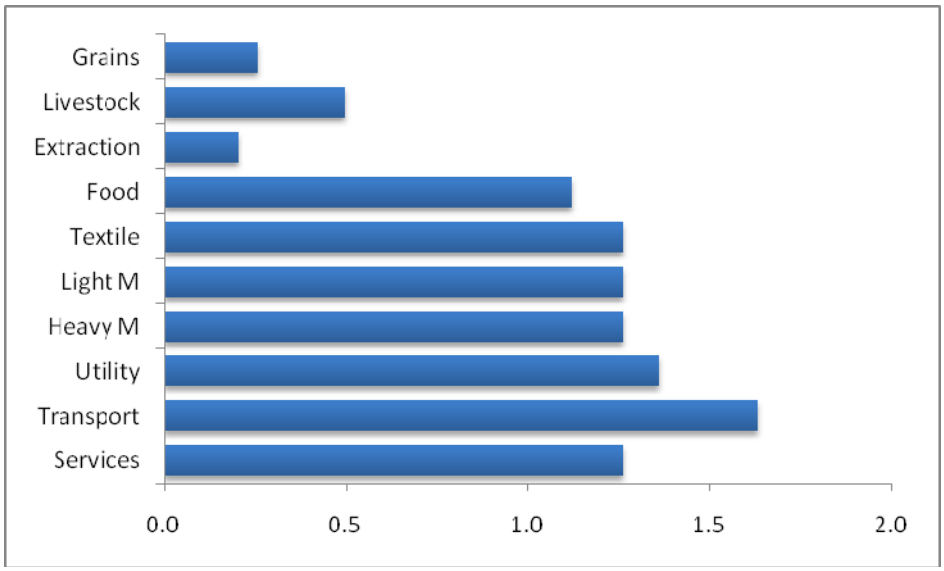


Source: GTAP Database 7 (Narayanan and Walmsley 2008).

Of the three manufacturing sectors, textile has the highest labor-capital ratio. So it will be interesting to see changes in this sector following labor market transition. Other services also have quite high labor-capital ratio, but almost half of the labor input is skilled labor.

In order to understand different sectors' responses to the labor shortage shock, it is also useful to look at the substitution elasticity among primary factors in Chinese sectors, in addition to labor-capital ratio and labor share of total value-added (see Figure 3). We notice that the elasticity is much smaller for the primary industries than for the other sectors. A small elasticity of substitution means input mix has to be relatively stable. As a result, the adverse effect of the labor supply shortage would be smaller, even if is a labor-intensive sector.

Figure 3. Elasticity of Substitution Among Primary Factors in Chinese Sectors



Source: GTAP Database 7 (Narayanan and Walmsley 2008).

In this analysis, the standard closure of the GTAP model is used. The amount of endowments, that is, labor, capital, land and natural resources, is fixed, and the price of them adjusts to ensure the factor market is in equilibrium. Labor and capital are perfectly mobile across sectors within an economy. In other words, wage rate and rate of return to capital are identical for each of the sectors. Meanwhile, land and natural resources are sluggish, and their prices or returns are different across sectors.

Design of experiments is somehow complicated. The Lewis turning point means increasing demand in the modern sector of the economy eventually exhausting surplus labor in the traditional sector and therefore pushing up labor costs. This, however, is difficult to implement in a static model. One possible way of simulation is to reduce labor productivity, which would increase demand for labor for fixed level of economic activity. However, decline in productivity may generate other undesirable consequences for the economy.

An alternative is to reduce labor supply, which would create labor shortage in the economy. Again this is not perfect, as it shrinks size of the economy. We should think of the simulations as slowdown in growth of labor supply, not outright decline in labor supply. The nature of the Lewis turning point implies that labor shortage would occur primarily in market for unskilled labor, at least initially. But as the economy evolves, shortage will probably spread to market for skilled labor, making labor shortage an economy-wide phenomenon.

One possible justification for this supply decline designation is that, due to the family planning policy, China's total labor supply is likely to take a downturn in the coming years. But, again, this is not Lewis turning point in original definition. We should interpret the modeling results with caution.

For the purpose of this study, we devised three shocks for experiments. In the first experiment, we reduce unskilled labor supply by 10 per cent. In the second experiment, we reduce skilled labor by 5 per cent. And in third and final experiment, we combine the above two shocks together. Subtotal commands are used in the simulation software,

GEMPACK, to ensure the sum of the results of the former two shocks equal to that of the latter.

