

Has Cambodia Reached the Lewis Turning Point?

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Abstract:

News and anecdotes of rising migration and episodic labor shortages have raised questions about whether the era of rural labor surplus is over in Cambodia. Using national household survey data, this paper examines the wage trend and empirically assesses whether Cambodia has reached Lewis Turning point at which Cambodia moves from a vast supply of low-cost workers to a labor shortage economy. Our results show that Cambodia has already reached rural Lewis turning point in 2011. This finding suggests that since 2011 Cambodia has faced at least labor shortage in some rural areas. However, we cannot find labor shortage at national level yet. Cambodia could face labor shortage at national level in the near future with the current trend of migration and expansion of both rural and urban sectors. Therefore, Cambodia needs to unleash of labor through mechanization and productivity in agriculture sector and effective labor market coordination. For the next phase of growth, Cambodia will need to switch to a growth model with a more reliance on improving total factor productivity (TFP) and capital deepening rather than just unskilled labor force.

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

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1. Introduction

“The whole country has got this issue (labor shortage); it’s not just us,”

James Sterling, CEO of a construction companies¹

The return of peace and political stability and improved infrastructure over the last two decades has improved rural economy and released a tremendous labor surplus. As a result, a large number of laborers moved from the agricultural to the industrial and service sectors. In fact, Cambodia’s comparative advantage has been based on the mix of large land areas and abundant labor force. As political stability has been maintained, such comparative advantage has played a key role in attracting foreign direct investment and expansion of manufacturing and service sectors. Until recent years, the supply of labor seemed to be unlimited, enabling Cambodia to maintain such comparative advantage in labor-intensive sectors.

However, the “labor shortage” phenomenon has begun to turn up in urban areas and some villages due to migration, sparking intensive media reports in recent years. There have been reports on labor shortages in garments, construction, and in some instances even in some rural areas. For example, the Cambodia Daily Newspaper (2013) reports that the construction sector faces chronic labor shortage due to a recent boom in construction projects throughout the country and workers migrating en masse to Thailand in search of higher wages. Similarly, Phnom Penh Post (2012) reports labor shortage in garment industry, a key urban sector in Cambodia employing around 700,000 workers.

¹ “Construction Sector Faces Chronic Labour Shortage”. April 23, 2013. Cambodia Daily, Phnom Penh.

Anecdotal evidence of such shortage and wage increase was viewed by some as an indication that Cambodia may have depleted a previously vast supply of surplus labor. This view was bolstered by the transitioning demography with more migration to neighboring countries.

However, an alternative view is that rather than lack of labor supply, the labor shortage as reported is a consequence of wage rigidity, lack of labor market coordination inside the country, and labor market segmentation such as immobility and lack of supporting infrastructure to support labor migration. As a consequence, there is co-existence of shortages in urban and booming areas and surplus labor in rural areas with limited connectivity or misinformed of employment opportunities.

There has been serious attention among policymakers whether Cambodia has moved from a period of unlimited supply to an era of labor shortage. Nonetheless, despite the attention and debates, there have been very few serious attempts to investigate this issue apart from some surveys on the labor market in Cambodia. A survey study by Kang and Liv (2012) finds that labor surplus in agriculture is only seasonal because migrant workers return home to farm during the agriculture peak season. Similarly, according to Garment Manufacturer Association in Cambodia (GMAC), garment factories see up to 20% of the workforce, which is about 80,000 workers, head home during agriculture peak season. This phenomenon is not unique to the garment industry but may occur in other sectors such as construction and services.

Against this background, it is both urgent and crucial to determine—on the basis of solid empirical evidence—whether the Cambodia economy has reached the Lewis turning point, a point at which it would move from a vast supply of low-cost workers to a labor shortage economy. Crossing this threshold will have far-reaching implications for

Cambodia and its industrial and labor policies. This finding has important implications both for Cambodia's labor policy as well as its future development.

This paper attempts to fill this gap by examining the wage trend and provide analysis based on Lewis model. Our results show that Cambodia already reached rural Lewis turning point in 2011. This suggests that since 2011 Cambodia has faced at least labor shortage in some areas². However, we cannot find labor shortage at the national level yet. Cambodia could face serious labor shortage issues in the coming years with the current trend of migration and expansion of urban and rural economy, and labor force growth. This finding has important policy implications for Cambodia's future development³. The country could face labor shortage in the coming years if there is no further unleash of labor through mechanization and rising productivity in agriculture sector.

The remainder of the paper is organized as follows: Section 2 provides a brief overview of recent trends in Cambodia's economy and its labor market; Section 3 presents theoretical framework on the labor market in Cambodia; Section 4 discusses the Cambodian labor market in the Lewis conceptual framework. Section 5 presents the empirical framework and estimation results using Cambodian Socio-economic survey; Section 6 concludes, provide policy implications for the labor market development, and suggest further research on the labor market in Cambodia.

2. Cambodia's Economy and the Labor Market Context

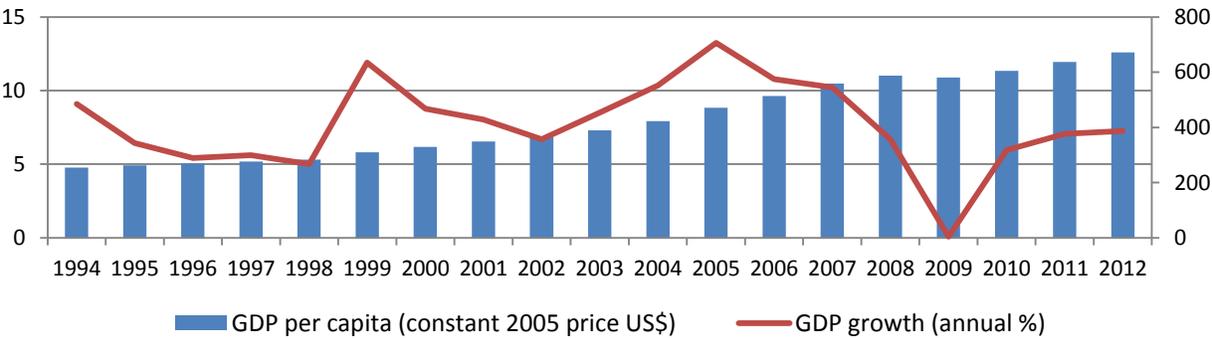
² To confirm the finding, the team has also conducted realty check by visiting Takeo, Kompong Cham, and Mondulkiri.

³ It should be noticed that with large area of Economic Land Concession, a large area of northeastern part of Cambodia has been converted to mass rubber plantation. Within the next few years, these rubber plantations are expected to yield, which then would need an additional half a million workforce (MAFF 2013 data).

Cambodia has an impressive economic performance over the past decade. The average annual growth rate between 1999 and 2008 was around 10 percent (Figure 1). After the abrupt output drop during the global financial crisis in 2008-2009, the economy has recovered and the annual growth rate between 2010 and 2012 was around 7 percent. By 2011, Cambodia’s GDP per capita and GDP is three times of that in 1994.

The rapid economic growth over the last decade has been largely driven by four sectors: garments, tourism, construction, and agriculture. As can be seen in Figure 2, industry is the fastest growing sector as its contribution to GDP has been constantly increasing. In 2011, industry expanded by around 13.9 percent. Growth in this sector is driven by manufacturing (garments and footwear) and construction. The garment sector is Cambodia’s the main source of foreign exchange income and employs around 700,000 workers, mostly women. It accounts for around 80 percent of Cambodia’s total export and has been growing at an average of 28 percent a year.

Figure 1: Cambodia’s GDP and growth



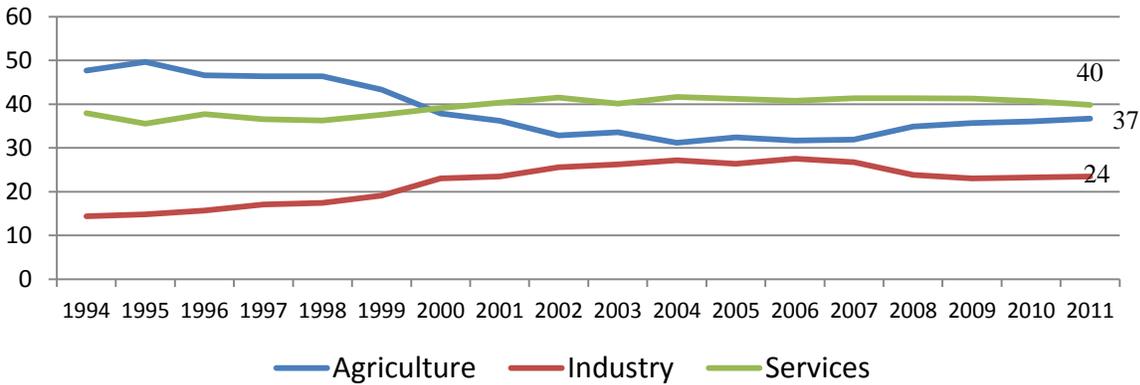
Source: World Bank data

The service sector had been growing at around 10.5 percent per annum over the period 1999-2008. This sector was largely by driven by tourism, and recently by the financial sector. Transport, telecommunication, and hospitality (hotels and restaurants) have also

been growing in tandem with the tourism boom. The agricultural sector, which contributes one third of the economy, has an average annual growth of 5.1 percent over the last five years. Agricultural sector remains an important part of the Cambodia’s economy as it remains the biggest employer.

