Has the Lewis Turning Point Arrived in China?—Theoretical Analysis and International Experience*

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各国农业劳动力占总劳动力的比重随着各国人均GDP增长呈现先加速下降而后减速下降的趋势，分界点就是刘易斯转折点。跨国平行数据的回归结果表明，刘易斯转折点在人均GDP为3,000–4,000美元（购买力平价2000年国际美元）之间出现。中国的人均GDP超越了这一水平，但农业劳动力比重远高于该经济发展水平下的世界平均水平，这很可能意味着中国的农业劳动力转移仍有较大潜力。

关键词：刘易斯转折点 劳动力转移 跨国平行数据

Using World Bank cross-country panel data to estimate the economic development level that corresponds to the Lewis turning point, we find that as GDP per capita increases, the share of rural labor in the total labor force tends to decrease first at an accelerated rate and then, after passing the Lewis turning point, at a reduced rate. Regression analysis of cross-country panel data shows that the Lewis turning point is reached when GDP per capita reaches somewhere between US$3,000 and US$4,000 dollars (PPP, constant international US dollars for the year 2000). GDP per capita in China has exceeded this level, but the proportion of rural labor in the total labor force remains much higher than the average for countries at the same level of economic development. This may imply that there is still considerable potential for rural labor transfer in China.

Keywords: Lewis turning point, labor force transfer, cross-country panel data

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I. Introduction

The Lewis turning point was first put forward by W. Arthur Lewis and then further developed by C.H. Fei, G. Ranis and others. They proposed that labor force transfer out of the traditional (agricultural) sector provides surplus labor for the modern (industrial) sector, so that the cost of labor for the latter remains unchanged until a point emerges at which surplus labor begins to disappear and the cost of labor rises rapidly. This is called the Lewis turning point. There are two criteria for testing the arrival of the Lewis turning point. The first is quantity, i.e. rural surplus labor, defined as labor with a marginal output of zero, decreases rapidly and approaches exhaustion. The second is price, i.e. real wages in the modern sector of the economy show a significant increase. Ryoshin Minami was the first to identify the emergence of the Lewis turning point in Japan around 1960, and Moo-ki Bai’s research indicates that the Lewis turning point emerged in the ROK around 1970. It is worth mentioning that both tended to use price rather than quantity in identifying the Lewis turning point. In addition, Li Yue’s study demonstrates that the Lewis turning point emerged in Taiwan about the second half of the 1960s. However, by and large, empirical research on the Lewis turning point is scarce.

The Lewis turning point is of great significance in guiding the economic development of developing countries (or countries with a dual economy). Before its emergence, it is not hard for these countries, and especially for their modern sector, to achieve fairly rapid economic growth, although the income gap between the skilled and the unskilled will widen. Economic development in China since the institution of reform seems to tally with the theoretical description of conditions before the arrival of the Lewis turning point. On the one hand, the economy has had sustained rapid growth in which rural labor transfer has made an important contribution. On the other hand, contrary to classical market theory but consistent with the assumptions and predictions of the Lewis model, rural labor transfer has also been

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2 Minami proposed to identify the turning point by investigating several criteria such as movement in wages in the traditional sector; the relationship between wages in the traditional sector and marginal labor productivity; wage gaps; and the elasticity of the labor supply in the modern sector. Ryoshin Minami, “The Turning Point in the Japanese Economy,” pp. 380-402; The Turning Point in Economic Development: Japan’s Experience.
accompanied by a widening gap in income between urban and rural residents. Now that the
Chinese economy has experienced a long period of rapid growth and a sizable proportion of
the rural labor force has transferred to the industrial sector of the economy, the question is
naturally asked: Is the Lewis turning point approaching in China?

Cai Fang and a few others first raised this question and answered it in the affirmative. In
terms of numbers, Cai estimates that there were about 50 million workers in the rural
surplus labor force (those below 40 years of age) in 2005 instead of more than 100 million as
generally believed, accounting for only one-tenth of the total labor force. In terms of price,
he uses official data as evidence of the accelerated rise in the average pay in industries where
migrant workers are concentrated. At the same time, the data from his survey of five Chinese
cities show that in the period from 2001 to 2005 the hourly rate of pay for workers from
outside areas increased 60 percent faster than it did for native workers.

Cai Fang’s research touched off a debate in academia. Among his supporters, Wu Yaowu
used data from a survey of the demand for labor conducted by the Ministry of Labor and
Social Security and found that compared with 2002, enterprises had significantly raised
the level of workers’ wages in 2003 and 2006, with an increase of about 30 percent in
2006 alone. Making use of data from the Ministry of Agriculture, Wang Dewen’s research
indicates that the daily rate of pay for long-term hired labor in agriculture has increased by a
big margin since 2005. On the opposing side, Han Jun et al. believe, on the strength of their
first-hand survey data, that there are still 100 to 120 million surplus laborers in China’s rural
areas. However, they also hold that structurally speaking, the supply of skilled and young
rural workers falls short of demand on all fronts. Song Shifang maintains that the recent
accelerated rise in wages in the non-agricultural sector has been triggered mainly by increases
in labor productivity and that wages in the agricultural sector have failed to keep step; hence
the Lewis turning point has not arrived yet.

This paper attempts to identify the Lewis turning point from a new perspective. Firstly,
we make use of the 1980-2004 data of more than 100 countries from the World Development
Indicators (WDI) database of the World Bank in order to identify the Lewis turning point

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7 Scholars who raised this issue at an early date also include Wang Cheng and Bao Xiaozhong. See Wang Cheng, “The Turning Point in Labor Demand and Supply and the Transformation of China’s Dual Economy”; Bao Xiaozhong, “The Lewis Model and the Shortage of Rural Migrant Workers.”