Consequences of labor shortage for the Chinese economy

Increases in wage rates are probably the most apparent responses to labor shortage shocks (see Table 2). This is understandable as declining supply leads to rising prices. In the scenario of unskilled labor shock, wage of unskilled workers rises by 7.6 per cent. But wage for skilled workers actually declines by 2.4 per cent. Similarly, prices of land, capital and natural resource fall, respectively, by 5.6 percent, 2.1 percent and 1.3 percent. Reduction in skilled labor supply also raises wage of skilled workers but lowers prices of unskilled workers, land, capital and natural resources.

The simulation with combined unskilled and skilled shocks has very similar consequences. Wages for unskilled and skilled workers increase by 7.4 per cent and 1.7 per cent, respectively. However, land price falls by 6 per cent, capital price declines by 2.2 per cent, and price of natural resources lowers by 0.6 per cent.

Table 2. Changes in GDP Deflator, CPI, Terms of Trade and Factor Prices (%)

	Two Shocks Combined (-10%, -5%)	Unskilled Labor Shock (-10%)	Skilled Labor Shock (-5%)
GDP Deflator	1.20	0.97	0.23
CPI	0.88	0.72	0.16
Terms of Trade	0.97	0.84	0.12
Unskilled Labor	7.42	7.62	-0.20
Skilled Labor	1.67	-2.40	4.07
Land	-5.98	-5.63	-0.35
Capital	-2.17	-2.08	-0.09
Natural Resources	-0.64	-1.30	0.66

Note: The three shocks implemented are: reduction of unskilled labor by 10%, reduction of skilled labor by 5%, and combination of the above two. All numbers are percentage changes relative to the base line scenario.
Source: Author's simulation applying the GTAP model.

Declines in prices of other factors are probably associated with lowering of these factors' marginal returns, as a result of labor shortage. We may think of a Cobb-Douglas production function in which unskilled labor, skilled labor, land and natural resources are production inputs. Taking partial derivatives can confirm that the marginal products of other factors are positively correlated with levels of unskilled labor inputs. Another way of understanding this result is through lower GDP and, therefore, less aggregate demand, as a result of unskilled labor shortage.

A more general price consequence, however, is higher inflation following emergence of labor shortage. According to modeling results, the combined shock, which is equivalent to 8.9 per cent reduction in total labor supply, pushes up CPI inflation by 0.9 percentage point. Product prices rise in almost all sectors, by an average of 0.8 per cent. The only exception is resource extraction, presumably because this is the least labor-intensive sector. Change in GDP deflator is even greater, at 1.2 percentage points.

The numbers show much smaller impacts of the skilled labor shock than those of unskilled labor shock. But this picture is distorted by smaller shock devised for skilled labor supply than that for unskilled labor supply (5 per cent versus 10 per cent) and also much smaller proportion of skilled labor in total labor supply than unskilled labor (21.8 per cent versus 78.2 per cent). In fact, 1 per cent decline in labor supply raises CPI by 0.09 per cent if decline concentrates in unskilled labor or by 0.15 if decline concentrates in skilled labor.

Terms of trade improves as a result of labor shortage. Reduction of unskilled labor by 10 per cent leads to terms of trade improvement by 0.8 per cent, while reduction of skilled labor by 5 per cent improves China's terms of trade by 0.1 per cent. When the two shocks are combined, terms of trade improves by 1 per cent. This implies that while Chinese exports worth more in the international markets, their competitiveness could be under pressure. But this may not be an undesirable development given the policymakers' concern about too much reliance on export markets.

These results suggest that the Lewis turning point may signal the beginning of a period of relatively high inflation. This will be very different from what China has become used to for the past decade or so. It may also raise questions about China's monetary policymaking, especially the appropriate levels of inflation.

Labor shortage leads to lower levels or, at least, slower growth of GDP (see Table 3). Apparently this is the expected result of a static and short-run model. In short, the -10 per cent shock to unskilled labor supply leads to fall of GDP by 4.1 per cent, while the -5 per cent shock to skilled labor supply causes a drop of GDP by 0.6 per cent. Different GDP elasticities of two types of labor supplies are interesting. The aggregate case suggests an elasticity of about 0.5: a 1 per cent decline in overall labor supply lowers GDP by roughly 0.5 per cent.

We should note that, in the combined scenario with shocks to both unskilled and skilled labor supplies, GDP per capita actually increases by 4.7 per cent. This means that while the aggregate GDP activity shifts to lower level, the population becomes richer. It is mainly because there are less people to share the production resources.

The model also confirms that labor shortage in China would lower its current account surplus by increase investment ratio. This is consistent with the argument that perhaps China's current account surpluses in the early 21st century were a result of population dividends. This could be reversed once the dividends disappear (Cai 2010).

