China Has Reached the Lewis Turning Point

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Abstract

In the past several years, labor shortage in China has become an emerging issue. However, there is heated debate on whether China has passed the Lewis turning point and entered a new era of labor shortage from a period of unlimited labor supply. Most empirical studies on this topic focus on the estimation of total labor supply and demand. Yet the poor quality of labor statistics leaves the debate open. In this paper, China's position along the Lewis continuum is examined though primary surveys of wage rates, a more reliable statistic than employment data. Our results show a clear rising trend of real wages rate 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 model.

Key words: dual economy; surplus labor; Lewis model; labor market

China Has Reached the Lewis Turning Point

I. Introduction

As an economy transforms from an agricultural to industrial society, the balance of labor demand and supply will shift as well. In the initial stage of development, most people stay in rural areas engaged in agricultural production. With the existence of underemployed labor in rural areas, the industrial sector can expand its employment without creating pressures to raise industrial wages. Consequently, it is possible to observe a period of industrial growth without rise in real wage. However, as the industrial sector develops to the point where the labor supply in the agricultural sector becomes limited, industrial wages begin to quickly rise. Based on historical experience of the developed countries, Lewis (1954) first conceptualizes the above economic transformation process from unlimited to limited supplies of labor. In the literature, the structural change from excess of labor supply to 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 turning point. The current debate on whether China has arrived at the Lewis turning point highlights the difficulties of empiricaly identifying the Lewis turning point. Since the 1978 economic reform, China has experienced a rapid and pronounced economic transformation from a planned to market economy and from an agricultural to industrial society in just three decades. 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). A large number of laborers have moved from the agricultural to the industrial and service sectors. For more than two decades since the economic reform, labor supply seemed to be unlimited. As a result, China's manufacturing sector maintained a comparative advantage in labor-intensive products. Fueled by cheap labor, China's export in many of manufacturing goods has become so competitive in the international market that China has earned the name "world factory."

However, since 2005 the "labor shortage" phenomenon has begun to turn up in coastal cities, sparking intensive media reports about labor shortage in 2006 and 2007.[2] The subsequent global financial and food crises in 2008 and 2009 reduced demand for Chinese products, resulting in bankruptcies of some export-oriented enterprises. The external shocks seemed to temporally mute the acuteness of labor shortage for a few years. Recently, as China has emerged largely unscathed from the crises, the demand for labor recovered and concerns over labor

[1] The idea was further formalized by Ranis and Fei (1961 and 1964). 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, see http://www.nytimes.com/2005/04/03/business/worldbusiness/03iht-yuan.html.

shortage has renewed.[3]

As the world's largest exporter, China's manufacturing industry to a great extent determines the world price. However, if the Chinese labor force begins to experience shortages, labor costs in the manufacturing sector would then rise, eventually bidding up the price of final products. A higher price of Chinese products would have an impact not only on the global manufacturing production and trade system but also on the welfare of a vast number of consumers worldwide.

Domestically, such a structural change would affect the production structure in the agricultural, industrial and service sectors. As labors become more costly, agricultural production is likely to be replaced by machinery. Similarly, the currently competitive labor-intensive manufacturing sector will have to upgrade into a more capital and skill-intensive mode of production. This structure change will place a higher premium on the education of skilled labors.

The new paradigm of labor shortage, if confirmed, will have important implications on income distributions. Labor shortage will grant workers more bargain power in the marketplace, resulting in a more rapid growth in wages. Higher wages will likely narrow the enormous rural-urban income gap formed in the past. Part of the rising labor income will eventually translate into higher domestic consumption, playing a role in reducing the global imbalance.

In summary, it is both urgent and crucial to research whether the Chinese economy has reached the Lewis turning point based on solid empirical evidence. There is heated debate on whether China has passed the Lewis turning point and entered a new era of labor shortage. Most empirical studies on this topic focus on the estimation of total labor supply and demand. The poor quality of labor statistics, however, leaves the debate open. In this paper, China's position along the Lewis continuum is examined though primary surveys of wage rates, a more reliable statistic than employment data. Our results show a clear rising trend of real wages since 2003. The acceleration of the rate of real wages 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 China's future development model.