11 Han Jun, Cui Chuanyi and Fan Aiai, “A Micro-survey of Rural Surplus Labor.”

12 Song Shifang, “The Lewis Turning Point: Theory and Verification.”
from the perspective of cross-country comparative studies. Instead of the current methodology of studying individual countries, our research has been conducted using panel data from a large sample to ensure more robust economic statistical significance. Secondly, we introduce the quantitative criterion to examine the way in which the proportion of rural labor in the total labor force changes with economic development. By investigating this factor, we avoid the complex problem of measuring so-called surplus labor. Thirdly, we have redefined the Lewis turning point as the point at which, with the increase of national income, the gradual acceleration of the transfer of rural labor begins to slow down. Contrary to the generally held view about the instantaneous arrival of the turning point, we take rural labor transfer as a continuous and relatively smooth process, with the Lewis turning point being only the point at which the speed of transfer changes in a “quiet revolution.” Fourthly, we also introduce some natural endowment and government policy variables that may advance or retard the arrival of the Lewis turning point, enabling us to assess some other important factors that may influence changes in the turning point. 

Empirical analysis shows that both the unconditional turning point (i.e. with no control variable added) and the conditional turning point (i.e. with control variables added) are significantly present, emerging when per capita GDP reaches somewhere between US$3,000 and US$4,000 (PPP, constant international US dollars for the year 2000). China’s per capita GDP reached this level in 2002 at the latest. However, empirical analysis also shows that, compared with other countries with the same level of per capita GDP, the proportion of rural labor in the China’s total labor force is about 10 percentage points higher than the world average and the gap has widened over recent years. This in turn shows that rural labor transfer has not kept step with China’s rapid economic development and that the agricultural labor force still has untapped potential.

The remainder of this paper is organized as follows: the second part covers theoretical analysis. In this part we use a schematic model to discuss some conditions for the existence and movement of the Lewis turning point and on this basis put forward a workhorse model to demonstrate the main viewpoints of this paper. In the third part we provide an empirical

13 The method of empirical analysis employed in this article is a continuation of the famous research by Chenery and Syrquin. Using World Bank data on more than 100 countries for 1950-1970, they provided an empirical summing up of the universal rules of various structural transformations, including the structural transformation of the labor force, during the process of economic development. This article differs from their research in the following respects: (1) The Chenery-Syrquin model concludes that the proportion of rural labor in the total labor force decreases as per capita income rises, but fails to describe in detail the acceleration followed by deceleration which characterize this phenomenon. (2) They use only a simple OLS model while this paper uses the OLS model and the fixed effect model simultaneously, rendering the results more robust. (3) This paper uses the latest data for the years 1980-2004 while they used data for the years 1950-1970. See Hollis Chenery and Moises Syrquin, Patterns of Development, 1950-1970.

14 According to the data from the WDI database used by this paper, China’s per capita GDP at PPP exceeded US$3,000 in 1997 and reached US$5,400 in 2004. According to data released in 2008 that lowered China’s GDP at PPP, China’s per capita GDP exceeded US$3,000 in 2002.
analysis in which we introduce the data and model used in our empirical analysis and discuss the results in detail. We set down our conclusions in the last part.

II. Theoretical Analysis

We use a graphic model to demonstrate the concept of the Lewis turning point (Figure 1). This model is essentially consistent with the original expression by Lewis et al. In this figure, the vertical coordinate indicates value (represented by the monetary symbol ¥) and the horizontal coordinate indicates labor; its length is a fixed \( \bar{L} \), representing the total labor force and not taking into account increases in the population and the labor force. The values starting from the left endpoint indicate the size of labor force deployed in the agricultural sector while those starting from the right endpoint indicate the size of the labor force deployed in the industrial sector. The two oblique lines in the figure, MPL\(_a\) and MPL\(_m\), represent respectively the marginal output (or value of marginal product) of labor in the agricultural sector and the marginal output (or value of marginal product) of labor in the industrial sector, with the implicit assumption that the relative price of agricultural and industrial products remain unchanged. The point of intersection of MPL\(_a\) with the horizontal coordinate, \( \bar{L}_a \), represents the point where the marginal output of labor in the agricultural sector is zero.

Figure 1 The Lewis Turning Point

With economic development, the industrial sector rises (this is exogenous in the Lewis model) and MPL\(_m\) gradually moves to the left. Before MPL\(_m\) and MPL\(_a\) intersect, the labor the industrial sector absorbs from the agricultural sector is all surplus labor—labor with a marginal output of zero. If the agricultural sector is competitive, that is, if labor is paid according to its marginal output, the industrial sector will absorb the surplus labor with a zero
wage over a period of time. This process continues until the two oblique lines intersect, that is, the quantity of labor absorbed by the industrial sector is greater than $\bar{L} - \bar{L}_a$. Then wages in the industrial sector begin to rise and remain in line with wages in the agricultural sector, with labor being deployed around the point of intersection of these two lines. $\bar{L}_a$ is sometimes called the first Lewis turning point (indicated with the symbol LT$_1$).

1. Minimum wage

However, Lewis does not believe that wages in the industrial sector begin to rise at the first turning point, because wages in the agricultural sector are not paid in accordance with marginal output; in particular, in order to ensure the survival of agricultural workers, a minimum wage (also known as an institutional or subsistence wage, etc.) must be paid in the agricultural sector from the beginning. On a family farm, this wage is equal to the average output of labor. For the time being, we assume the minimum wage (indicated by $w$ and shown by the dotted line in Figure 1) is exogenous. By the same token, a minimum wage must also be paid in the industrial sector. Then, according to similar reasoning, the Lewis turning point will be the point of intersection of the horizontal line $\bar{w}$ and MPL$_a$, usually referred to as the second Lewis turning point (LT$_2$ in the figure).$^{15}$ Obviously, the second Lewis turning point arrives later than the first. That is to say, if the minimum wage exists and is significant, the actual turning point comes later than expected.$^{16}$

2. Relative price

The other problem that exists in the Lewis model is the relative price of industrial and agricultural products. Throughout the above analysis we have assumed that the relative price of the products of the industrial and agricultural sectors remains unchanged (and therefore marginal output is equal to the value of marginal product). But, in fact, industrialization is often accompanied by changes in relative price.