Table 3. Changes in Real GDP, Saving, Investment and Current Account (%)

	Two Shocks Combined (-10%, -5%)	Unskilled Labor Shock (-10%)	Skilled Labor Shock (-5%)
GDP (%)	-4.64	-4.08	-0.55
Saving Ratio (% GDP)	-0.03	-0.07	0.03
Investment Ratio (% GDP)	0.85	0.68	0.15
Current Account (% GDP)	-0.88	-0.75	-0.12

Note: The three shocks implemented are: reduction of unskilled labor by 10%, reduction of skilled labor by 5%, and combination of the above two. All numbers are percentage changes relative to the base line scenario.
Source: Author's simulation applying the GTAP model.

The combined labor supply shock reduces China's current account surplus by 0.9 per cent of GDP. However, the fall comes mainly from increase in investment ratio. Actually, investment also declined in absolute terms. But investment falls less than GDP and, therefore, investment ratio increases.

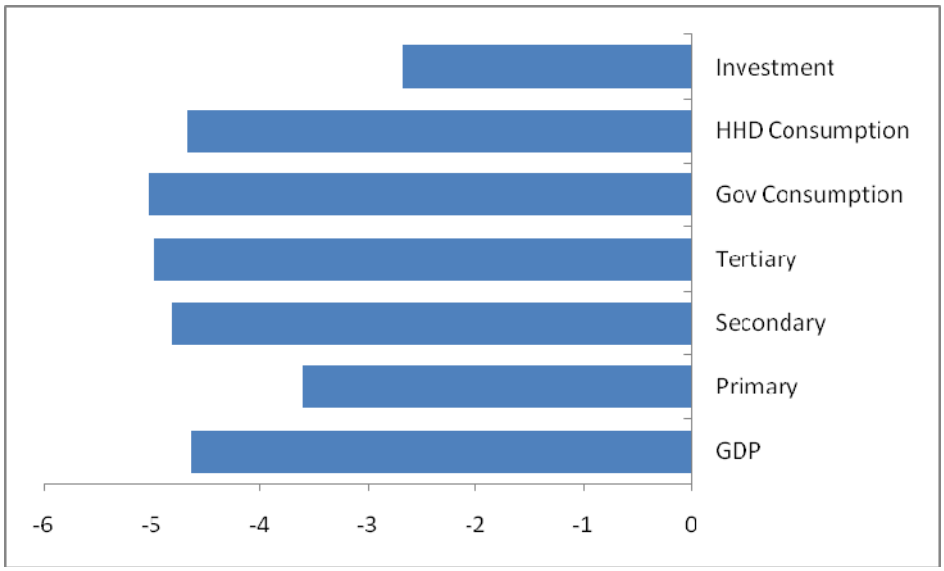
The simulation results also point to falling saving ratio in face of unskilled labor shortage but a rising saving ratio in face of skilled labor shortage. These findings indicate implicitly that unskilled workers save more proportionately than skilled workers. This is not consistent with the general impression that rich people normally save more. But perhaps skilled workers are not rich people. And it may also reflect the fact that unskilled workers generally enjoy much less social welfare benefits. And therefore they rely more on their own saving for social economic protection.

Macroeconomic structure may experience sea changes once labor shortage hits China (see Figure 4). On the production side, the secondary and tertiary industries are hit hardest. Meanwhile, relatively importance of the primary industry rises. These results may appear to be odd given that these primary industries have the highest labor-capital ratios. The reason why they respond much less to labor shortage than any other industries was because of much lower elasticity of substitution between labor and other factors, such as land, capital and natural resource (substitution elasticity of 0.2-0.5 for the primary industries versus over 1 for other industries in the GTAP model). Therefore, even when labor cost rise, the primary industries have limited room to lower labor demand.

On the expenditure side, consumption falls almost in proportion to GDP. Shrink of current account surplus relative to GDP should be a positive development, given current concerns about China's external surpluses and the global imbalance. The fact that exports fall faster than GDP also imply relatively lower export share of GDP. But investment falls less than GDP, which means investment share of GDP rises. So implications of labor shortage for structural imbalances of the Chinese economy are mixed.

These findings also have important policy implications. While emergence of labor shortage may help ease the external imbalance problem, it cannot effectively deal with the internal imbalance problem. To certain extent, population transition actually makes the consumption-investment disproportion problem even worse. However, if labor shortage really begins to raise shares of labor compensation and household income, then it could support consumption. Bottom line is that the government still needs to find ways for curing the overinvestment risk and boosting domestic consumption.

Figure 4. Responses of Macroeconomic Indicators to Combined Shocks (%)



Note: The shock implemented is reduction of unskilled labor by 10% plus reduction of skilled labor by 5%. All numbers are percentage changes relative to the base line scenario.
Source: Author's simulation applying the GTAP model.