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

II. Conceptual Framework and Literature Review

[3] For example, "Defying Global Slump, China Has Labor Shortage," *New York Times*, February 26, 2010, see http://www.nytimes.com/2010/02/27/business/global/27yuan.html.

Following Basu (2000), we use Figure 1 to illustrate 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 excess of labor supply 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 activities are located, is usually higher than in rural areas. Second, because migrant workers in the industrial sector have to bear the psychological cost of separation with their families, higher wages have to be offered to compensate the cost (Lewis, 1954).[4]

L represents total amount of labor force (aside from population growth), with O_R as the origin of the rural sector and O_M as the origin of 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 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, the urban employment totals at O_ML_1, while the rural labor force is numbered O_RL_1 at the subsistence wage level (m). As entrepreneurs earn a profit and reinvest some of the profit into production, total capital stock increases. More capital stock means 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 comprised 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 urban wage remains constant at w. This phase is referred to as an unlimited supply of rural labor force phase.

At point B_2, the marginal product of rural labor starts to exceed the subsistence wage level (m). As a result, from then on rural wage rises. The urban wage rate 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 wage rises while urban wage remains constant. After B_3, economic development enters the third phase: labor shortage becomes a national problem with wage level going up in tandem in both sectors. If focusing 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, real wage rate rises up first in rural areas ahead of urban areas.

[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 cities to look for a job.

Therefore, a sudden upward shift in rural wage is likely to predict a national labor shortage down the road.

The conceptual model offers some insights on how to measure and test 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 wouldn't be able 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) show that these economies achieved a gradual shift in labor from rural to urban areas, with wage patterns in consistent with the prediction of the Lewis model. The rapid economic transformation in 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. There is an emerging body of literature debating whether China has reached the Lewis turning point or not, with the current debate centering largely on the accurate estimations of the amount of surplus labor remaining in the rural areas. Cai and Wang (2008) are one of the first to show that China has begun to face labor shortage. They first estimate the remaining labor force based on the labor needs of various production activities in rural areas. They then subtract migrants and required agricultural workers from the total rural labor force to obtain the available surplus labor at about 107 million. However, due to lack of systematic statistics on migrant workers, the estimation of surplus labor depends upon various underlying assumptions. Thereby, differences in underlying assumptions could translate into a large discrepancy in the estimation of surplus labor.

Several studies hold opposing views. Green (2008) argues that the tightening labor force in the cohort of 20-30 is temporary and it 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 in the order of 0.5-0.85 billion. Based on income data in rural and urban areas, Knight also challenges the view of the arrival of Lewis turning point. He argues that from 1989-2005, average annual per capita real income in rural areas grew by only 5.8% compared to 8% of the annual urban real wage growth rate. He attributes the recent substantial increase in per capita income in rural areas to favorable government policies such as infrastructure investment and the abolishment of agricultural taxes instead of structural labor shortage.

A report by the World Bank (2008) also dismisses that China has reached the Lewis turning point, mainly from the following three aspects. First, the wage escalation in the coastal region reflects an adjustment from a previously extreme low wage level. Second, the widespread use of mechanization and other labor-saving technologies release labor from agricultural production and enlarge the surplus labor force. Finally, the official data of the double-digit wage increases is mainly based on surveys of workers in state-owned enterprise and large private enterprises. The real wage increase among unskilled labors may be much lower. Considering that a large proportion of migrant labors work in small and medium enterprises (SMEs), the use of official data results in a significant defect in gauging the reality of the situation.

In sum, researchers have not yet reached a consensus whether the excess of rural labor has been exhausted. The estimates of surplus labor used to explain the shortage of labor varies widely, and in some cases, by a difference of several times (Guo, 2008). Systematic wage statistics for SMEs and other informal employment are lacking. To overcome the above shortcomings, in this paper we examine 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 one hundred nationally representative villages in five provinces. The survey covers detailed information about wage rate for the period of 1993-2007. To our knowledge, this study is one of the first quantitative empirical studies based on rural wage data over a long period of time to analyze the Lewis turning point. As shown in the conceptual model, it is possible to test the Lewis turning point using only rural wages.