Overall, the growth is based on a narrow economic base: mainly the garment, tourism, and agriculture. The comparative advantages of these main sectors are largely based on a mixture of abundant land and low-cost workforce. Similar to agriculture, the garment sector is largely low-end garments and some footwear, with no broad diversification to more complex garments. Tourism still concentrates on a few destinations.

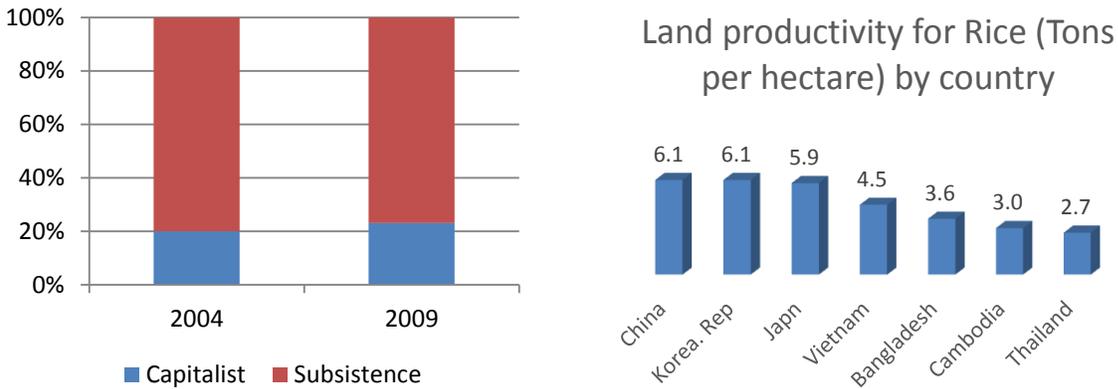
Figure 2: Share of GDP by Sector (percentage of GDP)



Source: World Bank data (April 2012)

Cambodia's rural economy is characterized as a dual-sector economy, overshadowed by a large subsistence sector as can be seen in Figure 3. Low productivity in agriculture is a combination of low labor productivity and land productivity. The agriculture is characterized by low rate of machinery and low employment per hectare of cultivated land. In Cambodia, the employment per hectare is 1.58 and the number of tractors per 100 sq.km of arable land is 21, which is low as compared to neighboring countries.

Figure 3: Economic Structure and Land Productivity

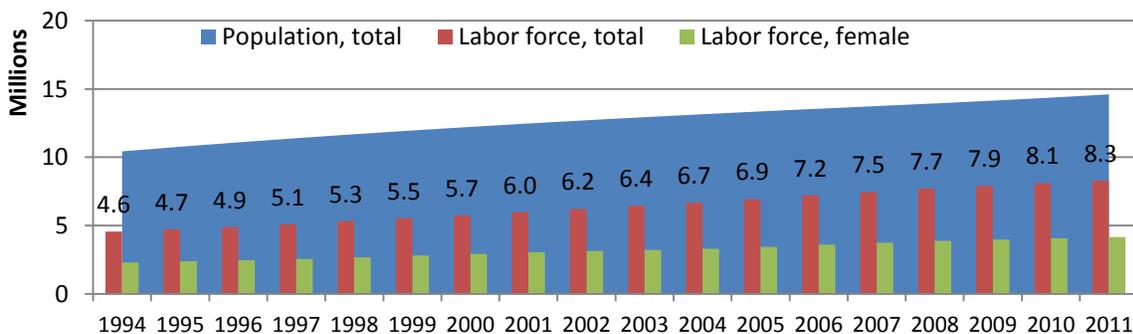


Source: Cambodia Socio-Economic Survey and World Development Indicators.

Labour Force

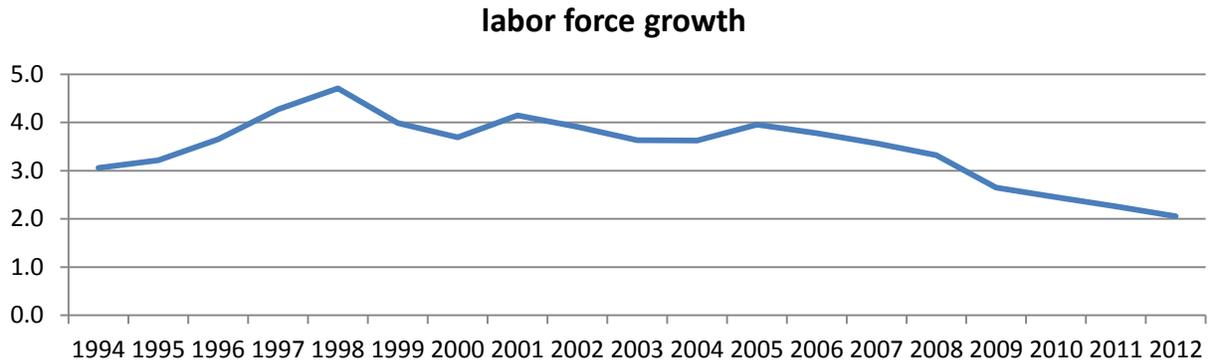
Cambodia’s population in 2012 is 14.6 million and the active labor force is around 7.5 million (Figure 4). Three quarters of them, about 2.5 million people, are youth aged 15 to 29. 300,000 young people enter the workforce every year. The labor force growth was around 4% on average between 1998 and 2007. However, the growth rate started to decline and dropped to 2% in 2012 (Figure 5). Most of labor is still engaged in agriculture which employs 56% of total labor force (Figure 6). Rural sector is dominated by agriculture while urban sectors are largely manufacturing and service sectors (Figure 7).

Figure 4 Population and labor force



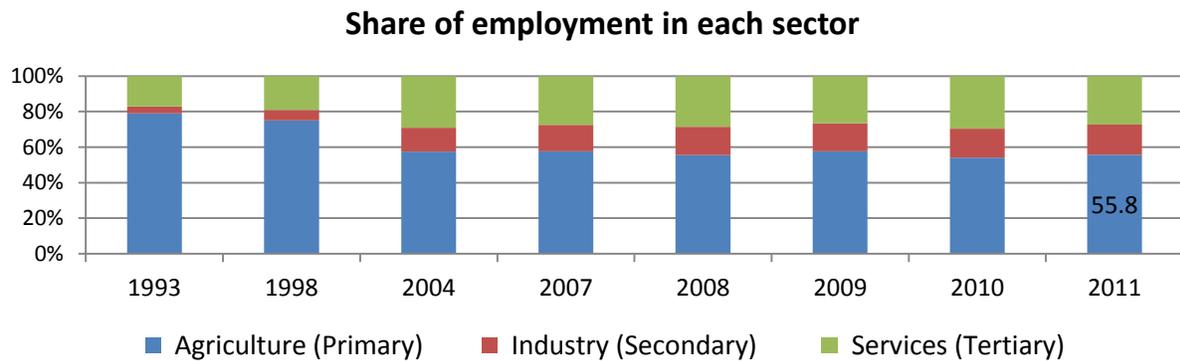
Source: World Development Indicators

Figure 5: Labor force growth in Cambodia



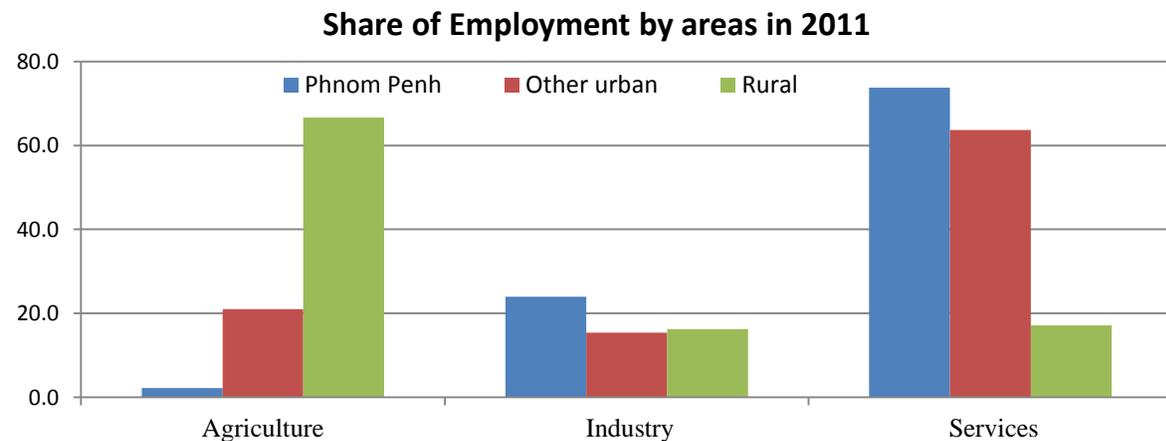
Source: World Development Indicators

Figure 6: Employment in each sector



Source: National Institute of Statistics, 2011.