Let us consider what will follow if the relative price of the industrial sector decreases. At this time, two effects will occur. One is the direct effect. Obviously, changes in the relative price will give rise to relative changes in the oblique lines of the marginal value of the product of the industrial and agricultural sectors, MPL$_a$ and MPL$_m$ (at this time, they are not of equal value to the oblique lines representing marginal output, but we use the same symbols to represent them). That is, when the relative price of the industrial sector decreases, the oblique line of the value of the product of the industrial sector MPL$_m$ will move toward the left more slowly, postponing the arrival of the first and second Lewis turning points, even if the size of the labor force corresponding to the turning points does not change.

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15 The division into the first and second turning points was put forward by G. Ranis and C.H. Fei in the article mentioned above. They also call the two points the shortage point and commercialization point respectively.

16 However, there also exists an exceptional possibility that the two turning points may coincide; for example, when the maximum output of agricultural products is just able to meet the survival needs of the total labor force (i.e., the minimum wage is equal to per capita agricultural output). At this time, any transfer of labor exceeding $\bar{L}_a$ is impossible.
The other effect is an indirect one, i.e., the impact of changes in relative prices on the minimum wage. It should be noted that the direction of change in the minimum wage depends on choice of product serving as the criterion of valuation, or numéraire. If agricultural product is chosen, the minimum wage will come down and the minimum wage horizontal line will tilt to the lower left (not shown in the figure), making the second turning point \( LT_2 \) move forward (looking from right to left). At the same time, until the arrival of the turning point, the labor costs of the industrial sector drop rather than remaining unchanged. If industrial product is chosen as the numéraire, the minimum wage will rise, making the second turning point \( LT_2 \) move back (looking from right to left). At the same time, until the arrival of the turning point, the labor costs of the industrial sector will already have gone up to some extent, but not as fast as when the turning point is approaching.

### 3. Technological progress

The Lewis turning point assumes no technological progress in the agricultural sector during labor force transfer—no change in the marginal output of agricultural labor. But in fact, exchanges between the industrial and the agricultural sectors inject new production factors or technology into the agricultural sector, and at the same time the government may adopt policies to encourage technological progress in agriculture.

**Figure 2 Technological Progress in Agriculture**

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17 Here it needs to be assumed that consumers’ reservation utility depends on the quantity of the two kinds of products, that is, assuming that there is a certain degree of mutual substitution between industrial and agricultural products and that the minimum wage is defined as the level of income that allows for consumers’ reservation utility. Strictly speaking, we can construct the following consumer choice model for analysis. Consumers choose the consumption quantities of agricultural and industrial products \( c_a \) and \( c_m \) in order to maximize their utility function \( u(c_a, c_m) \) and meet their budgetary constraints: \( c_a + P_m * c_m = I \), in which \( P_m \) is the price of industrial product, agricultural product is taken as the numéraire and \( I \) is income. From this we derive consumers’ indirect utility function \( V(P_m, I) \), so that consumers’ minimum wage \( I \) can be obtained from the equation \( V(P_m, I) = V_0 \), in which \( V_0 \) is the exogenous reservation utility (which can equal the utility level determined by the average output of agricultural labor and zero industrial output before the start of industrialization).
The impact of technological progress on the marginal output of the agricultural sector hinges on the type of technological progress. We will consider three types (in the broad sense) of technological progress: labor-saving, labor-augmenting and labor-neutral (Figure 2).\(^\text{18}\) When technological progress in agriculture is labor-saving (Figure 2a), as in the widespread use of farm machinery, the marginal output of a small proportion of the labor force will go up, but with the increase in the labor force, marginal output will fall more rapidly, eventually leading to an increase in agricultural surplus labor. When technological progress is labor-augmenting (Figure 2b), as in the use of fertilizer and improved varieties, marginal output for a given quantity of labor will increase, ending with a reduction in agricultural surplus labor. When technological progress is labor-neutral (Figure 2c), the quantity of agricultural surplus labor will remain unchanged but the marginal output of labor will nevertheless increase. It is not difficult to see that labor-saving technological progress makes the first Lewis turning point move back, with the second turning point also moving back so long as the minimum wage is low enough; that labor-augmenting technological progress makes both the first and the second turning points move forward; and that with labor-neutral technological progress, the first turning point remains in its original place while the second moves forward. In addition, all three types of technological progress raise agricultural output at the two turning points.

4. Workhorse model

The above simple analysis has made it clear that the movement of the Lewis turning point (and even its existence) depends on many factors. We need to refine these factors, i.e., to set up more stringent but realistically rational hypotheses in order to construct a workhorse model capable of making clear predictions.