III. Data Description

This paper is based on two data sets. The first one is a primary survey in Gansu Province of China 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), are selected based upon ecological conditions. In each county, three townships are randomly chosen and all the villages in the selected township are surveyed. In total, the sample size is 88, including 31 villages from Huining county, 22 villages in Tianzhu County, and 35 villages in Weiyuan County. The first survey was conducted in 2004 and the second in 2007. The questionnaires have detailed information about village affairs, including wages in harvest and slack season. The survey team gathered the information through 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 shortage, greatly inhibiting agricultural production, however, education quality is one of the best in the province. Weiyuan County sits to the south of Lanzhou. As the birthplace 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 a high concentration of angelica, Codonopsis and other Chinese herb production. Tianzhu County is located in the northwest of Lanzhou, boardering Qianghai Province, with livestock production as the major livelihood. 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, 101 villages were surveyed in the five provinces. In each province, 20 villages were randomly surveyed with the exception of Jilin where 21 villages were selected. Similar to the Gansu survey, the 2005 survey also contains recalled information on wages in previous years. In 2007, the sample is expanded to 170 villages with average of 35 villages in each province. One key feature of the CCAP village survey is that both male and female daily wages were reported.

(A) The patterns of outmigration in Gansu

Table 1 reports the summary statistics about the share of labors working outside the county from 1993 to 2006. In 1993, for the three counties as a whole, 16.8% of labor force worked outside the county. By 2006 the ratio reached 40.5%. In the first two five-year periods (1993-1998 and 1998-2003), the annual growth rates averaged at only 2.1% and 2.4%, respectively. From 2003 to 2006 the average annual growth rate sped up substantially to 9.6%, more than four times the previous decade. The median share of migrant workers reveals the same patterns: in the period of 2003-2006, the rate of outmigration far exceeded 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 some villages the share 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%) was much higher in the period of 2003-2006 than the previous two periods (respectively 1.2% and 1.7%). The results suggest that the rate of migration has jumped up in villages previously with fewer migratory workers, especially in the period of 2003-2006.

Weiyuan County has held the lowest rate of migrant workers in all the years. Both the mean and median wage rates reflect this situation, whereby Huining and Tianzhu counties in 2006 enjoyed a migratory labor rate of 40% or more, three percentage points higher than Weiyuan. As one of the largest potato and herbal medicine production clusters, 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 less favorable natural resource endowment for agricultural production, people in Huining and Tianzhu have to more actively seek jobs in the nonagricultural sector, either locally or far-away from home.

(B) Wages in Gansu

The above summary statistics have indicated a continuous decrease in the remaining workforce, especially in recent years. However, these numbers alone are not adequate to help discern rural labor scarcity. As shown in the conceptual model in the last section, a shortage of rural labor should be reflected by an increase in real wages. A national labor shortage is likely to last trickle down to remote poor areas. Therefore, examining the evolving patterns of real wages

in remote, less developed regions will help 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 during the slack period. A short-term labor shortage during harvest does not necessarily means a chronic shortage of labor in other times. Therefore, it is necessary to distinguish seasonal and permanent labor shortage. A Lewis turning point means that even in the slack season, there is a labor shortage.

Table 2 shows the local real daily wage data during the harvest season in the period of 1993-2006. From 1993 to 2003, wages barely changed from 17.0 to 17.2 yuan per day. By 2006, it jumped to 26.8 yuan, an annual growth rate of 6.6% during a three-year period. The reported median wages even declined between 1993 and 2003 before an abrupt escalation.

To further check if the above findings hold for the slack reason, Table 3 presents the summary statistics of real daily wages for the slack season. As expected, real wages in slack seasons were consistently lower than those in the harvest season across counties for all the 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%. The overall pattern for the slack season mirrors closely observed in the harvest time. Overall, the sluggish real wages in during 1993-2003 suggest an excess of rural labor force prior to 2004. However, the subsequently dramatic increase in real wages, even in the slack season, signals a new paradigm of labor scarcity since 2004.

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 of 20 yuan for all the three counties. The equalizing trend of wages suggests that the labor market has become highly integrated and the surplus labor available for migration has begun to run out in these poor rural areas.

The coefficient of variation in the real wage as shown in Tables 2 and 3 paints a similar picture. During the harvest season, the coefficient of variation drops from 28.7 in 1993 to 19.3 in 2006, indicating an increasing integration of labor market over time. From 1993 to 2003, the CV declined by 0.7 on average per year, while from 2003 to 2006, the annual rate of decline in CV was as high as 3.1%, 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.