Figure 7: Employment in each Rural and Urban sectors



Source: National Institute of Statistics, 2011.

Based on 2011 CSES, self-employment workers include own account worker, unpaid family worker, and others. They represent about 77% of the total labor in the economy. This largely reflects the prevalence of the informal economy in Cambodia. Table 1 shows the structure of Cambodian labor force. In our study, we pay attention to the wage trend of this group and the employee.

Table 1: Share of Employed Persons

Employment Status	Number	Percent
Employee	1,890,740	22.78%
Employer	24,900	0.30%
Own account worker	4,345,050	52.35%
Unpaid family worker	2,031,840	24.48%
Other	8,300	0.10%
Total	8,300,000	100%

Source: Author's calculation based on CSES 2009 and 2011.

There has been a clear trend of youth moving from agricultural sector in rural area into low-skilled urban manufacturing industries such as garment and construction sectors (CAMFEBA, 2008). These have been the sectors that can absorb labor surplus from rural area without significant skill requirements. Garment sector mainly female workers while construction largely absorbs male workers. In addition, there have also been outflows of labor force, largely women, to foreign countries such as Malaysia, the republic of Korea, Saudi Arabia and Thailand. The labor flows are well documented in the literature on migration. Therefore, to understand the dynamics of labor flows, it is also important to observe the pattern of migration.

Migration

“For us, we had a very amazing team...and we’ve trained them for many years. But now they’ve all left and gone to Thailand,”

James Sterling, A construction company⁴

The Cambodian population is on the move. While Cambodia remains predominantly an agrarian country, enormous numbers of people have been streaming into Phnom Penh, the country’s capital city and their neighboring countries. The prospect of higher incomes and better educational opportunities in the cities has induced increasing levels of migration, especially among youth. In other words, in urban areas, there are schools and opportunities for degrees that can move people into higher socio-economic positions. It can also assist their families back in rural areas who may receive remittances that can move them out of poverty. Youth migration from rural to urban areas is both a factor and a result of growth and development.

The real picture of labor migration, however, may be more difficult to quantify. Half of rural out-migration is to Phnom Penh, and international migration makes up a surprisingly large percentage. Most migration is labor-related and the vast majority of international migration is to Thailand (MOP 2012). According to CSES data, in 1998, one in every 20 Cambodians lived in the city of Phnom Penh. In 2012, it is one in 10. There have also been large flows of out-migration to neighboring countries, estimated at around 60,000 people. In total, about 500,000 legal and illegal workers are estimated to be in Thailand so far. Latest figures from Cambodian ministry of labor indicate that the number of workers migrating abroad legally has more than doubled over the last few years: from 53,160 in 2009/2010 to 130,000 in 2012.

⁴ Cambodia Daily (2013).

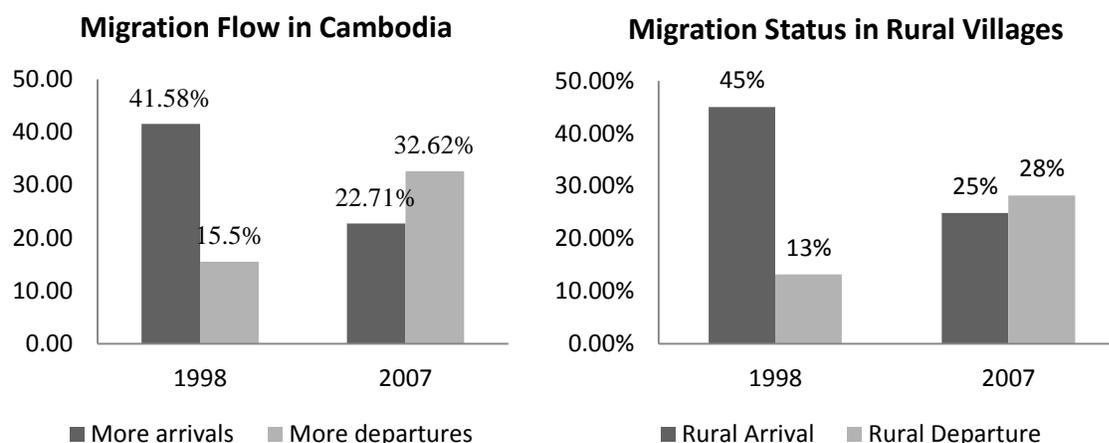
Despite steady economic growth, many Cambodians, especially young people, struggle to find jobs, which have driven the rise in migration to other countries for work. While Thailand has long been one of the most popular destination countries for Cambodian workers (followed by Malaysia and Korea), the numbers are steadily rising as a result of the Thai government’s introduction of a new minimum wage of 300 *baht* per day (\$10), compared to 18,000 *riel* (\$4.50) for unskilled laborers in Cambodia.

Table 1a: Selected Rural Migration Statistics for Cambodia

	Out-migration	In-migration	Net migration
Average rate	48.1	8.1	-40.0
Standard deviation of the average rate	46.4	18.7	51.2
Median rate	32.7	4.6	25.8
Largest population flow from a single village	-600	+352	-590

Source: CRUMP, MOP (2012)

Figure 7a: Migration Flows and Status

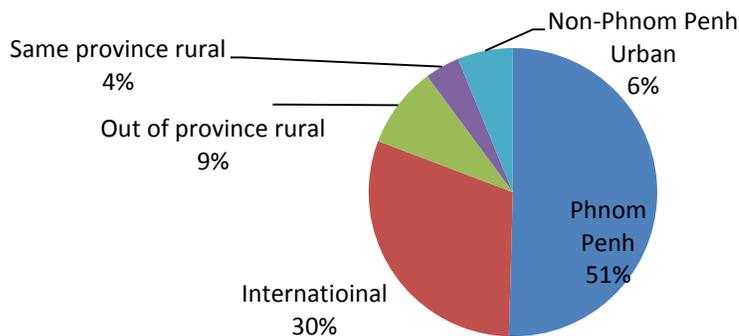


Source: CSES (1998, 2007)

According to National Institute of Statistics figures, about a quarter of the total Cambodian population is internal migrants: people who have moved from their district of origin for at least three months. As can be seen in table 1.3, the average out-migration rate per population of 1,000⁵ is 48.1, which is to say that an average of 4.81% of the population of the village moved out within a single year. The average in-migration rate per population of 1,000 is 8.1. There is also quite wide variation around these means, as we can see from the standard deviations. Also shown are the median rates and the single largest flow of population out of a village and into a village. One village lost a total of 600 persons in a year, while another gained 352.

The net-migration rate is simply the in-migration rate minus the out-migration rate. The average net-migration rate per 1,000 is -40.0. On average then, rural areas lost 4% of their population in a single year. This is a truly astounding rate of population loss. Remoteness and lack of facilities encourage out-migration (CRUMP 201). While population momentum has maintained some growth in rural areas, 90% of villages have experienced a fall in population due to out-migration.

Figure 8: Destination of migration



Source: CRUMP, MOP(2012)

⁵ CRUMP, MOP (2012)

As can be seen in figure 8, half of migrants out of rural areas move to Phnom Penh while another 30 percent leaves the country. Rural to non-Phnom Penh urban migration is about 6%. In other words, rural to urban migration is about 57% and rural to rural migration is about 13%.

Based on the CSES data, the following Table 2 shows the change of migration pattern from 1998 to 2007, the episode of rapid economic growth in Cambodia. Large outflow of labor force increase rapidly due to the 10 years economic boom and the growth of export oriented manufacturing sector in 2007 where many workers migrated to urban areas, seeking job in the garment sector. The table shows that amid the population growth, urban population has increased by 47% while rural population increased by just 12%. This captures the trend of workforce flows from rural to urban areas. Nonetheless, 80% of the population is still living in rural areas.

Table 2: Overview of rural and urban population in Cambodia 1998-2008

Rural population 1998	9,626,510
Rural population 2008	10,781,940
Percent change in rural population	+12%
Urban population 1998	1,786,030
Urban population 2008	2,619,270
Percent change in urban population	+46.7%
Percent of Cambodia classified as rural in 1998	84.4%
Percent of Cambodia classified as rural in 2008	80.5%

Source: CSES 1998, 2008.

In addition, the labor force in Cambodia has a number of characteristics. First, domestic migrant workers continue to return during the agriculture peak season to help on the farm. Workers choose to return to farm partly because it is an obligation and partly

because of insufficiently attractive wages in other sectors. The garment sector also sees up to 20% of the workforce (about 80,000 workers) returning home during the agriculture peak season (GMAC 2011).