As indicated in the above analysis, changes in the relative price will affect the oblique lines representing the value of the marginal product of labor in the agricultural and industrial sectors. Further, we can conclude that the relative price of the agricultural sector will, as a whole, tend to decline, a conclusion based on the general fact that the income and price elasticity of demand for agricultural products is smaller than that for industrial products. In order to highlight this general fact, we may as well introduce the following assumption: there is an upper limit to the demand for agricultural products, and this limit is greater than or equal to the total agricultural output at the beginning of the industrialization process. At the same time, we can also assume that when agricultural output is less than this upper limit of demand, the relative price of agricultural and industrial products does not change; but after this, the relative price of agricultural products falls dramatically to zero. The above assumption changes the oblique line of value of marginal product in the agricultural sector MPL\(_a\) (Figure 1, dotted line). When the input of agricultural labor raises

\(^{18}\) If expressed by production function, the three types of technical progress, labor-saving, labor-augmenting and labor-neutral, are expressed as the increase in A in the following three production functions respectively: \(f(AL, z)\), \(f(L, Az)\) and \(f(AL, Az)\), in which \(z\) indicates other production inputs.
total agricultural output above the upper limit of demand, the extra output will have no value, transforming the oblique line of value of marginal product in the agricultural sector into a vertical line. At the same time, the two points where the oblique line becomes vertical are the first and the second Lewis turning points. In addition, we assume that technological progress is labor-neutral. The advantage of this assumption is that it avoids a too strong assumption that the first Lewis turning point automatically moves back with technological progress. However, taking note of the fact that this kind of technological progress (in fact, any of the types of technical progress mentioned above) increase the agricultural output of a labor force of a given size, we can still conclude that technological progress will shift the oblique line of the value of marginal product to the upper left, making the (first and second) Lewis turning points keep moving back.

Finally, generally speaking, industrialization may advance more quickly than agricultural technological progress (after all, agricultural technological progress may just be some sort of “spillover” effect of industrialization process). Therefore, in the short term, the oblique line of value of marginal product in the agricultural sector (i.e., the Lewis turning point) moves back at a speed slower than that at which the oblique line of value of marginal product in the industrial sector moves forward. When the latter “catches up” with the former, the Lewis turning point emerges: rural labor transfer will slow down or even stop and the wages of workers will rise rapidly. However, in the long term, as agricultural technological progress “follows the leader,” the Lewis turning point will move steadily back and rural surplus labor will be continuously produced, although this process may be relatively slow. If we take into simultaneous consideration the two processes above, we can see that the transfer of rural labor is a process that moves from gradual acceleration to gradual deceleration. The Lewis turning point is precisely the point dividing acceleration from deceleration.

We summarize this theoretical analysis into the following hypothesis for empirical testing:

**Hypothesis (the Lewis turning point):** As a country’s economy continues to grow, the proportion of rural labor in the total labor force will experience a process of initial accelerated decline followed by a reduced rate of decline. In other words, a Lewis turning point exists at a given level of economic development (per capita income) when the transfer of rural labor switches from acceleration to deceleration.

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19 This is consistent with the view of C.H. Fei and G. Ranis. They believe that the so-called turning point cannot be reached instantly. In less developed countries it may take decades to complete the process. C.H. Fei and G. Ranis, *Growth and Development from an Evolutionary Perspective*.

20 Interestingly, Chenery and Syrquin in their above-mentioned 1975 book (see Note 13) also suggested the hypothesis of the “S-shaped curve”: “Among less developed countries that have grown substantially over the past fifty years, it is often possible to identify a period in which the rate of change has accelerated following an earlier period of little structural change. Taken together, these observations suggest that an S-shaped curve, characterized by an upper and lower asymptote, will generally represent the major features of the structural transformation.” However, they did not test this hypothesis in their empirical analysis of labor force structure.
III. Empirical Analysis

In this section we use many years of cross-national panel data to test, through empirical analysis, whether the Lewis turning point exists. Specifically, our regression equation is:

$$agremp_{it} = \sum_{k=1}^{3} \beta_k \left[ \ln gdppc_{it} \right]^k + \sum_l \gamma_l X_{it} + \text{year}_i + \text{country}_i + \varepsilon_{it}$$

In this equation, agremp is the proportion of agricultural labor in the total labor force, an explained variable; of the explanatory variables, gdppc represents per capita GDP, ln means taking the logarithm, X represents other control variables, year and country represent the fixed effect of years and countries respectively, ε is a random error term, and the two subscripts i and t respectively represent country and year. The key element of the model is the introduction of the cubic polynomial of per capita GDP (logarithmic value) to describe the rules behind the possible appearance of initial accelerated decline followed by a reduced rate of decline in the proportion of rural labor as per capita GDP changes. If $\beta_1 > 0$, $\beta_2 < 0$, and $\beta_3 > 0$, then the rules will be valid. The transfer rate of rural labor (i.e. the percentage decline in rural labor for every one percent increase in per capita GDP) is:

$$\frac{\Delta \text{agremp}}{\Delta \ln \text{gdppc}} = \beta_1 + 2 \beta_2 \ln \text{gdppc} + 3 \beta_3 \ln \text{gdppc}^2,$$

and the Lewis turning point is the point at which the accelerated decline changes to a reduced rate of decline, that is, the point at which the second-order derivative of the cubic polynomial is zero, which meets the condition of $\ln \text{gdppc} = -\beta_2 / 3 \beta_1$. In addition, the two points at which the first-order derivative of the cubic polynomial is zero may be seen respectively as the beginning and end of rural labor transfer. We will discuss separately what happens when no control variable is introduced and when control variables of different kinds are introduced. It could be said that in the former case we are looking for the “unconditional turning point” while in the latter we are looking for the “conditional turning point.”

In the latter case, we take into consideration two types of control variables. One is observed control variables, including the natural endowments and government policies of various countries. “Natural endowments” refers to the natural conditions of agricultural production in different countries before the start of industrialization, variables that do not change with time. The control variables reflecting natural endowments used in this article consist mainly of the proportion of irrigated land in total cultivated land and per capita cultivated land. Government policies include fiscal policy (supply of public goods), market opening policy, etc., which

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21 In this article, the rate of labor transfer is defined by the growth rate of per capita GDP, not by time. When per capita GDP grows at a relatively stable rate, the definition using the growth rate of per capita GDP is consistent with that using time.

