China Has Reached the Lewis Turning Point

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ABSTRACT

In the past several years, labor shortages in China have become an issue. However, there is heated debate as to whether China has passed the Lewis turning point and moved from a period of unlimited supply to a new era of labor shortage. Most empirical studies on this topic focus on estimation of total labor supply and demand. Yet the poor quality of China's labor statistics leaves the debate open. In this paper, China's position along the Lewis continuum is examined though primary surveys of wage rates, which offer a more reliable statistic than employment data. Our results show a clear rising trend in real wage rates since 2003. The acceleration of real wages even in slack seasons indicates that the era of surplus labor is over. This finding has important policy implications for China's future development.

Keywords: dual economy, surplus labor, Lewis model, labor market

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1. INTRODUCTION

As a society moves from an agricultural to an industrial economy, the balance of labor demand and supply shifts as well. In the initial stage of development, most people remain in rural areas, engaged in agricultural production. When this concentration of workers leads to underemployment in rural areas, the industrial sector can expand and increase its labor force with no pressure to raise wages. Thus there may follow a period of industrial growth with no rise in real wages. However, as the industrial sector develops to the point where the supply of labor from the agricultural sector becomes limited, industrial wages begin to rise quickly. Based on the historical experience of developed countries, Lewis (1954) first conceptualized this process of economic transformation. In the literature, the structural change from an excess supply of labor to one of labor shortage is often called the *Lewis turning point*.[1]

Although this term is referred to extensively, in reality it is very difficult to pinpoint the exact moment of change. The current debate on whether China has arrived at the Lewis turning point highlights this difficulty. Since the 1978 economic reform, China—in just three decades—has experienced a rapid and pronounced economic transformation from a planned to a market economy and from one based on agriculture to one emphasizing industry. The success of the rural reform in the late 1970s and early 1980s greatly improved agricultural productivity and released a tremendous amount of surplus labor from the land (Du 2006). As a result, a large number of laborers moved from the agricultural to the industrial and service sectors. For more than two decades since the economic reform, the supply of labor seemed to be unlimited, enabling China's manufacturing sector to maintain a comparative advantage in labor-intensive products. Fueled by cheap labor, many of China's manufactured goods became so competitive in the international market that China earned the name "the world's factory."

However, since 2005, the "labor shortage" phenomenon has begun to turn up in coastal cities, sparking intensive media reports in 2006 and 2007.[2] The subsequent global financial and food crises in 2008 and 2009 reduced demand for Chinese products, resulting in the bankruptcies of some export-oriented enterprises. These external shocks seemed to mute the acuteness of the labor shortage, at least temporarily. Recently, however, as China emerged largely unscathed from the crises, the demand for labor has once again intensified, leading to renewed expressions of concern.[3]

As the world's largest exporter of manufactured goods, China to a great extent determines world prices. However, if Chinese labor shortages continue and grow, labor costs in the manufacturing sector will rise, as will, eventually, the prices of China's products. Such higher prices would have an impact not only on global markets and trade but also on the welfare of a vast number of consumers worldwide.

Domestically, structural changes due to labor shortages would affect the well-being of the agricultural, industrial, and service sectors. As labor became more costly, agricultural production would probably come to depend more heavily on machinery as opposed to human labor. Similarly, the currently competitive, labor-intensive manufacturing sector would have to upgrade into a more capital-dependent and skill-intensive mode of production. These structural changes would then place a higher premium on the education of skilled laborers.

The new paradigm of labor shortage, if confirmed, will have important implications for income distribution. The labor shortage will give workers more bargaining power, resulting in a more rapid rise in wages. Higher wages will likely narrow the enormous rural–urban income gap of the past. Part of this rising income will eventually translate into higher domestic consumption, thus helping to reduce the global imbalance.

In summary, it is both urgent and crucial to determine—on the basis of solid empirical evidence—whether the Chinese economy has reached the Lewis turning point. At present there is heated debate

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[1] This idea was further formalized by Ranis and Fei (1961). See Fields (2004) for a recent review of the Lewis turning point.
[2] For example, "China Sees Beginning of a Labor Shortage," *New York Times*, April 4, 2005. http://www.nytimes.com/2005/04/03/business/worldbusiness/03iht-yuan.html.
[3] For example, "Defying Global Slump, China Has Labor Shortage," *New York Times*, February 26, 2010. http://www.nytimes.com/2010/02/27/business/global/27yuan.html.

regarding this issue. Most empirical studies focus on the estimation of total labor supply and demand; but the poor quality of China's labor statistics leaves the debate open. In the present paper, China's position along the Lewis continuum is examined through primary surveys of wage rates, which provide more reliable statistics than employment data. Our results show a clear rising trend in real wages since 2003. And the acceleration of this rising trend, even in slack seasons, indicates that the era of surplus labor is over. This finding has important policy implications both for the general global economy as well as for China's future development.

This paper is organized as follows. Section 2 provides a conceptual framework for testing the Lewis turning point and a review of the related literature. Section 3 describes the wage patterns in six provinces based on two primary surveys. Section 4 presents a multivariate regression analysis to further test the Lewis turning point by controlling for local factors. The paper concludes in Section 5.

2. CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Following Basu (2000), Figure 1 illustrates the basic idea of the Lewis hypothesis in the transition from unlimited to limited labor supply during the process of economic growth. For simplicity, assume that a closed economy has an agricultural and an industrial sector. In rural areas, there is an oversupply of labor for agricultural production. Therefore the marginal product of labor is equal to the subsistence wage, m. In the industrial sector, however, employers have to pay a higher wage, w, for several reasons. First, the cost of living in cities, where most industrial activity occurs, is usually higher than in rural areas. Second, because migrant workers in the industrial sector must bear the psychological cost of separation from their families, higher wages must be offered to compensate them (Lewis 1954).[4]

Figure 1. Conceptual model of the Lewis turning point

Source: Adapted from Basu (2000).

L is the total size of the labor force (aside from population growth), with O_R representing origin in the rural sector and O_M origin in the urban sector. The curve CD represents the marginal product of labor in the agricultural sector, being flat over a wide range. The marginal product of labor in the industrial sector is represented by AB, which is higher than that in the agricultural sector and exhibits a downward slope.

The process of economic development can be divided into three stages. The first stage is between points B_1 and B_2, with the initial marginal output of labor in the urban sector being represented as A_1B_1. With corporate profit maximization as the goal, the marginal output of labor will be set equal to the wage level (w), which would be represented at equilibrium in B_1. Corresponding to this, total urban employment is shown as O_ML_1, whereas the rural labor force is represented by O_RL_1 at the subsistence wage level (m). As entrepreneurs earn a profit and reinvest some of it in production, the total stock of capital increases. More capital stock means a higher marginal product of labor. This is reflected by the rightward shift of the marginal product of labor in the urban sector from A_1B_1 up to A_2B_2. The transfer from rural to urban areas is composed only of surplus rural labor, which has no impact on wage levels. The rural workers are paid at the fixed subsistence wage level (m), and the urban wage remains constant at w. This phase is one in which there is an unlimited supply of rural labor.