Second, there are skills shortages and mismatch in Cambodia (see, for example, ADB 2009; CAMFEBA 2008; HRINC 2010; World Bank 2012). Most young Cambodians do not have the right skills for the job market, especially practical and technical skills. Furthermore, work attitude, communication, teamwork, and problem-solving are among the major issues in the current labor market. The causes of Cambodia's skills shortage and mismatch appears to be largely caused by the combination of growing demand for skills and the limited capacity of secondary education systems in providing skills with adequate quality and industry relevance. As a consequence, skills shortages are hindering Cambodia's development (ADB Economic Outlook 2012).

3. Conceptual Framework and Literature Review

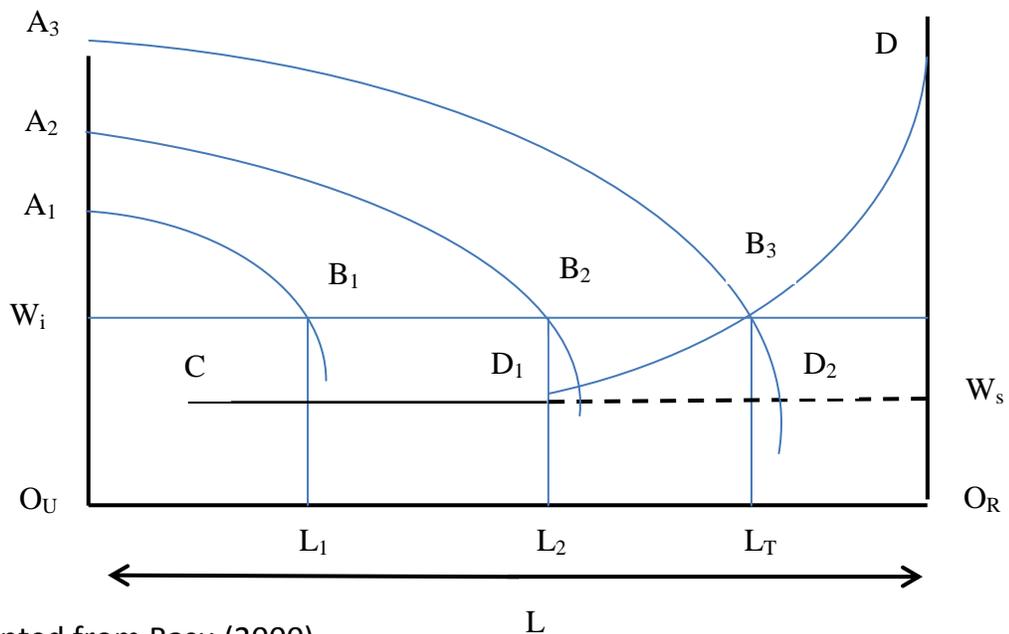
The balance of labor demand and supply usually shifts when a society moves from an agrarian to an industrial economy. The Harris-Todaro (1970) model focuses specifically on rural to urban migration, by introducing the idea of income differentials between rural and urban areas. It thus focuses on the decision to move on the balance between what one could be expected to earn in one area as compared to another. In this sense, the labor flows are pushed by lower income and pulled by an expectation of higher income.

Based on the historical experience of developed countries, Sir Authur Lewis (1954) first conceptualized the process of labor flows and economic transformation. In the initial stage of development, most people remain in rural areas, being engaged in agricultural

production. When this concentration of workers leads to underemployment in rural areas, the industrial sector can expand and absorb more labor 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 when the supply of labor from the agricultural sector becomes limited, industrial wages begin to rise quickly. In the literature, the structural change from an excess supply of labor to one of labor shortage is often called the Lewis turning point.

The following figure 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, let us 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, w_s . In the industrial sector, however, wage w_i is higher for several reasons: higher cost of living in cities, where most industrial activity occurs, and psychological cost of separation from their families (Lewis 1954).

Figure 9: Conceptual model of the Lewis turning point



Source: Adopted from Basu (2000)

L is the total size of the labor force, with O_R representing origin in the rural sector and O_U origin in the urban sector. The curve CD represents the marginal product of labor in the agricultural sector, being flat to some extent. 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 categorized 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_UL_1 , whereas the rural labor force is represented by O_RL_1 at the subsistence wage level (w_s). 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 (w_s), and the urban wage remains constant at w_i . 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 (w_s); 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 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 framework offers some insights into the investigation on the Lewis Turning points. Many studies have applied the framework to assess the labor market conditions. For instance, Xiaobo et al. (2010) applied this Lewis framework to assess the labor shortage in China. Mitali and Papa (2013) uses the Lewis model to assess when the transition to a labor shortage economy is likely to occur in China. Similarly, based on the framework, Jan (2007) examine the labor market condition in the EU new members state.

4. Cambodia and the Lewis Turning Point

"The employers can overcome the labor shortage crisis if they pay their workers more; it's a case of labor market competition",

A Senior Official of Government of Cambodia⁶.

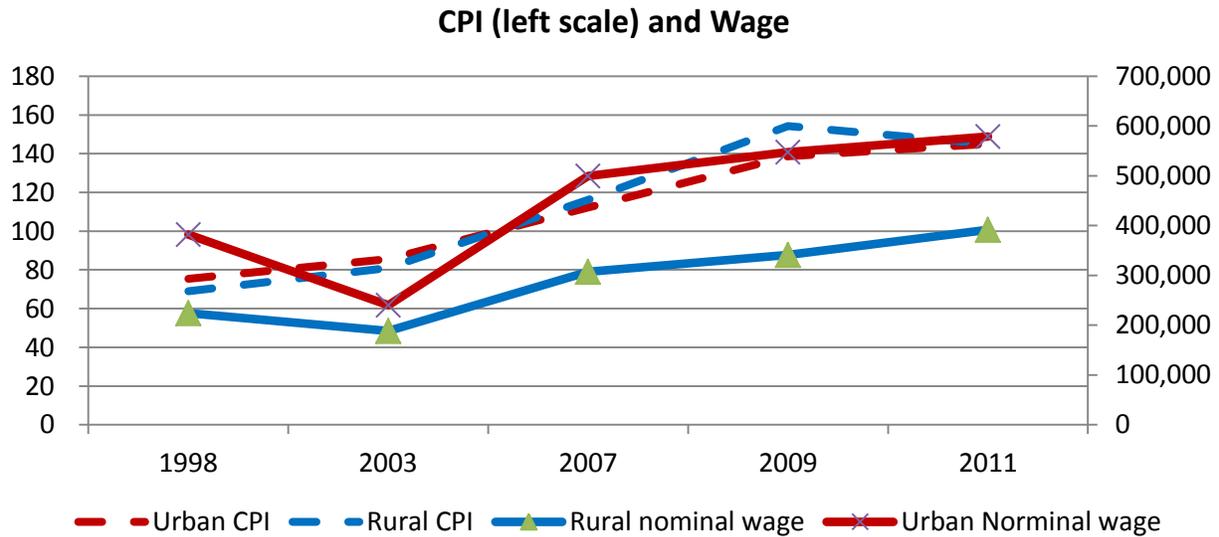
In many ways, Cambodia's economic development echoes Sir Arthur Lewis' model, which argues that in an economy with excess labor in a low productivity sector (i.e., rural agriculture in Cambodia), wage increases in the industrial sector are limited by wages in agriculture, as labor moves from the farms to industry (Lewis, 1954).

Wage is a good barometer for testing the Lewis Turning point, to assess the Lewis Turning Point in Cambodia, we need to examine the wage performance in both rural

⁶ Phnom Penh Post (2008).

and urban areas. The following section will provide analysis on this framework and the real wage performance in Cambodia.

Figure 10: Nominal Wage and Inflation



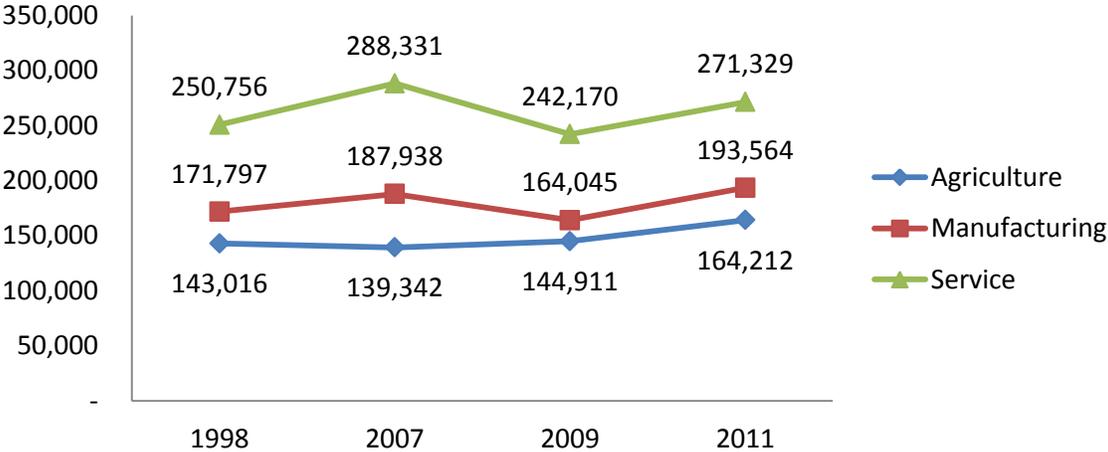
Source: CSES

Figure 10 shows the trend of nominal wages and CPI in rural and urban areas. Overall, rural and urban nominal wage has increased over time since 2003 after the drop from 1998 to 2003. However, rapid inflation has also been observed at the same time, especially between 2003 and 2007, which erodes the purchasing power of the earning. CPI in 2007 is 43% and 31% higher than the 2003 CPI in rural and urban areas respectively. Compared to 1998, the nominal wage in urban areas and rural areas in 2011 is 52% and 75% higher respectively.