22 The two points can be expressed by the following equations: $\ln \text{gdppc} = -(\beta_2 / \beta_1) - (2 / \beta_1)(\beta_2^2 - 3 \beta_1 \beta_3)^{0.5}$ and $\ln \text{gdppc} = -(\beta_2 / \beta_1) + (2 / \beta_1)(\beta_2^2 - 3 \beta_1 \beta_3)^{0.5}$. In theory, before the starting point and after the end point, the proportion of the agricultural labor force is increasing, but this conclusion does not agree with reality. However, the empirical analysis below will show that the two points are both located at almost the two ends of the income range under discussion and therefore do not have any substantial impact on the empirical rules we have discovered.
may change over time. The policy control variables used in this article include per capita telephones, degree of openness, per capita expenditure and per capita spending on education. The other type of control variable comprises latent control variables, namely the dummy variables of time (year) and country. The dummy variable of time can reflect factors such as technological progress and global climate change that influence all countries and change over time, while the country-specific dummy variable can reflect different natural and social (including governmental) characteristics of various countries that do not change with time.

The data used in our empirical analysis are from the WDI database (released in 2006), spanning 25 years from 1980 to 2004 and covering 118 countries. The database provides data on more than 800 development indicators for over 200 countries, dating from as early as 1960 and covering demographic, economic, social, environmental and many other aspects. The database releases the data annually, but does not update all indicators every year or provide data for each indicator for every country.

The statistical features of the main variables are shown in Table 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Size of sample</th>
<th>Mean value</th>
<th>Median</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of rural labor in total labor force</td>
<td>Percentage</td>
<td>1,528</td>
<td>20.12</td>
<td>14</td>
<td>18.45</td>
<td>0</td>
<td>93</td>
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<tr>
<td>Ln per capita GDP</td>
<td>PPP, constant international US dollars for the year 2000</td>
<td>2,687</td>
<td>8.72</td>
<td>8.74</td>
<td>1.07</td>
<td>6.18</td>
<td>11.07</td>
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<tr>
<td>Share of irrigated land in total cultivated land</td>
<td>Percentage</td>
<td>2,223</td>
<td>19.71</td>
<td>11.7</td>
<td>25.43</td>
<td>0.1</td>
<td>100</td>
</tr>
<tr>
<td>Per capita cultivated land</td>
<td>Hectares per capita</td>
<td>2,488</td>
<td>0.272</td>
<td>0.18</td>
<td>0.36</td>
<td>0.00</td>
<td>3.22</td>
</tr>
<tr>
<td>Per capita telephones</td>
<td>Telephones/1,000 people</td>
<td>2,832</td>
<td>269.64</td>
<td>125.69</td>
<td>344.86</td>
<td>0.29</td>
<td>1,998.12</td>
</tr>
<tr>
<td>Economic openness (total imports and exports/GDP)</td>
<td>Percentage</td>
<td>2,588</td>
<td>82.48</td>
<td>71.01</td>
<td>47.17</td>
<td>6.32</td>
<td>376.22</td>
</tr>
<tr>
<td>Per capita expenditure (per capita GDP × share of expenditure in GDP)</td>
<td>PPP, constant international US dollars for the year 2000/person</td>
<td>2,565</td>
<td>1,792.89</td>
<td>961.36</td>
<td>1,885.89</td>
<td>38.94</td>
<td>11,794.89</td>
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<tr>
<td>Per capita education spending (per capita GDP × share of education spending in GDP)</td>
<td>PPP, constant international US dollars for the year 2000/person</td>
<td>2,359</td>
<td>471.76</td>
<td>267.76</td>
<td>504.85</td>
<td>7.50</td>
<td>2,485.42</td>
</tr>
</tbody>
</table>
1. The Lewis turning point

Regression results are shown in Table 2. In Column (1) are regression results for the unconditional turning point. Only the cubic polynomial of the logarithmic value of per capita GDP is introduced and no control variables are added. The estimated coefficient of all the power terms of per capita GDP, $\beta_i$, is consistent with theoretical expectations and highly significant. Specifically, $\beta_1 = 206.6$, $\beta_2 = -28.28$, $\beta_3 = 1.169$. The Lewis turning point of rural labor transfer occurs where \( \text{gdppc} = \exp\left[-\frac{\beta_2}{2\beta_3}\right] = \text{US$3,178}$ (with the logarithmic value being 8.06). The transfer rate of rural labor at this time obtained from the above formula is a 0.21 percentage point decrease for every one percent increase in per capita GDP. It can also be calculated that rural labor transfer starts at US$268 per capita GDP and ends at US$37,676 per capita GDP. The results are represented visually in Figure 3.

Columns (2) and (3) show the results when latent control variables are added. Column (2) shows the results when the dummy variable of year is added but not the dummy variable of country (that is, a pooled data model). We can see that per capita GDP at the turning point under this condition is US$3,301, which is not very different from the figure for the unconditional turning point. Column (3) shows the results when the dummy variables of year and country are both added (that is, a fixed effect model). We can see that per capita GDP at the Lewis turning point rises to US$4,301, differing considerably from the figure for the unconditional turning point (statistical testing also reveals a significant difference between the two).