At point B_2, the marginal product of rural labor starts to exceed the subsistence wage level (m); from then on, therefore, the rural wage rises. The urban wage will remain at w until the marginal product of urban labor shifts to B_3. The range between B_2 and B_3 is the second stage. In this phase, only the rural

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[4] There are other explanations for the wage gap between the two sectors. For example, Harris and Todaro (1970) argue that the higher urban wage is largely due to higher unemployment rates in urban areas, as a worker must be physically present in the city to look for a job there.

wage rises while urban wage remains constant. After B_3, economic development enters the third phase: labor shortages become a national problem, with wage levels going up in tandem in both sectors. If one focuses only on the rural sector, the Lewis turning point is at B_2. For the economy as a whole, the turning point occurs later, at B_3. According to this model, the real wage rate rises first in rural areas and second urban areas. Therefore a sudden upward shift in the rural wage is likely to predict a national labor shortage down the road.

This conceptual model offers some insights into the measurement and testing of the Lewis turning point. First, it is necessary to look at a long time horizon to gauge the Lewis turning point. Suppose, in examining only the first stage of development (B_1B_2) as shown in Figure 1, one were unable to identify the turning point. By examining the economic development process of Taiwan and South Korea over a long period ranging from the colonial era to the phase of export-oriented development, Fei and Ranis (1975) showed that these economies achieved a gradual shift in labor from rural to urban areas, with wage patterns consistent with the predictions of the Lewis model. The rapid economic transformation of China over the past three decades provides another ideal setting to test the Lewis turning point.

Second, wages are a good barometer for testing the Lewis turning point. An emerging body of literature is debating whether or not China has reached the Lewis turning point—a debate centering largely on the accurate estimation of the amount of surplus labor remaining in the rural areas. Cai and Wang (2008) were among the first to show that China has begun to face labor shortages. They first estimated the remaining labor force based on the labor needs of various production activities in rural areas. They then subtracted migrants and the required agricultural workers from the total rural labor force to obtain the available surplus labor, which they estimated at about 107 million. However, owing to lack of systematic statistics on migrant workers, this estimate depends upon several underlying assumptions. It follows that differences in underlying assumptions may translate into large discrepancies in the supposed amount of surplus labor.

Several studies hold opposing views. Green (2008) argues that the tightening labor force in the cohort of 20–30 years old is temporary and will reach 190 million in 2010 and 215 million in 2015. He estimates that China's surplus labor force in rural areas in 2006 was on the order of 0.5 to 0.85 billion. Based on income data in rural and urban areas, Knight (2007) also challenges the view of the arrival of the Lewis turning point. He argues that from 1989 to 2005, average annual per capita real income in rural areas grew by only 5.8 percent, compared with the 8 percent growth rate of the annual urban real wage. He attributes the recent substantial increase in per capita income in rural areas not to a structural labor shortage but to favorable government policies, such as infrastructure investment and the abolition of agricultural taxes.

A report by the World Bank (2008) also dismisses the idea that China has reached the Lewis turning point, mainly in the following three respects. First, the wage escalation in the coastal region reflects an adjustment from a previously very low wage level. Second, the widespread use of mechanization and other labor-saving technologies released labor from agricultural production and enlarged the surplus labor force. Finally, the official reports of double-digit wage increases are based mainly on surveys of workers in state-owned and large private enterprises. The real wage increase among unskilled laborers may have been much lower. Considering that a large proportion of migrant laborers work in small and medium-sized enterprises (SMEs), the use of official data constitutes a significant flaw in determining the reality.

In sum, researchers have not yet reached a consensus as to whether the excess of rural labor has been exhausted. Estimates of surplus labor used to explain the labor shortage vary widely—in some cases, by a several-fold difference (Guo 2008). Systematic wage statistics for SMEs and other informal types of employment are lacking. To correct these shortcomings, we examined the evolving patterns of rural wages based on two primary data sets: surveys in 88 villages in three state-designated poor counties in Gansu Province, one of China's poorest provinces, and in over 100 nationally representative villages in five provinces. The survey covers detailed information on wage rates for the period of 1993–2007. To our knowledge, this is one of the first quantitative empirical studies based on long-term rural wage data to analyze the Lewis turning point. As shown in the conceptual model, it is possible to test the Lewis turning point using rural wages only.

3. DESCRIPTION OF DATA

This paper is based on two data sets. The first is a primary survey in China's Gansu Province conducted jointly by the Chinese Academy of Agricultural Sciences, Gansu Agricultural University, and the International Food Policy Research Institute (IFPRI). Three nationally designated poor counties—Huining, Weiyuan, and Tianzhu Tibetan Autonomous Counties (hereinafter referred to as Tianzhu)—were selected based upon ecological conditions. In each county, three townships were randomly chosen and all the villages in the selected township surveyed. In total, the sample size was 88, including 31 villages from Huining County, 22 villages in Tianzhu County, and 35 villages in Weiyuan County. Interviews were first conducted in 2004 then later in 2007. The questionnaires collected detailed information about village affairs, including wages in harvest and slack seasons. The survey team gathered the information by interviewing village leaders and accountants.

      All of the three counties are nationally designated poor counties. Huining is east of Lanzhou, the capital city of Gansu, and right next to Ningxia Province. It suffers serious water shortages, which greatly inhibit agricultural production; however, the quality of education is among the best in the province. Weiyuan County sits to the south of Lanzhou. As the origin of the ancient Weihe River, the county is renowned for its agricultural production, with wheat, potatoes, and maize as major crops. In addition, it is also known as the "Millennium Medicine Township," with high concentrations of *Angelica*, *Codonopsis*, and other Chinese herbs. Tianzhu County is located in the northwest of Lanzhou, bordering Qianghai Province, with livestock production as the major source of income. It is sparsely populated, with a large share of minority ethnic groups.

      The second data source is a village survey conducted by the Center for Chinese Agricultural Policy (CCAP) of the Chinese Academy of Sciences in Jiangsu, Hebei, Shaanxi, Jilin, and Sichuan provinces in 2005 and 2008. In 2005, a total of 101 villages were surveyed in these five provinces. In each province, 20 villages were randomly surveyed with the exception of Jilin, where 21 villages were selected. Like the Gansu survey, the 2005 survey also contains information on wages in previous years. In 2007, more interviewing was undertaken with the sample being expanded to 170 villages, with an average of 35 villages in each province. One key feature of the CCAP village survey is that the daily wages of both men and women were reported.