(C) Wages in eastern, central and western rural areas

Through examining the evolving patterns of migration and wages in three poverty-stricken counties of Gansu province, we have shown that a scarcity in labor has emerged in poor

rural areas during recent years. One may question if the findings hold true for China as a whole given that 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 want to argue that our findings of labor shortage based on data from Gansu are likely to be more conservative than using nationally representative data due to the fact that the last pocket of surplus labor tends to exist in areas far away from places generating jobs. A labor shortage in very remote rural areas implies the tightness of national labor market, but not the verse versa. To test this argument, we further analyze 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 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 wage has sped up in the more recent period of 2004-2007 than the previous 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%, compared to only 1.8% during the period of 1998-2003. The overall coefficient of variation has declined from 41.6 in 1998 to 26.4 in 2007 (a rate of decline of 3% 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 gauge the broad picture of real wages at the regional level, we group these five provinces plus Gansu province 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 1 graphs real wages in the three regions. Apparently, real wages in the eastern region are consistently higher than those in the western region. The central region, represented only by Jilin province, had the highest real wage among the three regions. This is probably due to the special feature of Jilin Province: as a land abundant province, 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. Keeping the caveat of sample problem for the central region, let's examine the evolving patterns over time. All the 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 east region was deeper than for other two regions over the period of 1998-2003, suggesting a more rapid increase in demand for male labors in the east than elsewhere. In comparison, the real wages in the central region (Jilin Province) remained almost unchanged.

Apart from male wages, the CCAP village survey includes daily wages of female laborers (see Table 5). A comparison of Tables 4 and 5 suggests that there is a clear gender gap in wage rate. In 1998 the real wage of male workers averaged 18.0 yuan, while the women's real wage

was only 13.7 yuan. In 2007, they were 42.7 and 32.8 yuan per day, respectively. The gender difference in real wages to a large degree reflect the difference in demand for male and female labors in agricultural production. In rural areas, most farming and local nonagricultural jobs require heavy physical works, thereby placing a wage premium on male workers. Across all the provinces, the annual growth of real wages in the period of 2004-2007, either measured as mean or median, far exceeded that during 1998-2003. Similar to the labor market for male workers, the female labor market has shown a higher degree of integration over time. The CV in the real wage of the female labor force declined from 47.6 in 1998 to 27.6 in 2007. The speed of integration (4.3%) is faster in the second period than in the first (1.6%).

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

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 east region prior to 2004. From 2003 onwards 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.

(D) The age profile of 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 understand if China still has some room to promote migration for certain age cohorts. Based on the CCAP village survey, Figures 3 and 4 plot the percentage of laborers working outside their county by age group in 2004 and 2007 for males and females, respectively. With 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 cohort. In 2004, over 50% and 40% of male and female laborers worked outside their home county, respectively. By 2007, the figures had exceeded 60% and 50%. Among the young cohort of 15-24, more than 55% were migrant workers in 2007. With such a high rate of migration, the future of manufacturing sector, which has overwhelmingly relied on young workers in the past, looms large.

It is apparent that the rate of migration gradually declines as age increases. After 45 years of age, merely 3% of women worked outside their home counties, while the rate of outmigration among men remained at 14% for a 45-year old man. 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 permanently settle down in the job destinations. Consequently, married women often have to stay at home to take care of children and elderly as well as work when their households take 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 hinge upon the size of the labor force above 30 years of age, especially married female workers. Reforming migration policies to facilitate permanent migrations may still have some potential in releasing more laborers from the rural areas.

IV. Empirical Analysis

The above evidence at the aggregate level has shown an accelerating wage increase 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, education level, and available job market information at the local level. To check the robustness of the above findings at the aggregate level, we employ 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 include: roads, the ratio of ethnic minority in 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 0. Good road connections would reduce the cost of seeking a job outside. Some villages in the poor western regions, especially mountainous areas, are not connected by all seasonal 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 improvement in roads would facilitate further labor migration.

The education variable refers to the average year of schooling within a village, which is calculated based on the distribution of 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 associated with higher wages.