Changes at the sector level reveal more structural adjustment of the economy (see Table 4). By decomposing changes in trade balance, we find that shrink in external surplus concentrate mainly in the manufacturing sectors: textile and clothing, light manufacturing and heavy manufacturing. Textile and clothing is by far the hardest hit industry, consistent with the expectation that China will lose competitiveness in labor-intensive activities quickly. Declines in trade surpluses of three manufacturing sectors account for 150 per cent of fall in total trade surplus. Meanwhile, grains, resource extraction and other services actually improve their trade balance.

Changing trade of the manufacturing sector is basically reflected in greater-than-average falls in their exports but smaller-than average declines in their imports. Similarly, production of manufacturing activities also falls most drastically, as a result of labor shortage. However, services decline even more, confirming that these activities are also labor-intensive.

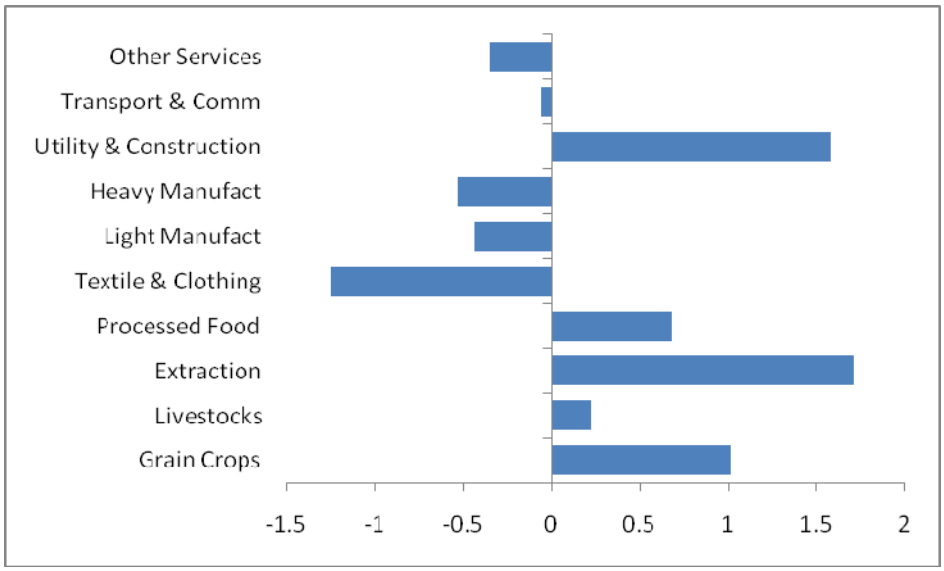
Table 4. Responses of Production and Trade by Sectors to Combined Shocks (%)

	Production (%)	Exports (%)	Imports (%)	Trade Balance (US$m)
Grain Crops	-3.73	-2.81	-2.90	267
Meat & Livestock	-4.53	-6.08	-2.38	-87
Resource Extractions	-3.03	9.09	-8.26	5,022
Processed Food	-4.07	-3.07	-2.77	-61
Textile & Clothing	-6.00	-6.05	-2.00	-4,480
Light Manufacturing	-5.18	-5.75	-1.51	-5,842
Heavy Manufacturing	-5.28	-5.15	-2.64	-5,607
Utility & Construction	-3.17	-4.22	-3.10	-8
Transport & Communication	-4.81	-3.59	-2.88	54
Other Services	-5.10	-4.16	-3.00	185
Total	-4.75	-5.05	-3.04	-10,558

Note: The shock implemented is reduction of unskilled labor by 10% plus reduction of skilled labor by 5%. All numbers are percentage changes relative to the base line scenario.
Source: Author's simulation applying the GTAP model.

Potential changes in production structure are probably best illustrated by comparing individual sectors' percentage changes with the economy-wide average (see Figure 5). A positive number indicates the sector shrinks less than the economy and, therefore, its share in the economy expands. Of the ten broad sectors included in the model, five sectors, including utility and construction, processed food, resource extraction, livestock and grain crops, all expanded in relative terms. The other five sectors, including textile and clothing, light and heavy manufacturing, transport and communications and other services, all shrink.

Figure 5. Individual Sector Production Change Relative to the Economy's Average Production Change (percentage points)



Note: The shock implemented is reduction of unskilled labor by 10% plus reduction of skilled labor by 5%. All numbers are percentage changes relative to the base line scenario minus the average change rate.
Source: Author's simulation applying the GTAP model.

Lessons from these simple findings are apparent. The arrival of the Lewis turning point could signal difficulties for China's massive manufacturing expansion. Industrial upgrading will be the key for China to sustain rapid growth. But the model does not tell where Chinese industries should move to. The policymakers hope to boost the service sectors. But labor market transition does not automatically support service sector development. The government will need to look for effective measures to overcome the existing barriers.