It is appropriate and important to look at real wage trend in the key sectors. Figure 11 shows the trend of real wage rate by sector of economic activities. Wage in services sector is the highest, followed by those in manufacturing and agriculture. This trend is

consistent with the Lewis conceptual framework which argues that wage in urban sector such as manufacturing and service is higher than that in rural sector (Agriculture)⁷. The real wage in service sector increased 15% from 1998 to 2007, but dropped by 16% from 2007 to 2009 due to the crisis. Such large drop reflects the Cambodia’s vulnerability to external shocks, especially in key service sector such as tourism⁸. At the same time, real wage in manufacturing sector has almost not changed between 1998 and 2011, increasing by just 9% between 1998 and 2007 and by just 3% between 2007 and 2011. In fact, it slightly dropped in 2009 before bouncing back in 2011. As manufacturing sector concentrates in urban areas, this trend suggests that there has been small pressure on urban wage increase in real terms. This means that in 2011, Cambodia has not reached Point Lewis turning point B₃ (labor shortage at national level) in the Lewis model discussed above.

Figure 11: Average real wage by sectors of economy



Source: Authors calculation based on CSES (1998, 2007, 2009, 2011)

Most important to our analysis is real wage in agriculture, which is equivalent to rural wage in the Lewis conceptual framework. Real wage in agriculture was almost constant

⁷ Real wage by urban and rural, and by male and female can be seen in Figure A1 and A2 in the Appendix.

⁸ Amid significant contractions in garments, tourism, and construction, agriculture witnessed good harvests in 2009.

between 1998 and 2009, which is similar to line CD_1 in the Lewis Framework. This pattern suggests that there was still labor surplus in agriculture in 2009. Nonetheless, the real wage in agriculture experienced moderate increase by 23% in 2011 as compared to real wage in 2009. This increase signals a new paradigm of labor scarcity, although not labor shortage at the national level yet.

The real wage in agriculture is still 9% below wage in manufacturing sector. In this regards, based on the Lewis Framework, in 2011 Cambodia is still in phase 2 (B_2B_3 area) as can be seen in Figure (9). This suggests that Cambodia has passed partial Lewis Turning Point since 2011. In other words, Cambodia is already facing labor shortage in agriculture sector. However, the evidence based on the data 2011 data shows that Cambodia has not faced labor shortage at national level yet in 2011⁹. Cambodia can still afford labor supply to urban sectors as long as the real wage in urban sector is significantly higher than rural wages. But that labor surplus will not last long unless there is improvement in productivity in agriculture to unleash more labor surplus.

By examining the evolving patterns of migration and wage in rural areas, the trend confirms that since 2011, a scarcity of labor has emerged in rural areas. But this analysis could suffer from three drawbacks. First, the wage increase of agriculture and manufacturing in recent years can reflect an adjustment from a previously low wage level. Second, the ongoing mechanization and other labor-saving technologies can release labor from agriculture and enlarge the labor surplus. In this regard, researchers and policymakers may not be able to reach a consensus as to whether the excess of rural labor has been exhausted. In addition, systematic wage statistics for SMEs and other informal types of employment are also lacking.

⁹ To connect to the current labor market conditions, the authors have visited some villages to confirm the findings. The daily wages of those surveys are listed in the appendix.

To confirm our findings above, we further conduct empirical investigation using the CSES data¹⁰. To our knowledge, this is one of the first quantitative empirical studies based on the long term wage data to analyze the Lewis turning point in Cambodia. As shown in the conceptual framework, it is possible to test the Lewis turning point using rural wages.

5. Empirical Investigation

As discussed in the conceptual model in section 3, a shortage of rural labor should be reflected by an increase in real wages. A national labor shortage eventually tends to trickle down to rural areas. Therefore, examining the evolving patterns of real wages in rural areas should help to reveal whether Cambodia has reached the Lewis turning point nationwide.

5.1 Methodology

To investigate urban and rural wage trends, this study employs multivariate regression method at both aggregate level and individual level. The regression method is used because it allows the study to capture main factors that may contribute to increasing wage rate.

Following (Xiaobo, Jin, & Shenglin, 2010), real wage is regressed on education, land ownership, and infrastructure as specified in the following equation (1). To ensure robustness of the results and normal distribution of real wage and to reduce the skew

¹⁰ The issues of labor shortage have been discussed in several countries such as Japan (Watanabe, 1994), Korea (Park, 1994), Thailand (Pracha, 1994), and Bangladesh (Xiaobo, et al., 2013).

effect of the income distribution as guided by the literature, logarithm of real wage is regressed on all explanatory variables in equation (1)

$$\begin{aligned} \lnrwage_i = & \beta_0 + \beta_1 viledu_i + \beta_2 percapita_land_i + \beta_3 d_urban_i + \beta_4 infra_i \\ & + \beta_5 d_2007_i + \beta_6 d_2009_i + \beta_7 d_2011_i + \varepsilon_i \end{aligned} \quad (1)$$

where *lnrwage* is monthly village's average real wage in its logarithm. *viledu* is village's average education level which is intended to capture the impact of education on real wage at village level. *percapita_land* is average land owned per-person in each village. *d_urban* stands for dummy for urban which equal 1 if the villages is classified as urban village and 0 otherwise. *infra* is a variable that is used to capture the level of development of local infrastructure. *d_2007*, *d_2009*, *d_2011* is dummy for year 2007, 2009 and 2011. Noted that the based year is *d_1998* which is excluded from equation (1) to avoid dummy trap. Subscript *i* stands for village. It should be noticed that due to the nature of the CSES data, panel data regression cannot be used.

Education

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 education level. In this paper, the number of high school completion is 12 years, secondary school is 9 years and primary school is 6 years. The average year of school is calculated as: average year of school = (labor force with high school education x 12 + labor force with secondary school education x 9 + labor force with primary school education) / total labor force. Labor force is defined as workers who are older than 15 years¹¹. In most of the literature, education plays an important role in producing human capital, (Schultz, 1964), and thus is expected to positively affect real wage.

¹¹ The age criteria for adult labor force are based on International Labor Organization (ILO)'s definition and it is consistent with the definition of Cambodia socio-economic survey (CSES).

Land Ownership

Land ownership, measured by average size of land per capita, is an important asset for most of the poor in the rural area. People with more land ownership are less likely to migrate to the city, resulting in available labor in the village. Therefore, more land ownership may negatively affect the real wage. On the contrary, more land ownership may positively affect the real wage, if more workers are demanded for agriculture's production and plantation. In the context of Cambodia, as rural area is occupied by most poor people whose own small plot of land, the increase in the ownership may reduce the migration.

Infrastructure

Infrastructure plays an important role in attracting investment and labor flows from other provinces. But it can also facilitate labor outflows. People living in location with good infrastructure may have less incentive to migrate to other areas to look for jobs. However, good connectivity can also encourage labor outflows if the wages in other areas are higher. In this regard, the level of infrastructural development can affect wage. Urban areas usually have better infrastructure than rural areas and thus tend to have higher wages than rural areas.

In this study, due to limited data availability, the number of schools in the province is used as proxy for the development of local infrastructure. This proxy has some limitations as the school statistics is available at provincial level, not at village levels; therefore it is invariant across villages within the same provinces. However, it varies across provinces, which captures the difference of infrastructure development across the province. Despite this limitation, this proxy is still the best proxy, given the lack of available data.

Year Dummy

The year dummy variable is added to the regression equation to capture the trend of average real wage over the years after controlling for the effect of other explanatory variables. By using dummy variable for years, we take account of effect of time on distribution of real wage. In this paper, the 1998, 2007, 2009 and 2011 Cambodia Socio-economic survey (CSES) data are used. Years 2007, 2009, and 2011 are used to reflect the recent wage trends.

Urban/Rural Dummy

To capture the difference between rural and urban areas, the dummy for rural and urban is also included in the regression. This variable equals 1 if the village belonged to the urban area and 0 otherwise. For a number of reasons, the wage in the urban areas is expected to be higher than that in the rural areas for a number of reasons. First, the cost for living in the city is higher than that in the rural. In this regards, wage rate must be higher to reflect this higher living cost. Second, when workers migrate from rural to urban area, they have to incur risk and cost of separation from their family. Thus, wage rate in the urban village is expected to be higher than that in the rural one as explained in the framework of the Lewis two- sector model.