The ethnic minority ratio variable refers to the percentage of ethnic population in total village population. Many ethnic minority groups have different language, beliefs, diet, and traditional cultures, which to some extent hinders them from more actively participating in

nonagricultural activities elsewhere. Therefore, the ethnic minority ratio is also taken into account when 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 in total cultivated area. A village dominated by high-value added agricultural production, such as fruits and Chinese medicine herbs, is likely to require more local labors than one primarily engaged in cereal production. Therefore, difference 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 increased to 30. The share of minority population is around 13%. The average level of village education has slightly increased from 6.95 to 7.23 years. The share of high school graduates rose from 11.5% to 13.7%. The number of labor force with primary school education accounted for the largest share, despite a slight decline from 42.7% to 40.0%. Per capita arable land area dropped from 3.1 down to 2.5 mu, in large response to the national policy of reforestation ("grain for green"). With the shrinkage of total arable land area, the ratio of land area on cereal production moved up from 71.4% to 76.6%.

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 education variable is significant and positive. A more educated labor force earns higher wages. The negative coefficient for the ethnic minority ratio variable suggests that villages with higher concentration of minority ethnic groups have lower wages. The share of cereal cropping area has a significant and negative impact on real wages.

In the second regression R2, we add year dummies with 1993 as the base period. Our purpose is to check if the coefficients for the year dummies show a similar trend to those exhibited in the previous section after we control for the local factors. Among all the five major control variables, only the ethnicity share variable remains significant. The dummy variables for 1998 and 2003 are insignificant, suggesting 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 1% 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 1%, reinforcing the findings of a jump in real wages since 2003.

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

We repeat 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 the real wages in slack seasons illustrate that the Lewis turning point had arrived in 2003, even after we control for various local factors.

For a better visualization of the temporal pattern, Figure 5 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, while 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.

V. CONCLUSIONS

The economic reform and opening up policy have greatly promoted China's economic growth. The rapid industrialization in the coastal areas has generated vast employment opportunities, absorbing a large number of surplus labor in rural areas. With the supply of seemingly unlimited cheap labor, China has garnered an increasingly larger share of export of manufacturing products in the international market and earned the name of "world factory". Using micro-level data in six provinces, this paper shows that the era of unlimited labor supply has already gone and the Lewis turning point in rural China had 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 shortage in the coastal region picked up by the media. This is consistent with the prediction of Lewis model that the turning point for the rural area can be observed ahead of the urban area.

While entering the new territory of labor shortage, China's labor-intensive and export-driven growth model will gradually lose its comparative advantage. China will have to reorient its development strategy towards more skill and capital intensive based labor. 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, many children choose to drop from primary and junior high schools to enter the city doing odd jobs to get cash income (Fan, Kanbur, and Zhang, 2010). Some of the unskilled labor force is likely to be left behind in the future as the demand of industrial and service jobs shifts to skilled labor.

Of course the current shortfall does not mean that there is entirely no room to increase labor supply. The rapid rise in wages may also induce institutional innovations, which help 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 consolidate the fragmented land and make it more suitable for large-scale agricultural operations. The subsequent increase in the use of agricultural machinery would thereby release mcuh 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 enters the working age, they are less willing to take jobs in harsh working environments far away from home. Without a change in family planning policy, labor shortage and aging would likely develop into a chronic problem in the foreseeable future.

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Table 1: Summary Statistics of Labors Working outside the County

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

Note: Computed by authors. CV represents coefficient of variation.

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

Note: Calculated by authors. CV represents coefficient of variation. The real wages are constant in 2006 price, deflated by provincial consumer price index.

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
	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

Note: Calculated by authors. The real wages are constant in 2006 price, deflated by provincial consumer price index. CV represents coefficient of variation.

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

Note: Calculated by authors based on the CCAP village surveys. Wages are comparable in 2006 level, deflated based on rural consumer index. CV represents coefficient of variation.

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
		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

Note: Calculated by authors based on the CCAP village surveys. Wages are comparable in 2006 level, deflated based on rural consumer index. CV represents coefficient of variation.

Table 6: Summary Statistics of Control Variables at the Village level Used in Regressions

Variables		2003	2006
Have 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 year 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

Note: Calculated by authors based on Guizhou surveys in 2004 and 2007.