The Patterns of Outmigration in Gansu

Table 1 reports the summary statistics on the percentage of laborers working outside the county from 1993 to 2006. In 1993, for the three counties as a whole, 16.8 percent of the labor force worked outside the county. By 2006, the ratio had reached 40.5 percent. In the first two five-year periods (1993–1998 and 1998–2003), annual growth rates averaged at only 2.1 percent and 2.4 percent, respectively. From 2003 to 2006, the average annual growth rate sped up substantially to 9.6 percent, more than four times that of the previous decade. The median share of migrant workers reveals the same patterns: in the period 2003–2006, the rate of outmigration far exceeded that seen in the previous two intervals.

      The bottom panel of Table 1 presents the coefficient of variation (CV). A large CV means that in some villages most people work outside their own county, while in other villages the amount of migration is minimal. Over time, CV has declined consistently, dropping from 72.3 in 1993 to 36.6 in 2006. The average rate of decline in the CV (6.0 percent) was much higher in the period of 2003–2006 than in the previous two periods (respectively 1.2 percent and 1.7 percent). The results suggest that the rate of migration has jumped in villages that previously had fewer migratory workers, especially in the period of 2003–2006.

      Weiyuan County had the lowest rate of migrant workers throughout the studies. Both the mean and median wage rates reflect this situation. Whereas, in 2006, Huining and Tianzhu counties enjoyed a migratory labor rate of 40 percent or more, 3 percent higher than Weiyuan's. Residing in one of the largest production clusters for potatoes and herbal medicine, most farmers in Weiyuan can survive by engaging primarily in agricultural production. With enough to eat, the pressure of outmigration is reduced. In

contrast, with a less favorable set of natural resources for agricultural production, people in Huining and Tianzhu must seek jobs in the nonagricultural sector more actively, either locally or far away from home.

Table 1. Summary statistics of laborers working outside their counties

		Share of labor working outside the county (%)				Annual growth rate (%)			
		1993	1998	2003	2006	1993-1998	1998-2003	1993-2003	2003-2006
Mean	Huining	22.1	25.2	29.1	42.4	1.2	1.3	1.2	7.8
	Tianzhu	16.0	21.7	28.6	44.8	2.7	2.4	2.5	11.1
	Weiyuan	12.9	18.1	27.0	36.8	3.0	3.6	3.3	10.8
	Total	16.8	21.5	28.1	40.5	2.1	2.4	2.3	9.6
Median	Huining	17.6	19.2	24.4	42.9	0.8	2.1	1.4	12.3
	Tianzhu	16.5	23.5	31.1	46.6	3.1	2.5	2.8	10.4
	Weiyuan	10.8	18.0	27.0	35.9	4.6	3.6	4.1	10.5
	Total	13.6	19.2	28.1	39.7	3.0	3.4	3.2	11.1
CV	Huining	71.9	61.1	59.6	28.7	-1.4	-0.2	-0.8	-10.4
	Tianzhu	59.2	48.4	43.7	45.1	-1.7	-0.9	-1.3	-1
	Weiyuan	61.5	46.9	41.5	33.0	-2.3	-1.1	-1.7	-5
	Total	72.3	56.1	49.0	36.6	-2.2	-1.2	-1.7	-6

Source: Calculated by the authors.
Note: CV = coefficient of variation.

Wages in Gansu

The summary statistics presented above indicate a continuous decrease in the remaining work force, especially in recent years. However, these numbers alone do not suffice to gauge rural labor scarcity. As shown in the conceptual model in Section 2, a shortage of rural labor should be reflected by an increase in real wages. A national labor shortage is likely, eventually, to trickle down to remote poor areas. Therefore examining the evolving patterns of real wages in remote, less developed regions should help to reveal whether China has reached the Lewis turning point nationwide.

In Gansu, agricultural production is highly seasonal. During harvest time, the local demand for labor is much higher than it is during slack periods. A short-term labor shortage in harvest season does not necessarily means a chronic shortage of labor at other times. Therefore it is necessary to distinguish seasonal from permanent labor shortages. A Lewis turning point means that there is a labor shortage even in slack seasons.

Table 2 presents the summary statistics for local real daily wages during the harvest season in the period 1993–2006. From 1993 to 2003, wages barely changed from 17.0 to 17.2 yuan per day. By 2006, they had jumped to 26.8 yuan, an annual growth rate of 6.6 percent over a three-year period. The reported median wages even declined between 1993 and 2003, before an abrupt escalation.

Table 2. Wage rate during harvest season

	1993	1998	2003	2006	1993–1998	1998–2003	1993–2003	2003–2006
	Average wage (yuan/day)				Annual growth rate (%)			
Huining	17.9	14.7	18.0	26.5	-1.7	1.8	0	5.7
Tianzhu	20.1	15.9	18.7	27.5	-2.1	1.4	-0.3	5.8
Weiyuan	14.9	12.1	15.9	26.6	-1.8	2.4	0.3	7.8
Total	17.0	13.8	17.2	26.8	-1.8	1.9	0.1	6.6
	Median wage (yuan/day)				Annual growth rate (%)			
Huining	19.2	13.9	16.9	25.0	-2.8	1.7	-0.5	5.8
Tianzhu	19.2	17.3	19.6	30.0	-0.9	1.1	0.1	6.4
Weiyuan	15.3	11.6	16.3	25.0	-2.4	3.1	0.3	6.4
Total	19.2	13.9	16.3	25.0	-2.8	1.4	-0.7	6.4
	CV in wage (%)				Annual growth rate (%)			
Huining	22.8	21.9	20.3	26	-0.3	-0.7	-0.5	3.7
Tianzhu	16.5	15	13.5	16.3	-0.8	-0.9	-0.9	2.7
Weiyuan	35.1	30.6	30.2	16.5	-1.2	-0.1	-0.7	-8.4
Total	28.7	26.1	24.1	19.3	-0.8	-0.7	-0.7	-3.1

Source: Calculated by the authors.
Notes: The real wages are constant in 2006 yuan, deflated by the provincial rural consumer price index available from Gansu Province Statistical Yearbooks.
CV = coefficient of variation.

To further check if the above findings hold for the slack reason, Table 3 presents the summary statistics for real daily wages during slack seasons. As expected, these wages were consistently lower than those in harvest seasons across counties for all years. From 1993 to 2003, the real daily wage remained largely constant, with only a 0.1-yuan increase from 12.8 to 12.9 yuan. Thereafter, it soared to 19.6 yuan by 2006, exhibiting an annual growth rate of 5.8 percent. The overall pattern for the slack seasons closely mirrors the pattern observed during harvest times. Overall, the sluggish real wages of 1993–2003 suggest an excess of rural labor force prior to 2004. However, the subsequently dramatic increase in real wages, even in slack seasons, signals a new paradigm of labor scarcity since 2004.