To check the robustness of the result and to account for other variables such as gender and age, the regression at the individual level is also applied to identify the trend of real wage over the years. Key variables such as education, gender, rural/urban, land ownership, and infrastructure are controlled in the regression. In addition, the dummy for sector (agriculture, manufacturing and services) is also controlled to capture the wage difference among sectors. The estimated equation is based on Mincer's equation which is conventionally applied in the field of labor economics:

$$\begin{aligned} \lnrwage_i = & \alpha_0 + \alpha_1 education_i + \alpha_2 sex_i + \alpha_3 age_i + \alpha_4 land_i + \alpha_5 d_urban_i \\ & + \alpha_6 infra_i + \alpha_7 d_manu_i + \alpha_8 d_serv_i + \alpha_9 d_2007_i + \alpha_{10} d_2009_i \\ & + \alpha_{12} d_2011_i + \varepsilon_i \end{aligned} \quad (2)$$

where *rwage* and *lnrwage* are real wage and its logarithm respectively. *education* is education level of worker. *sex* equals 1 if the worker is male and 0 if the worker is female. *age* captures the level of experience of worker. *land* is the total land owned by the family of the workers. *d_urban* is dummy for urban and it equals 1 if person live in urban village and 0 otherwise. *infra* stands for infrastructure. *d_manu* and *d_serv* are dummy variables for manufacturing and service sector respectively. Finally, *d_2007*, *d_2009* and *d_2011* are year dummy for 2007, 2009 and 2011. The dummy year 1998 is used as the base year.

Sex and Age

Male is expected to earn higher wage than female. Especially for the case of least developed countries such as Cambodia. The reason is that men are able to migrate to work in other areas without much difficulty. Also, women are usually engaged in unpaid housework.

Age is variable that capture the seniority of worker. Old people tend to have more experience in the work than young people¹².

Other explanatory variables such as ***Education, land, d_urban, infra, d_2007, d_2009 - d_2011*** are expected to have similar sign as regression in equation (1).

¹² Adding the square of age to the equation to capture the effect of threshold does not affects the results because the coefficient of the square of age is not statistically significant and is close to zero.

5.2 Data

The data in this study comes from Cambodia socioeconomic economic survey (CSES) which is collected by the National Institute of Statistics (NIS). CSES used in this study comprise of CSES 1998, CSES 2003, CSES 2007, CSES 2009 and CSES 2011.

The main objective of CSES is to collect statistical information about the living conditions of the Cambodian population and the extent of poverty. CSES is a household survey that interviews both household head and household members. CSES includes several modules on various topics related to living conditions of household and its members such as housing conditions, education, economic activities, household production and income, household's level and structure of consumption, victimization, and others. CSES covers 24 provinces and thousands of villages in Cambodia. It includes both urban and rural villages in all provinces and this feature matches with the objectives of this study.

In total, 1795 villages are included in this study. 37% of the villages including in the sample is urban villages and 63% of the village is rural villages. See the Table A1 and A2 in the appendix for the number of observations and summary statistics for the main variables used in the village level regression analysis.

To check the robustness of the results, we also conduct econometric analysis at the individual level. In total, 11,956 individuals are included in the analysis. The observation number at individual level can be seen in Table A4 and A5 in the Appendix.

5.3 Results of Regression

Our purpose in this empirical investigation is to check whether the coefficients for the year dummies confirmed the trend to those exhibited in the previous section after controlling local factors. We applied multivariate regression with robust standard errors to account for potential heteroscedasticity.

Table 4 shows the regression results at both at village and individual level. For robustness check there are utilize a number of specifications. In specification 1, logarithm of real wage is regressed on the average number of years of schooling, size of land owned, dummy of urban/rural, infrastructure proxies by the number of schools in the provinces and year dummy. Specification 1 uses both urban and rural sample with urban dummy while specification 2 uses only rural samples. In the individual level regression, data on 2003 is dropped as the code in the survey is different from the CSES in other years. To make the comparison between village level and individual level more comparable and consistent, the village rural model 2 also drops the data in year 2003. Nonetheless, such drop does not affect our analysis as we are more interested in the trend in recent years. Our main interest is in rural wage trend. Therefore, we mainly focus on model 2 and 4 in Table 4. We observe that in all models, R-square is relatively low, which is appropriate for cross-section micro-data¹³.

The result shows that real wage in urban is higher than that of rural villages. Average real wage in the urban village is about 35% higher than that of rural villages¹⁴. On the other hand, being a worker in urban villages earns average wage 18% higher than those

¹³ R-square can be expressed as $\bar{R}^2 = 1 - \left(\frac{SSR}{SST}\right) * \left(\frac{n-1}{n-k-1}\right)$ where SST is total sum of square in dependent variables and SSR is residual sum of square. There are more variation of value than macro-data, thus SST in micro-data is smaller than that of macro-data. See for example, Cameron and Trivedi (2009).

¹⁴ The real wage derived by deflating nominal wage $W_{t_{pu}}$ by $CPI_{t_{pu}}$ where t is the year, p is province and u refers to village that is located in urban/rural region of the province.

in rural villages. As can be seen in individual results, men on average earn 12% higher wage than women do.

The average year of schooling is statistically significant in all regression. This implies that higher labor force with higher education positively increase real wage rate in the village. Overall, one unit increase of average year of schooling of labor force in the village increase real wage rate by about 2%.

Land is not statistically significant in the regression results. This explains the ambiguous effect of landownership on real wage at village level. As discussed earlier, the increase in ownership of land may reduce the out-migration flows and thus negatively affect the wage in the village as sufficient labor is available in the village. However, productive land ownership may also increase the demand for labor and thus increase real wage.

The coefficients of local infrastructure are all statistically significant in all regressions. However, the effects are economically not very significant. As discussed earlier, this might reflect the ambiguous effect. On the one hand, the infrastructure can positively affect the wage rate in the village because good infrastructure attracts investment, reduce labor out-migration, and attract labor flows from other areas. Nonetheless, if there is a wage gap with other areas, good infrastructure can make it easier for labor to flow out of village, reducing the labor availability in the village.

In all models, the results confirm that wage in urban sector is higher than that in rural sector. In model 3 and 4, the results reveal that average real wage in manufacturing and service sector is higher than that in agriculture sectors. Average real wage in manufacturing sectors, on average is around 15% higher than that of agricultural sector. Average real wage in service sectors is around 18% higher than the average real wage in

agricultural sectors. These results are consistent with most of the literature that wage in urban sectors are higher than wage in rural sectors.

The coefficients of our interest are those of the dummy year variables. In all regressions both at village and individual level, the dummy year coefficients are statistically significant. The coefficients show increasing wage trend in 2007 and 2011. There is a drop or less increase in wage in 2009, confirming the impact of global financial crisis to wage in Cambodia¹⁵.

The increase in real wage rate from 1998 to 2007 reflects the period of economic boom after the countries return to peace, public and private investment, growth of export oriented sector such as garment, tourism, and construction. However, despite of 1998-2007 economic growth at around 10% a year, the real wage has not increased as much. In addition, hitting by the impacts of global economic crisis in 2009, the coefficient of year 2009 is relatively small or even negative for individual-level regression. However, as the stability returns, the country's wage started increasing again. It should be noted that rural village is severally hit, with coefficient of year 2009 being only 0.07. This reflects the vulnerability of the sector to economic shocks.

Essential in assessing the Cambodia has passed the Lewis turning point is the significant increase in rural wage increase in 2011. Indeed, the increase may have compensated the drop in 2009, but it is even higher than the wage level in 2007, which should be the peak.

¹⁵ The data in year 2003 in both village level and individual level regression is excluded because the code for that year is difference from other years. Moreover, by dropping the data in year 2003, the comparison between individual and village level is more consistent and comparable. Also, we focus on wage trend in recent year only.