The modeling results also do not reveal possible impact on industrial upgrading within the manufacturing sector. This can be partly attributed to the aggregate levels of sector groups. A 10 per cent reduction in unskilled labor and 5 per cent reduction in skilled labor implies rising share of skilled labor in total workforce. And thus comparative advantage should shift toward more skill-intensive industries. And faster development of high-technology, high skill and high value-added manufacturing should be a natural result of labor market transition, if relevant obstacles can be overcome.

But this is not the whole story. Industrial upgrading is not automatically guaranteed by emergence of labor scarcity. In fact, many developing countries were captured by the so-called 'middle-income trap'. They were dynamic and rapidly growing when cheap labor was abundant. Once this resource runs out, their growth also unraveled. Whether or not China can avoid the middle-income trap will eventually determine if China will really overtake the U.S. to become the world's largest economy in the coming decades.

Implications for the world economy

Given China's importance in today's global economy and markets, it's likely that the expected labor market transition in China should have important implications for other countries, especially China's close economic partners. But individual countries' economic relations with China are different. From trade point of view, for some, such as India, China is probably more of a competitor since both are labor-abundant countries. For others, such as Australia, China is probably more complementary. These relations, however, are becoming increasingly more complex given China's rapidly diversifying economic structure.

The first issue we want to explore is if relatively higher inflation rate in China means higher inflation for the world. This is an important question since many attribute stable global inflation during the past decade to cheap Chinese exports. If Chinese prices are going to rise, would it lead to high inflation in the world as well?

The modeling results, however, do not support that hypothesis. In fact, CPI inflation fall in all countries/country groups except India (see Table 5). Magnitudes of such negative impacts are relatively small, ranging between 0.05 and 0.1 per cent. The greatest effects are seen in Australia and NIEs, while the smallest impacts are observed in USA, EU and Rest of the World. India's CPI rises by 0.04 per cent, compared with 0.9 per cent increase in Chinese CPI. Movements in GDP deflators generally follow the same pattern.

Table 5. How Does China's Lewis Turning Point Affect Other Countries' Inflation? (%)

	GDP Deflator	CPI	Terms of Trade
Australia	-0.12	-0.08	-0.20
India	0.04	0.04	0.08
Japan	-0.09	-0.07	-0.13
NIEs	-0.16	-0.09	-0.11
ASEAN	-0.10	-0.05	-0.09
RoAsia	-0.16	-0.05	-0.22
USA	-0.04	-0.03	-0.07
EU_25	-0.03	-0.02	-0.02
RoWorld	-0.06	-0.03	-0.09

Note: Results reported in this and the following tables are for the combined shocks: 10 per cent reduction of Chinese unskilled labor and 5 per cent reduction of Chinese skilled labor. All numbers are percentage changes relative to the base case scenario.
Source: Author's simulation applying the GTAP model.

We shouldn't take the results as evidence that Chinese inflation would not lead to global inflation. In fact, two changes are happening simultaneously in China in the model: one is higher price and the other is slower growth. *Ceteris paribus*, higher Chinese prices should lead to higher global prices, although the elasticity may be small. But slower Chinese growth helps ease pressure on global inflation. Clearly, this second effect dominates the modeling results. But the conclusion of the study is still valid: emergence of labor shortage in China does not necessarily lead to higher inflation in the world.

Changes in India provide a unique case study. At highly aggregated level, India shares a lot of commonalities with China, especially abundant unskilled labor and low labor cost. In fact, India's wages for both unskilled and skilled labor increase, just like what happen in China, an evidence of substitutability between Chinese and Indian labor-intensive products in international markets, although labor is not mobile in the GTAP model. For this reason, India's other factor prices all experience positive changes, even though the net impacts on India's GDP and current account remain small.

Given relative changes in price levels in China and the rest of the world, it is easy to understand why current accounts improve for all other countries, including India. This should be a positive change for important deficit countries like USA, Australia and India. And, therefore, labor market transition in China may help these countries take one step forward in reducing their external imbalances. Whether or not this would help resolving the global imbalance is unclear, since other surplus countries also experience deterioration of their terms of trade.

Except India, all other countries suffer from falls in factor prices, although magnitudes of these changes are relatively small (see Table 6). Again, this is probably because of lower economic activities as a result of changes in Chinese labor market. The largest falls occur in natural resource prices. This confirms the popular perception that if Chinese investment weaken, global commodity prices are likely to soften.