Table 7: Regressions on Daily Wage in Harvest Season

	Wages			Log(wages)		
	R1	R2	R3	R4	R5	R6
Having 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 year 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)
year=1998		-3.312***	-3.498***		-0.207***	-0.217***
		(0.69)	(0.62)		(0.05)	(0.04)
year=2003		-0.071	-0.334		0.009	-0.006
		(0.75)	(0.68)		(0.05)	(0.04)
year=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

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

Table 8: Regressions on Daily Wage in Slack Season

	Wages			Log(wages)		
	R1	R2	R3	R4	R5	R6
Having 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 year 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)
year=1998		-2.588***	-2.754***		-0.216***	-0.227***
		(0.67)	(0.63)		(0.06)	(0.05)
year=2003		-0.008	-0.264		0.021	0.002
		(0.71)	(0.67)		(0.06)	(0.05)
year=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

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

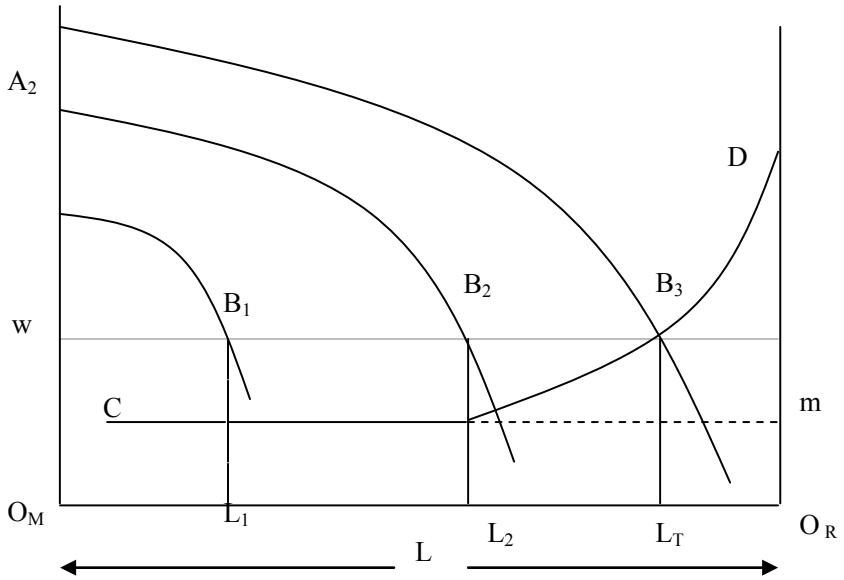

Figure 1 A Conceptual Model on Lewis Turning Point

Note: The figure is adapted from Basu (2000).

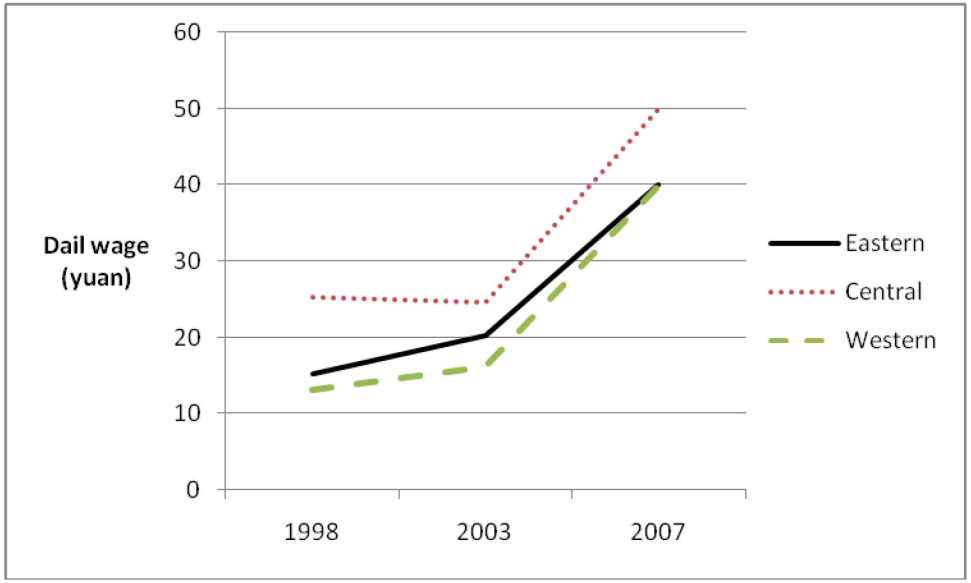

Figure 2 Male Wages by Region

Note: Calculated by authors based on the CCAP village surveys.