Table 3. Real wage rate during slack season

	1993	1998	2003	2006	1993–1998	1998–2003	1993–2003	2003–2006
	Average wage (yuan/day)				Annual growth rate (%)			
Huining	14.6	11.4	13.8	18.5	-2.1	1.7	-0.2	4.4
Tianzhu	14.4	11.8	14.7	22.8	-1.7	1.9	0.1	6.6
Weiyuan	10.2	8.5	11.2	18.3	-1.5	2.4	0.4	7.4
Total	12.8	10.3	12.9	19.1	-1.9	2	0	5.8
	Median wage (yuan/day)				Annual growth rate (%)			
Huining	15.3	11.6	14.2	20.0	-2.4	1.8	-0.3	5.1
Tianzhu	15.3	11.6	16.3	20.0	-2.4	3.1	0.3	3
Weiyuan	11.5	9.2	10.9	20.0	-1.9	1.4	-0.2	9.2
Total	13.4	10.4	13.1	20.0	-2.2	2	-0.1	6.4

Table 3. Continued

	1993	1998	2003	2006	1993–1998	1998–2003	1993–2003	2003–2006
	CV in wage (%)				Annual growth rate (%)			
Huining	26.6	27.7	25.4	25.8	0.3	-0.7	-0.2	0.2
Tianzhu	28.3	16.3	15	15.9	-4.7	-0.7	-2.7	0.9
Weiyuan	37.5	38.9	30.3	21.3	0.3	-2.1	-0.9	-5.0
Total	34.2	32.3	27.3	23	-0.5	-1.5	-1	-2.5

Source: Calculated by the authors based on Gansu surveys in 2004 and 2007.
Notes: The real wages are constant in 2006 yuan, deflated by the provincial rural consumer price index available from Gansu Province Statistical Yearbooks.
CV = coefficient of variation.

Among the three counties, Weiyuan County had the lowest local wages in both harvest and slack seasons between 1993 and 2003. However, by 2006, the wage gap among the three counties had almost disappeared. For example, in 2006, during the harvest period, the average real wage of workers in each county centers around 27 yuan. The median wage in slack seasons remained the same 20 yuan for all three counties. This equalizing trend of wages suggests that the labor market had become highly integrated and that the surplus labor available for migration had begun to shrink in these poor rural areas.

The CV in the real wage, as shown in Tables 2 and 3, paints a similar picture. During harvest seasons, the coefficient of variation drops from 28.7 in 1993 to 19.3 in 2006, indicating an increasing integration in the labor market over time. From 1993 to 2003, the CV declined by 0.7 on average per year; whereas from 2003 to 2006, the annual rate of decline in the CV was as high as 3.1 percent, indicating an accelerating trend of labor market integration in the second period. During the slack period, the CV in real wages exhibited the same trend, decreasing from 34.2 in 1993 to 23.0 in 2006, with most of the reduction occurring in the second five-year period.

Wages in Eastern, Central, and Western Rural Areas

By examining the evolving patterns of migration and wages in three poverty-stricken counties of Gansu province, we have shown that, over recent years, a scarcity of labor has emerged in poor rural areas. One may question whether these findings hold true for China as a whole, since the sample is not nationally representative. Given the lack of systematic wage data across regions and over time, it would be very difficult to determine the Lewis turning point using nationally representative data. We argue that our findings of labor shortages based on data from Gansu are likely to be more conservative than findings from nationally representative data would be, simply because the last pockets of surplus labor tend to exist in areas far away from centers that generate jobs. A labor shortage in very remote rural areas implies a tightness in the national labor market, but not the reverse. To test this argument, we further analyzed the trend of wages in eastern and central regions by using data from the surveys in Jiangsu, Hebei, Shaanxi, Jilin, and Sichuan Provinces, conducted by the CCAP.

Table 4 presents the summary statistics of real daily wages for male workers in rural areas in 1998, 2003, 2004, and 2007. Overall, the rate of increase in real wages rose more in the period of 2004–2007 than it did in the preceding period of 1998–2003. For example, in 1998, the average real wage was 18.0 yuan, and it reached 42.7 yuan by 2007. From 2004 to 2007, the annual growth rate of average real wages was as high as 9.1 percent, compared with only 1.8 percent during the period 1998–2003. The overall coefficient of variation declined from 41.6 in 1998 to 26.4 in 2007 (or 3 percent per year). The results are fully consistent with early findings on Gansu that the pace of wage increase has accelerated since 2003 and the labor market has become increasingly integrated.

In order to determine the broad picture of real wages at the regional level, we grouped these five provinces plus Gansu into eastern, central, and western regions, with Jiangsu Province and Hebei Province as the eastern region, Jilin Province as the central region, and Sichuan, Shaanxi, and Gansu

Provinces as the western region. Figure 2 depicts real wages in the three regions. Apparently real wages in the eastern region were consistently higher than those in the western region. The central region, represented only by Jilin Province, had the highest real wage among the three. This is probably because of a feature unique to Jilin Province: as a land-abundant province, its farm workers enjoy a more favorable bargaining power in the agricultural sector. Without including the several major central provinces, such as Hubei and Hunan, the sample for the central region used here is likely to be unrepresentative. Therefore one should be cautious in interpreting the results for the central region. Retaining this caveat for the central region, let's examine the evolving patterns over time. All three regions show the same pattern: from 2003 to 2007, real wages rose at a much faster rate than from 1998 to 2003. The slope of the curve for the eastern region was deeper than that of the curves for other two regions over the period of 1998–2003, suggesting a more rapid increase in demand for male laborers in the east than elsewhere. In comparison, the real wages in the central region (Jilin Province) remained almost unchanged.

Table 4. Daily wages for men

	1998	2003	2004	2007	1998–2003	2003–2004	2004–2007
	Average wage (yuan)				Annual growth rate (%)		
Jiangsu	19.4	25.6	27.4	42.3	2.4	2.9	6.5
Sichuan	14.0	19.6	20.3	39.3	3.0	1.6	10.0
Shannxi	13.1	16.6	21.0	41.8	2.0	11.0	10.4
Jilin	27.8	27.6	26.8	49.8	-0.1	-1.4	9.4
Hebei	15.2	21.4	21.6	40.0	3.1	0.4	9.3
Total	18.0	22.2	23.4	42.7	1.8	2.3	9.1
	Median wage (yuan)				Annual growth rate (%)		
Jiangsu	15.9	21.7	27.6	40.0	2.8	10.8	5.5
Sichuan	16.0	18.9	20.2	40.0	1.5	2.8	10.4
Shannxi	11.6	15.2	20.4	40.0	2.4	13.5	10.3
Jilin	26.8	26.1	27.3	50.0	-0.2	1.8	9.2
Hebei	16.1	20.6	20.1	40.0	2.2	-1.2	10.5
Total	16.0	20.7	20.2	40.0	2.3	-1.0	10.4
	CV (%)				Annual growth rate (%)		
Jiangsu	30.8	29.8	28.4	21.2	-0.3	-2.0	-4.1
Sichuan	25.9	44.4	38.2	25.6	4.8	-6.3	-5.7
Shannxi	29.3	26.6	27.4	17.9	-0.8	1.2	-6.0
Jilin	22.5	21.7	21.6	27.1	-0.3	-0.2	3.3
Hebei	36.1	34.9	39	31.9	-0.3	4.9	-2.9
Total	41.6	35.7	32.7	26.4	-1.3	-3.8	-3.0

Source: Calculated by the authors based on the village surveys conducted by the Center for Chinese Agricultural Policy (CCAP).
Notes: Wages are comparable at the 2006 level, deflated based on the rural consumer price index at the provincial level available from China Statistical Yearbooks.
CV = coefficient of variation.