Table 2 Lewis Turning Point (Regression Results)

<table>
<thead>
<tr>
<th>Explained variable: share of agricultural labor in total labor force (percentage)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A: explanatory variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1: economic development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln per capita GDP $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$</td>
<td>206.6***</td>
<td>233.7***</td>
<td>260.7***</td>
<td>243.9***</td>
<td>386.1***</td>
<td>429.3***</td>
</tr>
<tr>
<td>$\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$</td>
<td>(76.21)</td>
<td>(78.73)</td>
<td>(86.51)</td>
<td>(85.07)</td>
<td>(92.14)</td>
<td>(87.05)</td>
</tr>
<tr>
<td>ln per capita GDP $^2$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$</td>
<td>-28.28***</td>
<td>-31.55***</td>
<td>-32.58***</td>
<td>-33.13***</td>
<td>-47.65***</td>
<td>-53.42***</td>
</tr>
<tr>
<td>$\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$</td>
<td>(8.592)</td>
<td>(8.897)</td>
<td>(9.588)</td>
<td>(9.774)</td>
<td>(10.19)</td>
<td>(10.04)</td>
</tr>
<tr>
<td>ln per capita GDP $^3$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$</td>
<td>1.169***</td>
<td>1.298***</td>
<td>1.298***</td>
<td>1.385***</td>
<td>1.904***</td>
<td>2.154***</td>
</tr>
<tr>
<td>$\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$ $\quad$</td>
<td>(0.321)</td>
<td>(0.333)</td>
<td>(0.353)</td>
<td>(0.372)</td>
<td>(0.374)</td>
<td>(0.384)</td>
</tr>
</tbody>
</table>

23 In order to test whether the cubic polynomial of per capita GDP (logarithm) set up in this article is robust, we also tried introducing each of the first-order, quadratic and quartic polynomials and carrying out regressions with OLS regression and the fixed effect model. The results show that none of the coefficients of the quartic polynomial is significant so the quartic polynomial should not be used. All the coefficients of the first-order and quadratic polynomials are significant and consistent with the results of the cubic polynomial, but they reflect only a part of the rules described by the cubic polynomial, such as the overall downward trend and the deceleration trend in the latter part of the process.
### A2: Control Variables: Natural Endowments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of irrigated land in total cultivated land</td>
<td>-0.0549***</td>
<td>0.0448</td>
</tr>
<tr>
<td>Per capita cultivated land</td>
<td>-1.437***</td>
<td>0.0489</td>
</tr>
</tbody>
</table>

### A3: Control Variables: Government Policies

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per capita telephones</td>
<td>0.000598</td>
<td>0.0000760</td>
</tr>
<tr>
<td>Openness</td>
<td>-0.0617***</td>
<td>0.00128</td>
</tr>
<tr>
<td>Per capita expenditure</td>
<td>0.000067</td>
<td>0.000142</td>
</tr>
</tbody>
</table>

### A4: Fixed Effect

<table>
<thead>
<tr>
<th>Effect</th>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Group B: Turning Point

<table>
<thead>
<tr>
<th>Turning Point</th>
<th>3,177.571</th>
<th>3,301.752</th>
<th>4,301.495</th>
<th>2,903.075</th>
<th>4,196.839</th>
<th>3,892.436</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewis turning point</td>
<td>267.9933</td>
<td>307.7745</td>
<td>749.5601</td>
<td>318.9992</td>
<td>1,021.812</td>
<td>978.9398</td>
</tr>
<tr>
<td>Endpoint of transfer</td>
<td>37,676.15</td>
<td>35,420.63</td>
<td>24,684.96</td>
<td>26,419.65</td>
<td>17,237.48</td>
<td>15,477.01</td>
</tr>
</tbody>
</table>

### Group C: Statistical Characteristics

| Value of F                     | 813.31     | 96.15    | 16,877.58 | 89.06    | 232,276.46 | 292,492.58 |
| Size of sample                 | 1,475      | 1,475    | 1,475     | 1,475    | 1,288      | 1,149      |

Note: Figures in the brackets are the standard errors of the estimated value of regression coefficients after correction by serial correlation (first order lag) and heteroscedasticity; *** significant at the one percent level, ** significant at the five percent level, * significant at the ten percent level.

Column (4) indicates the result of adding the observed control variables; as technological progress is not among these variables, the dummy variable of year is still added, but not the dummy variable of country. The coefficients of the cubic polynomial of the logarithmic value of per capita GDP do not change much and the Lewis turning point emerges when per capita GDP reaches US$2,903. As far as the control variables are concerned, in the category of natural endowments, the level of irrigation (the proportion of irrigated land in total cultivated land) significantly reduces the proportion of rural labor in the total labor force,
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showing that this natural condition is labor-saving. The higher the amount of cultivated land per capita, the lower the proportion of rural labor. This may be because in places where there is more cultivated land per capita, long-standing agricultural production techniques help conserve labor, through, for example, more extensive use of animal power and the practice of letting the land lie fallow in rotation. In the category of government policies, greater openness reduces the proportion of agricultural labor in the total. In theory, greater openness may raise the proportion of rural labor in countries with a comparative advantage in agriculture, but it may also accelerate the transfer of rural labor through the introduction of technologies and capital conducive to industrialization. The results of empirical studies seem to suggest that the latter is more important. Increases in per capita spending on education help reduce the agricultural labor force, probably because a higher level of education improves rural labor’s access to modern skills and thus enables them to leave traditional industry.

In Column (5), country-specific fixed effects are substituted for natural endowments in the observed control variables for the purpose of controlling country-specific differences as much as possible. However, this may also bring about the problem of excessive control, as a large component of country-specific differences is differences in per capita income and related factors. The coefficients and significance of the main variables are not affected, and per capita GDP at the Lewis turning point rises significantly to US$4,197. Among the control variables of government policy, the coefficient of openness remains negative and significant, the coefficient of per capita spending on education remains negative but becomes insignificant, and the coefficient of per capita expenditure becomes significantly negative. In Column (6), with the variables of fixed effects and natural endowments both taken into consideration, the results of the main variables remain unchanged and per capita GDP at the Lewis turning point is US$3,892. However, in contrast with the pooled data model (Column 4 of Table 2), the coefficient of irrigation goes from significantly negative to insignificant and positive. The coefficient of per capita cultivated land (absolute value) becomes larger.24