Table 4: Regression Result for Village and Individual level's data

	Village level		Individual level	
	(1)	(2)	(3)	(4)
	lnrwage (all)	lrwage (rural)	lnrwage (all)	lnrwage (rural)
education	0.02*** (4.48)	0.01 (1.23)	0.02*** (5.12)	0.01*** (2.84)
Sex			0.12*** (10.19)	0.12*** (9.89)
age			0.00*** (5.20)	0.00*** (3.48)
Land ⁺	0.00 (0.52)	0.00 (2.24)	0.00 (-2.77)	0.00 (0.38)
d_urban	0.35*** (15.51)		0.17*** (10.51)	
infra	-0.00*** (-7.25)	-0.00*** (4.18)	-0.00*** (3.92)	-0.00** (2.06)
d_manu			0.15*** (10.08)	0.14*** (9.22)
d_serv			0.19*** (9.65)	0.17*** (8.59)
2007	0.24*** (6.85)	0.22*** (5.37)	0.06*** (2.69)	0.10*** (3.69)
2009	0.12*** (4.59)	0.07** (2.20)	-0.04** (-2.17)	-0.03* (-1.62)
2011	0.30*** (10.20)	0.27*** (7.40)	0.14*** (6.89)	0.16*** (7.29)
Constant	11.83*** (271.59)	11.88*** (272.86)	11.55*** (378.56)	11.60*** (377.88)
N	1713	1049	6571	4813
adj. R ²	0.27	0.08	0.16	0.09
AIC	1672.41	592.77	8155.75	4796.77

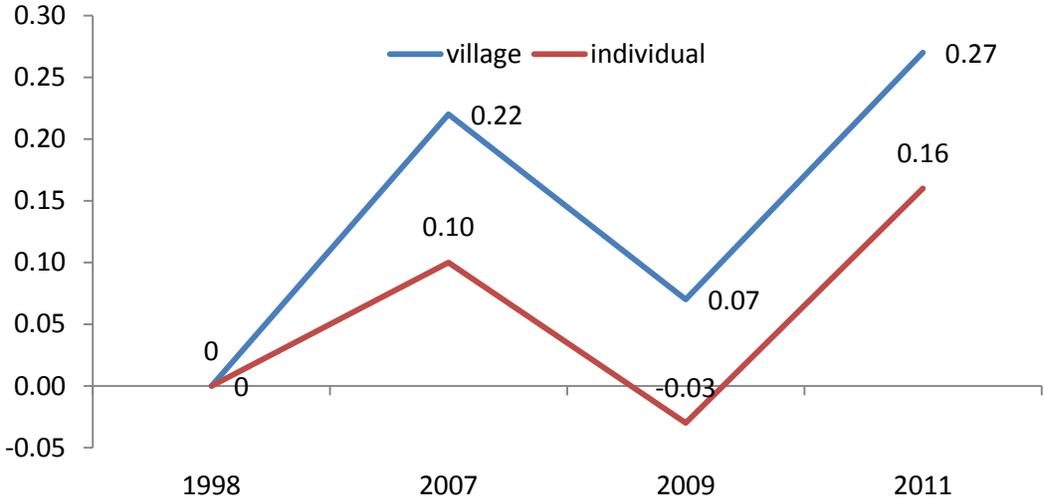
Notes: *t* statistics in parentheses and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

⁺ Land pc for the village level regression.

For better visualization of the temporal pattern, Figure 12 plots the coefficients from regression results at village and individual level. After controlling for a variety of factors, the figure show significant increase in real wage from 2009, especially wage in rural sectors. This trend indicates the arrival of the partial Lewis turning point. Again, this suggests that Cambodia may be facing labor shortage in rural areas, although not at national level yet in 2011. The real wage, however, started to experience an increasing trend in 2011. This finding is consistent with results of a study commissioned by ILO-ADB in 2012.

As discussed in the Lewis conceptual framework, such upward shift in the rural wage is likely to predict a national labor shortage down the road. In other words, if the trend keeps continuing, the country could face labor shortage in the coming years if there is no further unleash of labor through mechanization and productivity in agriculture sector.

Figure 12: Coefficients for the year dummies rural areas (village and individual level)



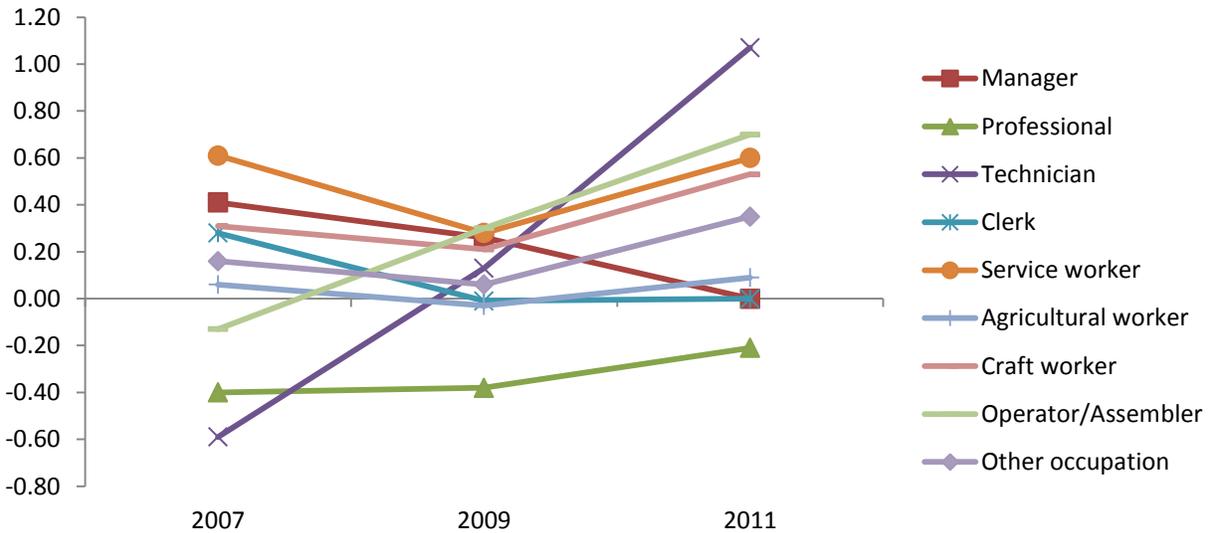
Source: Calculated by authors

Note: the coefficients of the year dummies are taken from R 2 and 4 in Table 4.

We also conduct regression analysis with seasonal dummy. The results do not change our earlier conclusion. The results are shown in the Appendix Table A6. For further robustness check, we also incorporate a variable of the share of population age 15-29 in the total village population which reflects the condition of labor supply. Interestingly, the 15-29 population age variables is strongly significant and negative in rural areas. This implies that the outflows of migration of this age group to the urban and neighboring countries can increase the wage in rural sectors.

We also run the regression at occupation levels. The result of the regression is shown in Table A8 and Figure 13 shows the trend of coefficients by occupation. The results confirm the increasing trend of both rural and urban wage trend, reflecting the partial Lewis turning curve in recent years. Figure 13 reveals some of the very important features related to some occupation with highly skilled requirement such as technicians, operators/assemblers and professional job where wage trend continuously increases afterward from 2007 to 2011. To confirm this wage trend, the paper also controls for productivity in agriculture by using number of tractors (See Table A9), and control unobserved fixed effect with unbalanced panel data (Table A10).

**Figure 13: Trend of Real Wage by Occupation
(Rural Regression Coefficients of Table A10)**



6. Conclusion and Policy Implication

The Cambodian economy is transforming rapidly. Most of the growth within the industrial and service sectors is located in urban areas, where labor and business activities tend to be concentrated. Recently, labor market developments paint a mixed picture about excess labor: wage developments do not clearly suggest exhaustion of surplus labor, while industrial relocation and some anecdotes signal tightening conditions. Using national household survey data, this paper examines the wage trend and empirically assesses whether Cambodia has reached the Lewis Turning point at which Cambodia would move from a vast supply of low-cost workers to a labor shortage economy.

Our results show that Cambodia has already reached rural Lewis turning point in 2011. This suggests that since 2011 Cambodia has faced its vast supply of low-cost workers in rural sectors. However, we cannot find labor shortage at national level yet. Cambodia

could face a challenge of labor shortage in the coming years with the current trend of migration, expansion of urban and rural sector, and the labor force growth rate; and if there is no further unleash of labor through mechanization and productivity improvements in agriculture sector. The labor shortage issue can be further intensified as an increasing number of unskilled workforces are flowing into Thailand and other countries.

This implies that news and anecdotes of labor shortage in urban sector is more likely to be explained by a combination of (1) skills shortage or mismatch, (2) seasonal labor shortage as workers head home during agriculture peak season, (3) urban wage rigidity in urban areas to compensate labor flows from rural areas, and (4) the lack of effective labor market coordination. Some location faces labor constraints due to a lack of local workforce and weak connectivity as well as supporting infrastructure. Labor shortage in urban sectors is seasonal because those engaged in temporary works move back in to agriculture sector during agricultural season.

The findings in this study have important policy implications for Cambodia's future development. As agriculture expansion is still going on at around 3% a year, Cambodia can face the labor shortage pressure if mechanization and productivity in agriculture is not improved. This would mean that the current extensive growth model that relies on factor accumulation based on low labor costs might not be sustained over the medium term. Comparative advantage is not static. As labor is mobile and can move to neighboring countries, Cambodia can lose its abundant labor-based comparative advantage.

Hence, for the next phase of growth, Cambodia will need to switch to a growth model with a more reliance on improving total factor productivity (TFP) and capital deepening

rather than just unskilled labor force. Economic development and industrial strategy should not be designed based on the assumption of abundant, low-cost labor and labor-intensive industries because it may not be the source of competitive advantage over the medium to the long term.

For the agriculture sector, mechanization and improving productivity is key to unleash further labor force into manufacturing and service sector which is growing fast. In addition, in order for rural households to permanently release some members into non-agriculture sector, workers need some types of social protection, which is not readily available yet. On the other hand, as international migration can exacerbate the labor shortage, seasonal unemployment in rural areas should be reduced by extending the farming season through irrigation and agriculture infrastructure development. At the same time, urban sector such as manufacturing and construction will have to upgrade into a more skill-intensive mode of production.