Figure 2. Male wages by region
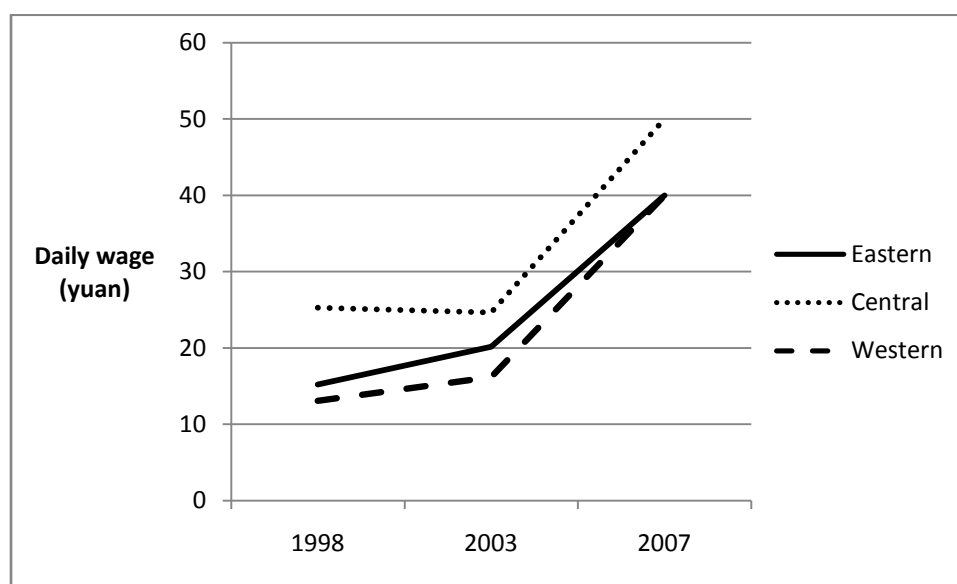
Source: Calculated by the authors based on the CCAP village surveys.

In addition to male wages, the CCAP village survey included the daily wages of female laborers (see Table 5). A comparison of Tables 4 and 5 suggests that there was a clear gender gap in wage rate. In 1998, the real wage of male workers averaged 18.0 yuan, while that of female workers was only 13.7 yuan. In 2007, these figures were 42.7 and 32.8 yuan per day, respectively. The gender difference in real wages to a large degree reflects the difference in demand for male and female laborers in agricultural production. In rural areas, most farming and local nonagricultural jobs require heavy physical work, thereby placing a wage premium on male workers. Across all the provinces, the annual growth of real wages in 2004–2007, measured as either mean or median, far exceeded that in 1998–2003. Like the market for male workers, that for female workers has shown a rising degree of integration over time. The CV in the real wages of the female labor force declined from 47.6 in 1998 to 27.6 in 2007. The speed of integration (4.3 percent) was faster in the second period than in the first (1.6 percent).

Table 5. Daily wages for women

	1998	2003	2004	2007	1998–2003	2003–2004	2004–2007
	Average wage (yuan)				Annual growth rate (%)		
Jiangsu	14.8	19.8	21.7	34.3	2.6	4.1	6.8
Sichuan	11.4	14.2	14.8	29.7	1.9	2.0	10.5
Shannxi	10.2	12.4	16.0	31.5	1.8	11.7	10.3
Jilin	21.3	21.0	20.3	38.8	-0.1	-1.5	9.8
Hebei	10.2	14.1	14.3	29.3	2.8	0.8	10.9
Total	13.7	16.4	17.5	32.8	1.6	2.9	9.5

Table 5. Continued

	1998	2003	2004	2007	1998–2003	2003–2004	2004–2007
	Median wage (yuan)				Annual growth rate (%)		
Jiangsu	15.9	19.7	20.0	32.5	1.9	0.8	7.3
Sichuan	10.7	15.2	15.1	30.0	3.2	-0.3	10.4
Shannxi	10.6	10.2	15.3	30.0	-0.4	19.4	10.3
Jilin	21.4	20.9	20.2	35.0	-0.2	-1.5	8.3
Hebei	10.7	10.3	12.5	27.5	-0.3	8.9	12.0
Total	11.7	15.5	15.3	30.0	2.5	-0.7	10.3
	CV (%)				Annual growth rate (%)		
Jiangsu	25.3	24.9	26.5	22.4	-0.2	2.9	-2.5
Sichuan	28.9	32.1	27.7	26.5	0.9	-6.2	-0.6
Shannxi	35.2	33.8	34.2	16.4	-0.3	0.5	-10.1
Jilin	37.2	35.4	35.4	24.1	-0.4	0.0	-5.4
Hebei	42.2	43.3	45.6	38.1	0.2	2.3	-2.6
Total	47.6	39.7	37.4	27.6	-1.6	-2.5	-4.3

Source: Calculated by the authors based on the village surveys conducted by the Center for Chinese Agricultural Policy (CCAP).
Notes: CV = coefficient of variation.
Wages are comparable at the 2006 level, deflated based on the rural consumer price index at the provincial level available from China Statistical Yearbooks.

Following the same regional classifications for male labor as in Figure 2, Figure 3 presents the evolving patterns of real wages of female workers in the three regions. The overall pattern echoes that of male laborer shown in Figure 2: there was a substantial upward shift in real wages in 2003. Despite very similar trends, Figure 3 presents one key difference from Figure 1. The lines of the eastern and western regions in Figure 3 are almost identical. In other words, female wages in the western region do not lag behind their counterparts in the east region.