24 We have also tried introducing or altering the regression of other control variables. In particular, we tried introducing an industry structure variable. Industry structure reflects the scale and speed of the development of non-agricultural industries and constitutes the impetus for demand for agricultural labor transfer. Regression results show that the introduction of an industry structure variable in the mixed data model (Column 4 of Table 2) and the fixed effect model (Column 6 of Table 2) produces little effect on other variables. The Lewis turning point emerges when per capita GDP reaches US$4,387 and $4,075 respectively. Coefficients of the two variables of the share of secondary and tertiary industry in GDP are both significantly negative, proving the existence of the demand impetus. However, with the industry structure variable the impetus may be endogenous. In addition, we also tried replacing the two variables of per capita expenditure and per capita education spending with the two variables of share of expenditure in GDP and share of education spending in the GNI respectively. The results remain basically unchanged. In the mixed data model and the fixed effect model, the Lewis turning point emerges when per capita GDP reaches US$2,605 and $4,973 respectively.
Summing up the above regression results, we can see a trend for the proportion of rural labor in the total labor force to go through a process of accelerated and then decelerated decline as the level of economic development rises (measured by the logarithmic value of per capita GDP). The dividing point between acceleration and deceleration—that is, the Lewis turning point—is somewhere between US$3,000 and US$4,000 per capita GDP. This result is robust for different regression models.²⁵

2. Forecasting for China

In addition to exploring the general rules of rural labor transfer worldwide, we also tried to pinpoint China’s position in the whole picture. China’s per capita GDP exceeded US$3,000 in 1997 and reached US$5,400 in 2004, entering the estimated range of the Lewis turning point. But does this mean that China has reached the Lewis turning point and surplus rural labor has started to dry up? To answer this question, we must compare the share of rural labor in China’s total labor force with the world average at similar levels of per capita GDP.

²⁵ According to this regression result, the ROK crossed the turning point in the period between 1971 (US$3,030) and 1976 (US$4,076), which basically tallies with the above-mentioned research by Moo-ki Bai (around 1970). Japan crossed the turning point in 1961 at the latest (US$5,621; data for earlier years not available), which does not conflict with Ryoshin Minami’s research findings (around 1960) mentioned above.
Table 3 Difference between Share of Rural Labor in China’s Total Labor Force and World Average

<table>
<thead>
<tr>
<th>Year</th>
<th>Per capita GDP (PPP, constant international US$ for the year 2000)</th>
<th>Actual value (%)</th>
<th>Predicted value (%)</th>
<th>D-value (%)</th>
<th>Confidence interval of 95% of predicted value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>762.6</td>
<td>68.7</td>
<td>66.1</td>
<td>2.6</td>
<td>62.3—70.0</td>
</tr>
<tr>
<td>1987</td>
<td>1,395.2</td>
<td>60.0</td>
<td>57.2</td>
<td>2.8</td>
<td>53.3—59.1</td>
</tr>
<tr>
<td>1988</td>
<td>1,527.6</td>
<td>59.4</td>
<td>55.6</td>
<td>3.8</td>
<td>51.6—57.4</td>
</tr>
<tr>
<td>1989</td>
<td>1,564.2</td>
<td>60.0</td>
<td>56.2</td>
<td>3.8</td>
<td>51.1—56.9</td>
</tr>
<tr>
<td>1990</td>
<td>1,596.3</td>
<td>53.4</td>
<td>54.5</td>
<td>-1.1</td>
<td>50.8—56.5</td>
</tr>
<tr>
<td>1991</td>
<td>1,720.8</td>
<td>53.9</td>
<td>51.1</td>
<td>2.8</td>
<td>49.2—55.0</td>
</tr>
<tr>
<td>1992</td>
<td>1,944.4</td>
<td>53.1</td>
<td>48.9</td>
<td>4.2</td>
<td>46.8—52.5</td>
</tr>
<tr>
<td>1993</td>
<td>2,199.0</td>
<td>50.8</td>
<td>45.6</td>
<td>5.21</td>
<td>42.2—49.9</td>
</tr>
<tr>
<td>1994</td>
<td>2,456.5</td>
<td>49.5</td>
<td>43.6</td>
<td>5.9</td>
<td>41.9—47.5</td>
</tr>
<tr>
<td>1995</td>
<td>2,734.1</td>
<td>48.5</td>
<td>40.5</td>
<td>8.0</td>
<td>29.6—45.2</td>
</tr>
<tr>
<td>1996</td>
<td>2,971.2</td>
<td>47.7</td>
<td>38.8</td>
<td>8.9</td>
<td>37.8—43.4</td>
</tr>
<tr>
<td>1997</td>
<td>3,204.8</td>
<td>47.4</td>
<td>37.1</td>
<td>10.3</td>
<td>36.1—41.7</td>
</tr>
<tr>
<td>1998</td>
<td>3,438.3</td>
<td>47.0</td>
<td>35.8</td>
<td>11.2</td>
<td>34.6—40.2</td>
</tr>
<tr>
<td>1999</td>
<td>3,653.8</td>
<td>46.9</td>
<td>33.9</td>
<td>13.0</td>
<td>33.3—38.9</td>
</tr>
<tr>
<td>2000</td>
<td>3,928.3</td>
<td>46.3</td>
<td>34.0</td>
<td>12.3</td>
<td>31.7—37.3</td>
</tr>
<tr>
<td>2001</td>
<td>4,233.2</td>
<td>45.2</td>
<td>31.9</td>
<td>13.3</td>
<td>30.1—35.7</td>
</tr>
<tr>
<td>2002</td>
<td>4,568.1</td>
<td>44.1</td>
<td>30.0</td>
<td>14.1</td>
<td>28.5—34.0</td>
</tr>
</tbody>
</table>

First, we calculate, according to the worldwide rule, the share of rural labor in the total labor force that China should have reached in successive years given its per capita GDP (i.e. the predicted values of the regression equations). We select regression results (2) in Table 2 (similar conclusions would be reached if other regression results were used). Comparing these predicted values with the actual values, we get the D-values for the share of rural labor in China’s total labor force and the world average (Table 3; see also Figure 3, in which China’s position is marked with the plus sign +). Since the institution of reform, the share of rural labor in China has fallen considerably, from nearly 70 percent to 40 percent; but in most years, the share of rural labor in China has been higher than the average level of other countries with similar incomes and the D-value has tended to grow larger, reaching more than 10 percentage points and going far beyond the confidence interval of 95 percent of predicted average value.