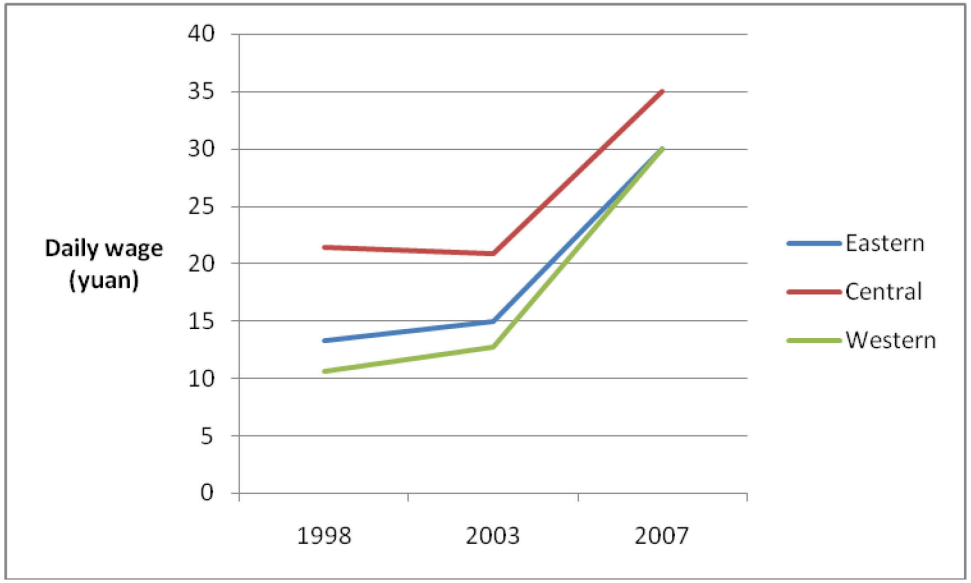

Figure 3 Male Wages by Region

Note: Calculated by authors based on the CCAP village surveys.

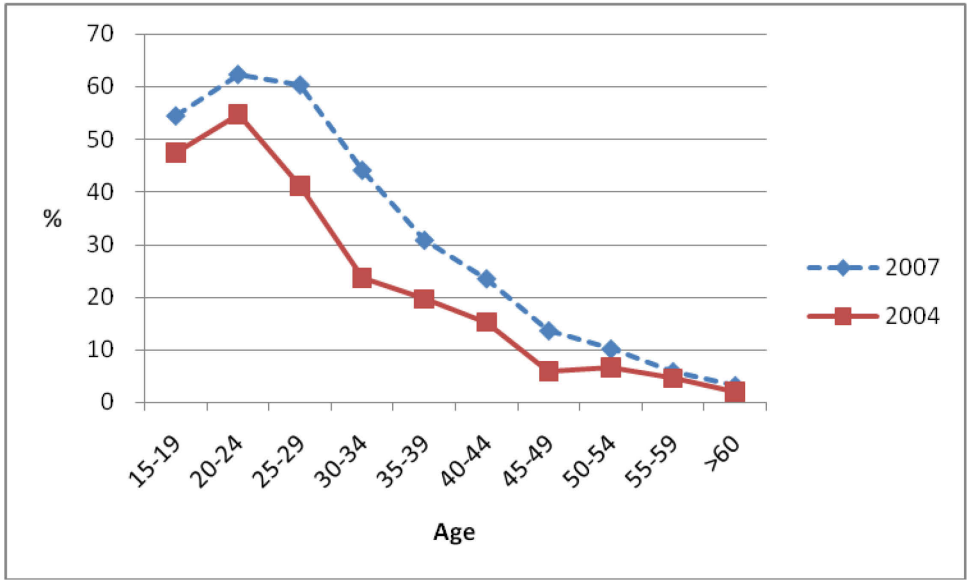

Figure 4 Share of Migratory Male Workers by Age Cohort

Note: Calculated by authors based on the CCAP village surveys. The migratory workers refer to those working outside their home counties.