Table 6. Likely Changes in Factor Prices in Other Countries (%)

	Unskilled Labor	Skilled Labor	Land	Capital	Natural Resources
Australia	-0.09	-0.10	-0.08	-0.10	-0.25
India	0.09	0.08	0.11	0.07	0.09
Japan	-0.09	-0.10	-0.10	-0.09	-0.30
NIEs	-0.15	-0.16	-0.13	-0.17	-0.39
ASEAN	-0.04	-0.06	-0.17	-0.06	-0.28
RoAsia	-0.03	-0.09	-0.10	-0.07	-0.22
USA	-0.03	-0.04	-0.15	-0.04	-0.18
EU_25	-0.02	-0.03	-0.08	-0.03	-0.17
RoWorld	0.00	-0.02	-0.10	-0.02	-0.11

Note: The shock implemented is reduction of unskilled labor by 10% plus reduction of skilled labor by 5%. All numbers are percentage changes relative to the base line scenario.
Source: Author's simulation applying the GTAP model.

Changes in economic activities in the rest of the world are somewhat less uniform (see Table 7). Both India and Rest of Asia benefit from China's lower activities, an indirect evidence of competitive relations between China and these countries. The saving ratios increase in India, USA and EU but decrease in all other countries. The investment ratios decline everywhere. As a result, all countries experience improvement in the current account.

Unfortunately this model does not capture the dynamic nature of international economic relations. Therefore, the negative correlations discovered in this study between China, on the one hand, and India and Rest of Asia, on the other, may be problematic. But at least from a static point of view, China's rapid rise in the technological ladder should make some room for other low-income countries with abundant labor.

Table 7. Effects on Macroeconomic Indicators of Other Countries (%)

	Real GDP (%)	Consumption (%)	Saving Ratio (% GDP)	Investment Ratio (% GDP)	Current Account (% GDP)
Australia	-0.008	-0.05	0.00	-0.03	0.03
India	0.004	0.01	0.01	0.00	0.01
Japan	-0.003	-0.02	0.00	-0.05	0.05
NIEs	-0.005	-0.07	-0.02	-0.06	0.04
ASEAN	-0.008	-0.07	-0.01	-0.04	0.03
RoAsia	0.002	-0.11	-0.02	-0.03	0.01
USA	-0.003	-0.01	0.00	-0.03	0.03
EU_25	-0.004	-0.01	0.00	-0.03	0.03
RoWorld	-0.004	-0.04	0.00	-0.02	0.02

Note: The shock implemented is reduction of unskilled labor by 10% plus reduction of skilled labor by 5%. All numbers are percentage changes relative to the base line scenario.
Source: Author's simulation applying the GTAP model.

Finally, what are the implications of Chinese labor market transition for sector structure of the rest of the world? The first to note is that almost all countries or country groups experience visible expansion in their manufacturing activities, especially in the textile and clothing industry (see Table 8). While this result sounds reasonable in terms of direction of change, the magnitudes of some of changes look problematic. For instances, it is probably easy to understand why the textile and clothing industries in ASEAN and Rest of Asia expand, how much Australia, Japan and USA can gain from this market vacuum left by China remains a question.

The sharp rise in exports of resource extraction sector in China and the widespread fall of resource exports in other countries warrant some detailed explanation. This is primarily driven by the fact that the extraction sector is the most capital and resource-intensive industry – capital and natural resources account for 53 per cent of value added of the sector.

The Lewis turning point significantly increases China's endowments in capital and natural resources, relative to labor, and decreases their prices. With lower prices of capital and natural resources, competitiveness of Chinese resource exports improve sharply, leading to higher exports and lower imports, and thus lower production elsewhere. But because the overall economic activity in China falls, the demand for mining products falls, leading to fall in the mining production in China.

The broad conclusion about structural change is clear. If the first decade of the 21st century saw China rapidly rising as a global manufacturing center, then the post-Lewis turning point time could see the opposite. In other words, global manufacturing activities concentrate in China today may find their ways elsewhere. Of course this is likely to happen gradually.

Table 8. Changes in Production by Sectors in Other Countries (%)

	Australia	India	Japan	NIEs	ASEAN	RoAsia	USA	EU_25	ROW
Grains	0.04	0.01	0.04	0.05	0.00	0.05	-0.03	0.01	-0.02
Livestock	0.07	-0.01	0.10	0.04	-0.01	-0.05	0.00	0.00	-0.01
Extraction	-0.29	-0.38	-0.23	-0.21	-0.24	-0.15	-0.15	-0.24	-0.19
Food	0.04	-0.03	0.02	0.04	-0.03	-0.03	0.00	0.00	-0.02
Textile	0.96	0.49	0.80	0.98	0.98	1.11	0.54	0.49	0.70
Light M	0.14	0.03	0.18	0.32	0.17	0.30	0.08	0.07	0.17
Heavy M	0.32	0.10	0.04	-0.07	0.05	0.68	0.08	0.04	0.23
Utility	-0.10	0.02	-0.13	-0.15	-0.13	-0.03	-0.07	-0.08	-0.04
Transport	0.00	0.02	-0.02	-0.08	-0.01	-0.01	-0.01	0.01	-0.02
Services	-0.02	-0.03	-0.01	0.01	-0.04	-0.06	-0.01	-0.01	-0.03