Figure 3. Female wages by region
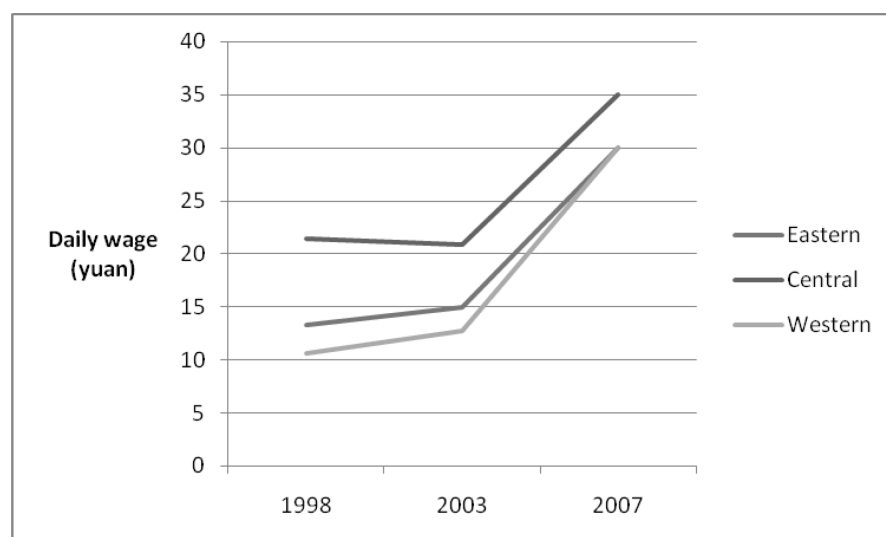
Source: Calculated by the authors based on the CCAP village surveys.

The analysis based on the more representative CCAP village survey reinforces the findings on the presence of Lewis turning point around 2003 based on data in Guansu Province. The rapid economic growth in the coastal region generated a high demand for rural laborers, in particular for male laborers, as reflected in the relatively higher growth rate of wages in the eastern region prior to 2004. From 2003 onward, real wages began to rise substantially and simultaneously in all the provinces regardless of their development level. This illustrates that labor scarcity has become a nationwide issue.

Age Profile of the Migratory Labor Force

Having shown evidence of labor shortage in recent years using aggregate data, we next examine the age profile of migratory workers to determine whether China still has some room to promote migration for certain age cohorts. Based on the CCAP village survey, Figures 4 and 5 plot the percentage of laborers working outside their county by age group in 2004 and 2007 for males and females, respectively. Within just three years, the share of migratory workers has increased across all the age groups, which is especially evident in the male 20–29 age cohort and the female 15–19 age cohort. In 2004, over 50 percent and 40 percent of male and female laborers, respectively, worked outside their home county. By 2007, the figures had exceeded 60 percent and 50 percent. Among the young cohort aged 15–24, more than 55 percent were migrant workers in 2007. With such a high rate of migration, the manufacturing sector, which has overwhelmingly relied on young workers in the past, may face a problematic future.

It is apparent that the rate of migration gradually declines as age increases. After 45 years of age, merely 3 percent of women worked outside their home counties, while the rate of outmigration among men remained at 14 percent. This gender difference is a result of institutional constraints on migration. The current migration policy makes it difficult for a migrant and his family to settle down permanently in jobs away from home. Consequently, married women often have to stay at home to take care of children and the elderly as well as to work when their households move to migratory jobs. On a positive note, the low rate of migration among married women implies that there is still a room to release more laborers, in particular female workers, from rural areas if more institutional innovations are introduced to promote permanent migration. In the future, China's manufacturing sector will increasingly depend upon a labor force above 30 years of age, especially married female workers. Reforming migration policies to facilitate permanent migration may still have some potential in releasing more laborers from the rural areas.

Figure 4. Share of migratory male workers by age cohort
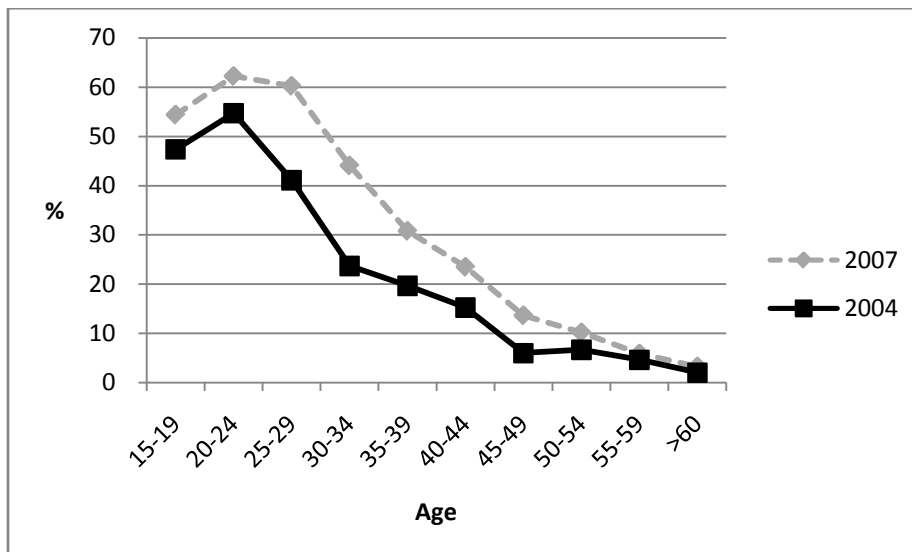
Source: Calculated by the authors based on the CCAP village surveys.
Note: The migratory workers are those working outside their home counties.

Figure 5. Share of migratory female workers by age cohort
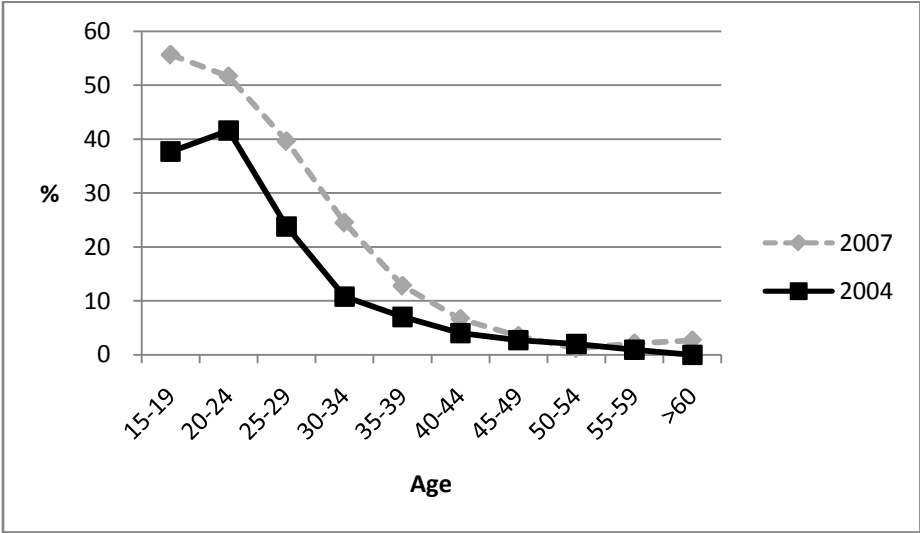
Source: Calculated by authors based on the CCAP village surveys.
Note: The migratory workers are those working outside their home counties.