Now let us consider the size of China’s fixed effect in the fixed effect regression model, which is equivalent to the vertical distance from China’s position to the world average regression line. Using the regression results in (3) of Table 2 above, that is, using the fixed

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26 We can obtain data on rural labor in China for 1980 and 1987-2002 from the WDI database.
effect model without introducing observed control variables, we get the fixed effects for thirteen major countries (Table 4). We can see from the table that China’s fixed effect is 19.3, 19 percentage points higher than the world average (with other conditions unchanged). In particular, for what are called the “BRIC” countries, China’s figure for the share of rural labor in the total labor force is lower only than that of India, an underdeveloped country; it is much higher than those of Japan and the ROK, which have passed the turning point, and is higher again compared to the developed countries. Obviously, the conclusion that China has a higher share of rural labor than the world average is robust.  

Table 4 Difference between the Share of Rural Labor in Some Countries and the World Average

<table>
<thead>
<tr>
<th>Country</th>
<th>Difference from world average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vietnam</td>
<td>32.25</td>
</tr>
<tr>
<td>India</td>
<td>31.74</td>
</tr>
<tr>
<td>China</td>
<td>19.29</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.83</td>
</tr>
<tr>
<td>ROK</td>
<td>0.20</td>
</tr>
<tr>
<td>Russia</td>
<td>-6.06</td>
</tr>
<tr>
<td>Japan</td>
<td>-6.19</td>
</tr>
<tr>
<td>France</td>
<td>-7.55</td>
</tr>
<tr>
<td>Germany</td>
<td>-8.56</td>
</tr>
<tr>
<td>Canada</td>
<td>-8.85</td>
</tr>
<tr>
<td>USA</td>
<td>-10.41</td>
</tr>
<tr>
<td>Britain</td>
<td>-11.14</td>
</tr>
<tr>
<td>Singapore</td>
<td>-14.22</td>
</tr>
</tbody>
</table>

So far, we have arrived at two seemingly contradictory forecasts for China. Judged by China’s per capita income, the Lewis turning point has arrived. However, as China has a higher proportion of rural labor compared to the average level of other countries with similar incomes, it seems there is still quite a lot of surplus labor. There are two possibilities here. One is that China has indeed arrived at the Lewis turning point, but has less potentially transferable rural labor than other countries; that is, China has reached this point with a higher proportion of rural labor. In our regression analysis, the significance of the control variables of natural endowments point to this possibility—due to disparities in natural and other conditions, different countries can accommodate different amounts of rural labor. The other possibility is that China’s potential transfer of surplus labor is consistent with the world average and its share of rural labor should eventually shrink to the average level of other countries with similar incomes. The present excessively high share is the result of policy and institutional constraints. Seen in the light of this analysis, the Lewis turning point is yet to come in China. In our regression analysis, the control variables of government policies are significant at least in part, which suggests that this possibility may also exist.

27 If we use the regression result in (5) of Table 2, that is, use the fixed effect model with policy control variables added, we will get a result not essentially different—China’s fixed impact would be 16.5.
Of the two views, we prefer the second; that is, given the fact that China has a much higher proportion of rural labor than other countries with similar incomes, we cannot say that the Lewis turning point has arrived in China even though the country’s per capita income has reached the level at which the Lewis turning point occurs. There are several reasons for this: first, it is not difficult to see from Figure 3 that the share of rural labor in China has increasingly deviated from the world average ever since reform and opening up, moving from initial closeness to the average level to a growing gap. This inclines us to support the second view. Second, under specifically Chinese conditions, the economy has developed rapidly since the initiation of reform and opening up, but the labor market barriers between urban and rural areas have not been removed. This reminds us that while economic development constitutes the ultimate force behind the transfer of rural labor, government policy is likewise important. Given data constraints, it is difficult for this article to measure the impact on labor transfer of some important policy and institutional factors, such as the land system, health care and income security, the tax system, and employment policy. These factors may explain why the share of agricultural labor is so high in China.

IV. Conclusion

The Lewis turning point (or Lewis model) provides a simple but powerful theoretical prediction for the impact of economic development on the transfer of rural labor. In theory, the Lewis turning point will inevitably be affected by various factors, including technological progress, in addition to economic development. Moreover, some of its theoretical assumptions merit further attention: for example, the setting of the minimum wage and the neglect of relative prices. All these remind us of the need to bear policy factors in mind when we use this concept to study real-world issues.

In spite of this, the empirical analysis we provide in this paper on the basis of a long series of cross-national data demonstrates that changes in the share of agricultural labor show an initial period of accelerated decline followed by deceleration. The dividing point between the two can be regarded as the Lewis turning point. This emerges when per capita GDP reaches somewhere between US$3,000 and US$4,000. China’s per capita income has reached this level, but it has a higher proportion of rural labor than countries with the same per capita income. This suggests that China can still use policy levers to release further rural labor, thus postponing the arrival of the Lewis turning point.

Notes on Contributors

Wang Jin, Ph.D. in Economics, is currently working at Guotai Jun’an Securities.

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