Note: The shock implemented is reduction of unskilled labor by 10% plus reduction of skilled labor by 5%. All numbers are percentage changes relative to the base line scenario.
Source: Author's simulation applying the GTAP model.

Toward a normal dynamic economy

Before summarizing the findings, we like to reiterate important limitations of the framework applied in this study. Like any models, GTAP has its own advantages and disadvantages. One most important advantage of the GTAP model is its detailed structure with ten country groups and ten industries. The model is widely used and well respected

among some applied international economists. It enables us to look at not only the macroeconomic impacts but also changes at sector level. It also enables us to pick up likely important changes in the rest of the world.

Initially, however, GTAP was designed primarily for trade policy analysis. So it is more sophisticated on trade linkages across countries. But it is light on financial aspects, especially capital markets. This is an important deficiency for analyzing important international economic issues in today's world. The most important setback, however, is its static nature. To analyze a long-term issue like labor market transition, a dynamic CGE model is much preferred. GTAP is the second best that we have access. We plan to revisit the question in the future by applying a dynamic computable general equilibrium framework.

We also like to caution on drawing too much implications from the simulation results. Like any models, simulation results from GTAP are to certain extent driven by the model structure and elasticities chosen. We take the results more as references for verifying our economic analysis, not hard evidences for predicting future events.

And, finally, by implement the shocks described above in GTAP framework essentially means we simulate a multi-year process in an annual framework. Decline of labor supply of the order of 5-10 per cent only occurs gradually, not within a single year. The simulating results may be over- or under-estimated. Short-term elasticity is often smaller than long-term one. Meanwhile, productivity gains may also grow with time, which may be able to offset the negative impacts of labor supply shocks.

With these qualifications in mind, we still find the modeling results revealing and exciting. First, emergence of labor shortage in China could see the beginning of a period of higher inflation. Wages will probably rise quickly for understandable reasons, although in the near term other factor prices may fall. But the overall impact is likely to be inflationary. Product prices of all sectors, except one, increase.

Second, decline in labor supply should have negative impact on economic activities, especially real GDP growth. This holds as long as marginal product of labor remains positive. The falls are broad-based in the primary, secondary and tertiary industries, on production-based measures, and in investment, consumption and net exports, on expenditure-based measures.

Third, labor shortage would have mixed impacts on China's imbalance problems. According to the modeling results, it improves external imbalance, by lower current account surplus, but worsens internal imbalance, by higher investment share of GDP. GDP growth is also going to be less dependent on exports, which fall faster than GDP.

Fourth, labor-intensive manufacturing is likely to lose out quickly after the Lewis turning point. In fact, manufacturing as a whole could be adversely affected, raising questions about China's future as the global manufacturing center. In the short term, economic structure could be skewed toward capital-, land- and resource-intensive activities.

And, finally, the world economy may slow slightly alongside moderation of Chinese growth. Low-income countries should be able to grow more rapidly in labor-intensive industries. Almost all other countries should experience improvement in their current accounts. Their prices may rise or fall, depending on which mechanism dominates: price transmission or demand connection.

We have not discussed the impacts on exchange rates. This is because exchange rate is treated as the monetary numéraire in the model. So unfortunately simulation results do

not reveal explicit changes in renminbi nominal exchange rate. However, rising inflation in China, especially against the background of lowering inflation elsewhere, suggests that renminbi should appreciate in real effective terms. This is consistent with China's improving terms of trade and lowering current account surplus.

So what are the key takeaways? The most important conclusion is that China will transition from an abnormal economy to a normal dynamic emerging economy. The modeling results tell us the Chinese economy will probably see slower growth and higher inflation after the Lewis turning point.

It may be argued that if China can accelerate productivity growth, then its growth rate does not have to fall. This is certainly possible theoretically. But in reality it is difficult. Not only resource constraints become tighter, but China is also closer to the global technology frontier, which makes rapid growth more difficult. And experiences of other countries also confirm some slowdown in GDP growth with emergence of labor shortage.