4. EMPIRICAL ANALYSIS

The evidence presented above shows, at the aggregate level, an accelerating trend toward increasing wages in recent years. However, the analysis masks important idiosyncratic differences at the local level. For example, an individual's migration decision is likely to be influenced by many factors, such as land endowment, educational level, and available job market information. To check the robustness of the above findings at the aggregate level, we employed a multivariate regression analysis by controlling for a number of factors at the local level. The regression analysis is based on the Gansu survey. The major control variables at the village level included roads, the ratio of ethnic minority to total population, the average educational level of the labor force, per capita cultivated cropping area, and cropping structure.

A dummy variable is defined as 1 if a village has cemented or asphalt roads, otherwise it is 0. Good road connections would reduce the cost of seeking employment further away. Some villages in the poor western regions, especially mountainous areas, are not connected by all-season roads. Impassable roads may inhibit local job opportunities and limit the flow of information about job opportunities elsewhere. As a result, lack of road access may depress local wages. If roads are a binding constraint, then improvements in roads would facilitate further labor migration.

The education variable refers to the average years of schooling within a village, which is calculated based on the distribution of the labor force at different educational levels. We count the number of years of high school education as 12 years, junior high school as 9 years, and primary school as 6 years. The average year of school = (labor force with high school education × 12 + labor force with secondary school education × 9 + labor force with primary school education × 6) / total labor force. As shown in the literature, the level of human capital is often associated with productivity (Shultz 1964). Therefore more educated workers are likely to be receiving higher wages.

The ethnic minority ratio refers to the percentage of persons of ethnic background in relation to the total village population. Many ethnic minority groups have different languages, beliefs, diets, and cultural traditions; to some extent, this hinders them from participating more actively in nonagricultural activities elsewhere. Therefore the ethnic minority ratio is also taken into account in analyzing local wage determinants.

Per capita arable land area reflects the degree of agricultural endowment. In areas with more abundant arable land, farmers may face less stringent pressure to look for jobs in remote and unfamiliar areas.

The cropping structure variable is defined as the ratio of cereal cropping area to total cultivated area. A village dominated by high-value added agricultural production, such as fruits and Chinese medicinal herbs, is likely to require more local laborers than one primarily engaged in cereal production. Therefore differences in the cropping structure may matter to local wages.

Table 6 lists the summary statistics of these control variables in 2003 and 2006. In 2003, 26 out of 88 villages had paved roads. By 2006, the number had increased to 30. Overall, the share of minority population is around 13 percent. The average level of village education has slightly increased from 6.95 to 7.23 years. The share of high school graduates has risen from 11.5 percent to 13.7 percent. The number of laborers with primary school education accounted for the largest share, despite a slight decline from 42.7 percent to 40.0 percent. Per capita arable land area dropped from 3.1 down to 2.5 mu (1 mu= 1/6 acre), mainly in response to the national policy of reforestation ("grain for green"). With the shrinkage of total arable land area, the ratio of land area to cereal production moved up from 71.4 percent to 76.6 percent.

Table 6. Summary statistics of control variables at the village level used in regressions

Variables		2003	2006
Presence of concrete/paved roads		26	30
Share of ethnic Han in total population (%)		86.81	86.45
Education	High school	11.46	13.7
	Junior high school	33.51	35.46
	Primary school	42.71	39.96
	Illiterate	12.32	10.87
Average years of schooling		6.95	7.23
Per capita arable land area		3.09	2.47
Share of cereal cropping area in total arable area		71.35	76.61

Source: Calculated by the authors on the basis of Guizhou surveys in 2004 and 2007.

Table 7 presents the regression results on real wages during the harvest season. The first regression, R1, includes only the five control variables. Road connections do not have much impact on local wages. The coefficient for the education variable is significant and positive. A more educated labor force earns higher wages. The negative coefficient for the ratio of ethnic minorities suggests that villages with higher concentrations of minority ethnic groups have lower wages. The share of cereal cropping area has a significant and negative impact on real wages perhaps because compared to cash crops, the returns to cereal crops are lower.

In the second regression, R2, we add year dummies, with 1993 as the base period. Our purpose is to check whether the coefficients for the year dummies show a similar trend to those exhibited in the previous section after controlling for the local factors. Among all the five major control variables, only the ethnicity variable remains significant. The dummy variables for 1998 and 2003 are insignificant, suggesting that wages remained largely constant even after controlling for village-specific variable and time effects. The coefficient for the year of 2006 is statistically significant and positive at the 1percent level.

To further control for some unobserved location factors, we add township dummies in regression R3. None of the five major control variables is significant. The year dummy variable for 2006 remains significant at the level of 1percent, reinforcing the findings of a jump in real wages since 2003.

As a robust check, we replaced the real wages with the logarithm of real wages, considering most economic variables to follow a lognormal distribution. As shown in the right panel of Table 7, all the results continue to hold after the transformation of dependent variable.

We repeated the above analyses by replacing the dependent variable with real wages in slack seasons and present the results in Table 8. All the findings are consistent with Table 7. In particular, the time dummy variables in 2006 are still highly significant. The results for real wages in slack seasons illustrate that the Lewis turning point had arrived in 2003, even after controlling for various local factors.

For a better visualization of the temporal pattern, Figure 6 plots the coefficients for the year dummy variables in the multivariate regressions as reported in Tables 7 and 8 during busy and slack periods, respectively. As can be clearly seen, even after controlling for a variety of factors, the real wages between 1993 and 2003 showed almost no change, whereas from 2003 to 2006 there was a substantial increase in real wages. Most notably, the trend line for the slack period mirrors that for the peak season, indicating the arrival of the Lewis turning point.

Table 7. Regressions on daily wage in harvest season

|	Wages			Log(wages)		
	R1	R2	R3	R4	R5	R6
Presence of concrete/paved roads	0.016	0.468	0.118	0.003	0.026	-0.005
	(0.93)	(0.93)	(0.93)	(0.93)	(0.93)	(0.93)
Average years of schooling	0.984***	0.195	0.339*	0.051***	0.011	0.021*
	(0.26)	(0.20)	(0.18)	(0.02)	(0.01)	(0.01)
Share of ethnic Han in total population (%)	-0.045***	-0.039***	-0.043**	-0.003***	-0.003***	-0.002**
	(0.02)	(0.01)	(0.02)	(0.00)	(0.00)	(0.00)
Per capita arable land area	0.259	0.548*	-0.515	0.036	0.050***	-0.013
	(0.46)	(0.32)	(0.37)	(0.03)	(0.02)	(0.02)
Share of cereal cropping area in total cultivated area	-7.985***	-2.305	4.325**	-0.494***	-0.209**	0.148
	(2.51)	(1.81)	(2.02)	(0.13)	(0.10)	(0.11)
1998		-3.312***	-3.498***		-0.207***	-0.217***
		(0.69)	(0.62)		(0.05)	(0.04)
2003		-0.071	-0.334		0.009	-0.006
		(0.75)	(0.68)		(0.05)	(0.04)
2006		9.339***	9.442***		0.454***	0.457***
		(0.90)	(0.82)		(0.05)	(0.04)
Township fixed effects	no	no	yes	no	no	yes
N	278	278	278	278	278	278
Adjusted R square	0.059	0.544	0.642	0.072	0.493	0.6
AIC	1819.619	1621.507	1561.517	200.26	35.171	-23.353

Source: Guizhou surveys in 2004 and 2007.Note: Robust standard errors are in parenthesis. The symbols *, **, and *** represents levels of significance at 10%, 5%, and 1% respectively.