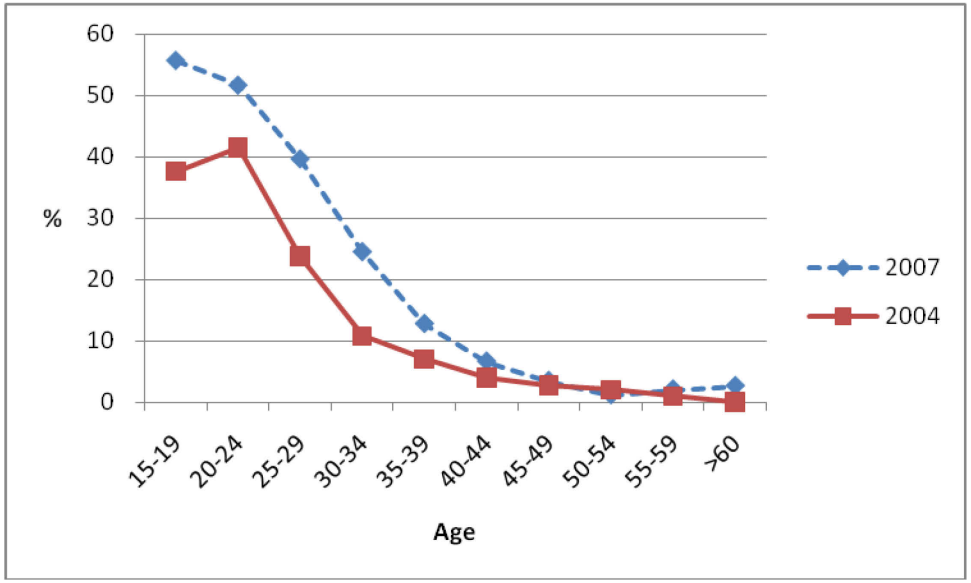

Figure 5 Share of Migratory Male Workers by Age Cohort

Note: Calculated by authors based on the CCAP village surveys. The migratory workers refer to those working outside their home counties.

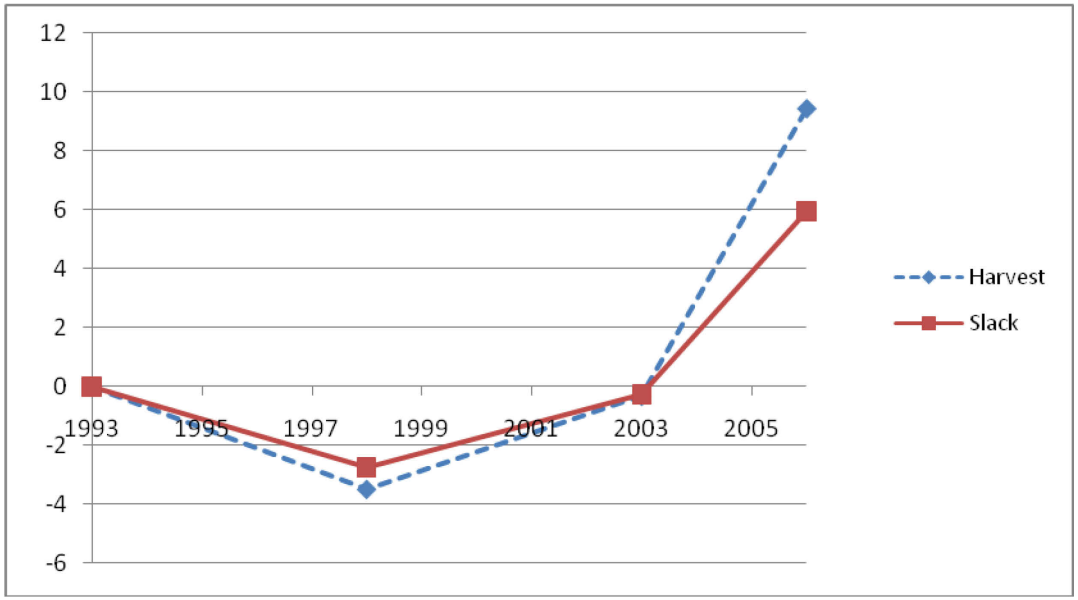

Figure 6: The Coefficients for the Year Dummies in Regressions on Wages in Harvest and Slack Seasons

Note: The coefficients for the year dummies are taken from R3 in Tables 7 and 8.