But this transition needs not to be a worry. In a way, China's macroeconomic performance during the past three decades, with average GDP growth of 9.6 per cent and average CPI inflation of 1.3 per cent, was unprecedented and abnormal. In comparison, the post-Lewis turning point Japan and Korea experienced periods of 8-9 per cent GDP growth and 5-6 per cent CPI inflation (see Table 9). So the expected changes will probably only move China back to the neighborhood of other dynamic emerging economies.

Table 9. Real GDP Growth and CPI Inflation in Japan, Korea and China (%)

	Japan (1960-72)	Korea (1982-96)	China (1997-2009)
GDP: Average	8.9	8.5	9.6
CPI: Average	5.6	5.2	1.3
CPI: Maximum	13.1	11.1	4.8
CPI: Minimum	3.6	2.3	-1.5

Source: Arthur Kroebor (2010), page 45.

In fact, labor market transition is only one of the factors that will help convert China to a normal economy. A more fundamental cause is the expected elimination of cost distortions. During the past thirty years, the Chinese government adopted a unique asymmetric reform approach: complete liberalization of product markets but heavy distortions in factor markets. The estimated factor cost distortions amount to between 6 and 12 per cent of GDP in 2000-2009 (Huang 2010).

These distortions are like producer subsidies. They artificially raise profits from production, increase returns to investment and improve international competitiveness of Chinese products. These distortions are important reasons why Chinese growth is so strong but imbalance problems are so serious. They also naturally repress inflation rates. Liberalization of factor markets and elimination of cost distortions, which have already begun, are likely to lead to slightly lower GDP growth but slightly higher inflation.

And this transformation is very important for policymaking and investment decisions. The government may have to revise its current policy framework. For instance, the government should learn to live with somewhat higher inflation. The central bank normally sets inflation target at around 3 per cent and tightens monetary policy

aggressively when CPI hits 5 per cent. These constraints should probably be relaxed. After all, slightly higher inflation is a natural result of correcting domestic price distortions.

The government should also get used to slightly slower growth. The 10 per cent average growth was partly contributed by productivity gain from transforming farmers into industrial workers. But it was also a result of the government's over-emphasis of GDP growth, which came at the expenses of growth quality and other social problems. It is much for the government to focus on efficiency of the economy and social protection of the people. To achieve this, the government will have to modify its system for reviewing performance of the local officials.

Concluding Remarks: Can China Avoid the "Middle-Income Trap"?

The modeling results reveal that China is likely to transition toward a 'normal economy'. But they do not tell if China is able to avoid the so-called 'middle-income trap'. In this final section, we offer a few remarks on two subjects: one, resolution of the structural risks; and, two, new sources of growth.

China managed extraordinary economic growth during the reform period. In the meantime it also accumulated a long list of risks, which already threaten sustainability of growth. And these risks include overinvestment, large external surplus, income inequality among households, declining shares of household income and consumption in the economy and under-developed service sector. Whether or not China is able to avoid the 'middle income trap', first of all, depends on its ability in defuse the existing risks.

Analyses in this study confirm that the Lewis turning point may be able to solve some of the existing problems. For instance, labor shortage may lead to decline in saving ratio and reduce current account surplus. Of course, complete resolution of external imbalance problem will likely require a more comprehensive policy package, including reforms of the exchange rate regime and domestic factor markets.

The Lewis turning point may also help increase wages and raise the share of household income in national income. Japan's experiences also confirm that the labor market transition can improve income distribution. Alongside the other reforms such as development of social welfare systems and redistribution of incomes, consumption growth may start to gather momentum. The modeling results, however, point to higher investment share of GDP following labor shortage. This may require more decisive policy actions such as financial liberalization to end financial repression.

The modeling analyses do not offer any insights on how to boost China's underdeveloped service sectors. In fact, simulation results point to relative shrink of the service sectors since they are generally more labor-intensive. But development of the service sector is critical for China to continue its rapid growth. Therefore, the government may need to find ways to overcome the existing obstacles for service sector development.

What really trapped many Latin America and Middle East middle-income countries was lack of innovation capability. They failed to move up the industrial ladder beyond resource-based activities. This will also be the real test for China. The government has set its eyes on high tech and high value-added industries to carry Chinese growth forward. But currently there are still huge gaps in China in areas of education, research and development, financial services, legal protection and lowering entry barriers.

To sum up, the Lewis turning point will likely transform China from an abnormal economy into a normal dynamic emerging economy, probably with lower GDP growth

and higher inflation. Labor market transition should help deal with some of the existing risk factors but does not provide automatic solutions to all the problems.

The biggest post-Lewis turning point challenge is how to avoid the so-called 'middle income trap'. And this depends on China's ability to resolve existing risks, maintain macroeconomic stability and, most importantly, build innovation capability that will continuously push China closer to the global technology frontier.

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