Table 8. Regressions of daily wage in slack season

	Wages			Log(wages)		
	R1	R2	R3	R4	R5	R6
Presence of concrete/paved roads	0.444	0.824	0.569	0.048	0.075*	0.048
	(0.71)	(0.58)	(0.55)	(0.05)	(0.04)	(0.04)
Average years of schooling	0.508**	0.046	0.254	0.039**	0.006	0.021
	(0.25)	(0.22)	(0.22)	(0.02)	(0.02)	(0.02)
Share of ethnic Han in total population (%)	-0.045***	-0.046***	0.014	-0.004***	-0.004***	0.001
	(0.01)	(0.01)	(0.02)	0.00	0.00	0.00
Per capita arable land area	0.918**	1.124***	0.389	0.097***	0.111***	0.05
	(0.37)	(0.28)	(0.41)	(0.03)	(0.02)	(0.03)
Share of cereal cropping area in total cultivated area	-7.137***	-3.044*	-0.118	-0.604***	-0.318**	-0.108
	(2.29)	(1.74)	(2.13)	(0.17)	(0.13)	(0.14)
1998		-2.588***	-2.754***		-0.216***	-0.227***
		(0.67)	(0.63)		(0.06)	(0.05)
2003		-0.008	-0.264		0.021	0.002
		(0.71)	(0.67)		(0.06)	(0.05)
2006		6.173***	5.966***		0.422***	0.410***
		(0.86)	(0.85)		(0.06)	(0.06)
Township fixed effects	no	no	yes	no	no	yes
N	246	246	246	246	246	246
Adjusted R square	0.058	0.441	0.52	0.088	0.427	0.51
AIC	1477.466	1352.059	1321.945	201.508	90.087	59.292

Source: Guizhou surveys in 2004 and 2007. Note: Robust standard errors are in parenthesis. The symbols *, **, and *** represents levels of significance at 10%, 5%, and 1% respectively.

Figure 6. The coefficients for the year dummies in regressions on wages in harvest and slack seasons
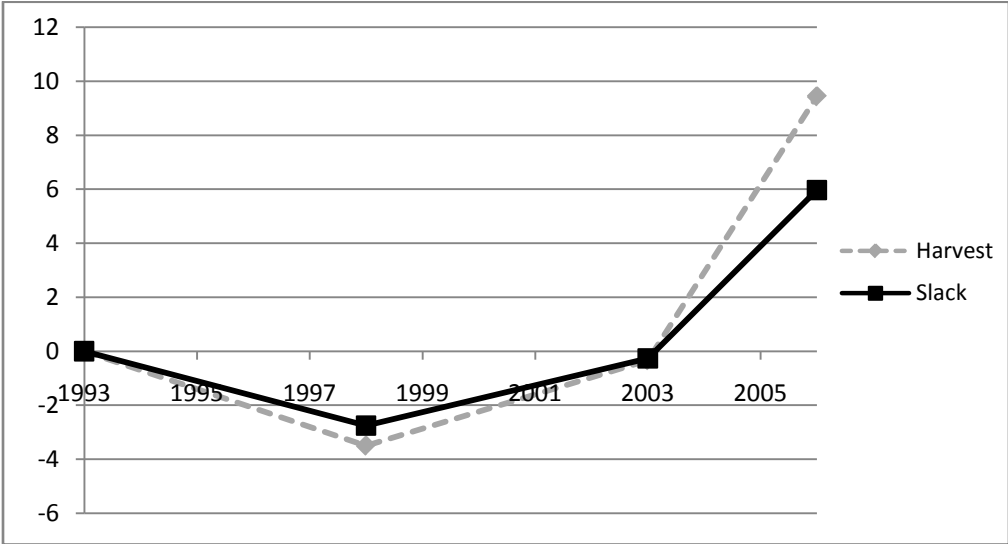
Source: Calculated by the authors.
Note: The coefficients for the year dummies are taken from R3 in Tables 7 and 8.

5. CONCLUSIONS

The economic reform and "opening up" policy since the late 1970s have greatly promoted China's economic growth. Rapid industrialization in the coastal areas has generated vast employment opportunities, absorbing much surplus labor from rural areas. With a supply of seemingly unlimited cheap labor, China garnered an increasingly large share of manufactured products for export in the international market and earned the name of "the world's factory." Using microlevel data in six provinces, this paper shows that the era of unlimited labor supply has already passed and that the Lewis turning point in rural China arrived in 2003. Real wages both in the peak and slack seasons have begun to rise substantially, foretelling a nationwide labor shortage. Interestingly, the turning point occurred a few years earlier than widespread reports on labor shortages in the coastal region picked up by the media. This is consistent with the prediction of the Lewis model that the turning point for rural areas can be observed ahead of that for urban areas.

Because China is entering a new era of labor shortage, China's labor-intensive and export-driven growth model will gradually lose its competitive advantage. China will have to reorient its development strategy toward labor practices that are more capital intensive and based on laborers' skills. The success of the new development model hinges upon on a strong investment in human capital. As industries become more technology- and knowledge-based, the demand for skilled labor will increase. However, in many rural areas, children choose to drop out of primary and junior high schools to move to cities, where they can do odd jobs to obtain cash income (Fan, Kanbur, and Zhang 2010). In the future, as the demand of industrial and service jobs shifts to skilled labor, some of the unskilled labor force is likely to be left behind.

Of course the current shortfall does not mean that there is no remaining flexibility in the labor supply. The rapid rise in wages may also induce institutional innovations, which help to release more labor from rural areas. For example, governments are increasingly attaching importance to rural old-age security and have already initiated a wide range of medical insurance systems. These safety nets would lessen many concerns of the migratory workers and facilitate migration. In addition, promoting land rental market development would help to consolidate fragmented land and make it more suitable for large-scale agricultural operations. The subsequent increase in the use of agricultural machinery would thereby release much of the rural labor force, alleviating shortages. Finally, China may have used up its population dividend, a result of the family planning policy begun in the early 1980s. As the one-child generation reaches working age, its members appear to be less willing to take jobs in harsh working environments far away from home. Without a change in family planning policy, labor shortages and aging may well develop into chronic problems in the future.

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