The success of the new development model will hinge upon a strong investment in human capital. The quality of basic education in Cambodia will be essential in this transformation. Also, to accommodate the economic growth and the fast transforming global economy, Cambodia needs to improve its productivity and address the skills shortages and mismatch. Skills shortage and mismatch can be reduced by a better mix of good basic education and technical training. Education providers should provide more relevant courses and more practical skills largely needed by the growing industries, particularly manufacturing, tourism and hospitality, construction, and high value agriculture. Cambodia's workforce must possess skills that are aligned with its transforming economy and that can promote its economic growth. If not addressed immediately, the current skills shortage and mismatch could restrain Cambodia's ability

to grow and to become a middle-income country as well as overcoming the middle-income trap.

In fact, with the New National Strategic Development Plan, the government is prioritizing and promoting skilled labor by heavily focusing on vocational and technical education. The main purpose is to fully benefit from the ASEAN economic community integration and to help the country successfully graduate from the foreseen middle-income trap which has been experienced by many countries that depend on low-skill labor for their development (see Education Strategic Plan 2014-2018). The findings from this study on labor shortage for skilled occupations such as technicians, professional occupation, and operator/assembler strongly reinforce the relevance of the current human resource development policy.

Further study using up-to-date wage data is needed to assess the current status of labor surplus. Building on this study, the next study should aim to assess the wage trend and Lewis Turning Points in 2012 and 2013, and conduct forecasting of when Cambodia would face Lewis Turning Point at national level.

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Appendix

Figure A2: Average of Male and Female Monthly Real Wage

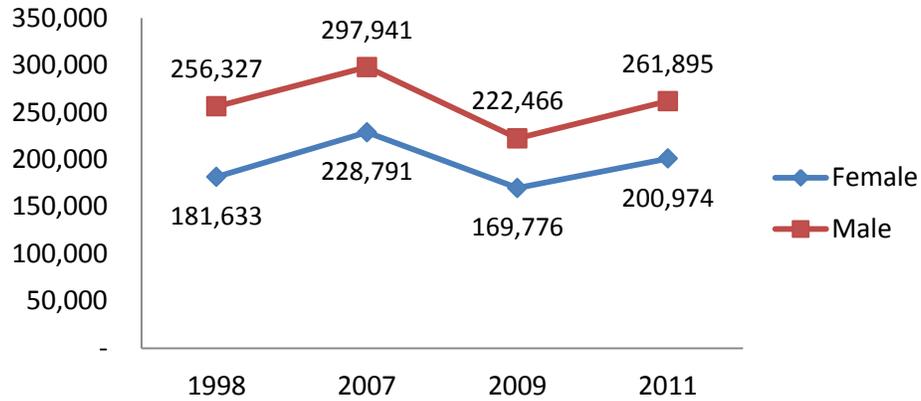


Table A1: Observations Used in this Study

Village

year	Freq.	Percent (%)
1998	431	24.06
2007	290	16.19
2009	715	39.92
2011	355	19.82
Total	1,791	100

Individuals

Year	Freq.	Percent
1998	1,651	13.81
2007	1,923	16.08
2009	5,555	46.46
2011	2,827	23.65
Total	11,956	100

Table A2: Mean of Main Variables

Year	Average year of Schooling	Average Per-capita Land	Average Number of School
1998	5.57	21982.22	337.66
2007	5.52	5012.38	511.40
2009	5.53	3834.99	580.03
2011	5.89	3632.04	588.15

Table A5: Summary Statistics for Main Variables in Individual Regression

Variable	Obs	Mean	Std. Dev.	Min	Max
lnrwage	19494	12.13	0.56	11.29	14.51
education	19494	8.57	4.46	0.00	21.00
sex	19494	0.61	0.49	0.00	1.00
age	19494	31.07	11.22	15.00	79.00
total land occupied	5041	16722.74	67466.30	2.00	3014400.00
infrastructure	19494	467.37	272.78	33.00	1189.00
d_urban	19494	0.47	0.50	0.00	1.00
d_manufacture	19494	0.35	0.48	0.00	1.00
d_services	19494	0.54	0.50	0.00	1.00
d_havest	19494	0.19	0.39	0.00	1.00
d_plant	19494	0.17	0.37	0.00	1.00
nhandtractors	8764	0.03	0.27	0.00	10.00
2003	19494	0.28	0.45	0.00	1.00
2007	19494	0.10	0.30	0.00	1.00
2008	19494	0.06	0.24	0.00	1.00
2009	19494	0.28	0.45	0.00	1.00
2010	19494	0.13	0.33	0.00	1.00
2011	19494	0.14	0.35	0.00	1.00

Table A6: Controlling Seasonality

	All lnrwage	Rural lnrwage		All lnrwage	Rural lnrwage
education	0.02*** (8.37)	0.00 (1.02)	education	0.01*** (6.83)	0.00 (0.46)
sex	0.05*** (3.65)	0.06*** (3.77)	sex	0.05*** (3.15)	0.06*** (3.46)
age	-0.00*** (-2.83)	-0.00*** (-2.73)	age	-0.00** (-2.29)	-0.00*** (-2.71)
land	0.00 (0.08)	0.00 (0.98)	land	0.00 (0.06)	0.00 (1.07)
infra	-0.00*** (-3.44)	-0.00** (-2.57)	infra	-0.00** (-2.38)	-0.00** (-2.38)
urban	0.10*** (6.13)		urban	0.09*** (5.01)	
d_manufacture	0.29*** (14.01)	0.32*** (15.17)	d_manufacture	0.31*** (14.36)	0.34*** (15.30)
d_services	0.16*** (7.66)	0.16*** (7.27)	d_services	0.17*** (7.97)	0.17*** (7.47)
d_havest	-0.02 (-1.06)	0.01 (0.55)	d_havest ⁺	-0.03 (-1.45)	0.01 (0.47)
d_plant	0.04** (2.32)	0.06*** (2.68)	d_plant ⁺⁺	0.05** (2.49)	0.06*** (2.65)
2007	-0.08*** (-3.74)	-0.11*** (-4.63)	2007	-0.09*** (-4.15)	-0.11*** (-4.78)
2008	-0.22*** (-7.40)	-0.27*** (-8.23)	2009	-0.09*** (-3.68)	-0.14*** (-4.93)
2009	-0.08*** (-3.43)	-0.14*** (-5.00)	2011	0.11*** (3.13)	0.13*** (2.96)
2010	0.05 (1.34)	0.01 (0.24)			
2011	0.11*** (3.36)	0.13*** (2.98)			
Constant	11.81*** (377.81)	11.90*** (358.82)	Constant	11.80*** (359.42)	11.89*** (343.99)
<i>N</i>	5041	3700	<i>N</i>	4494	3403
adj. <i>R</i> ²	0.08	0.10	adj. <i>R</i> ²	0.08	0.10
<i>AIC</i>	6764.04	4331.61	<i>AIC</i>	5988.78	4014.73

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

⁺harvest dummy for harvest season (September-November), ⁺⁺ Planting season (May-July).

Table A7: Controlling labor age 19-29 and female ratio

	All lnrwage	All lnrwage	Rural lnrwage	Rural lnrwage
village education	0.03*** (6.52)	0.03*** (6.24)	0.02*** (4.62)	0.02*** (4.81)
log(per capita land)	-0.03*** (-3.27)	-0.03*** (-3.19)	-0.01 (-0.84)	-0.01 (-0.88)
Infrastructure	-0.00*** (-4.86)	-0.00*** (-4.54)	-0.00*** (-2.80)	-0.00*** (-2.72)
female/population ratio	0.03 (1.31)	0.04 (1.43)	0.06** (2.22)	0.07** (2.38)
labor age 19_29/population ratio	-0.11 (-1.12)	-0.15 (-1.62)	-0.25** (-2.44)	-0.26** (-2.57)
dummy urban	0.20*** (8.25)	0.20*** (7.42)		
2003	0.26*** (5.55)	0.27*** (5.56)	0.29*** (5.78)	0.30*** (5.77)
2007	0.21*** (4.47)	0.20*** (4.37)	0.20*** (3.86)	0.20*** (3.86)
2008	0.04 (0.79)		-0.02 (-0.36)	
2009	0.14** (2.36)	0.13** (2.28)	0.06 (1.17)	0.06 (1.20)
2010	0.21*** (3.21)		0.24*** (2.94)	
2011	0.29*** (4.59)	0.29*** (4.52)	0.32*** (4.20)	0.32*** (4.19)
Constant	12.02*** (216.71)	12.03*** (211.91)	11.86*** (183.27)	11.86*** (179.87)
<i>N</i>	2163	2035	1566	1494
adj. <i>R</i> ²	0.09	0.08	0.08	0.07
<i>AIC</i>	2697.06	2579.28	1695.83	1646.82

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Regression and Trend of Real Wage by Occupation (Rural Area)

	Military lnrwage	Manager lnrwage	Professional lnrwage	Technician lnrwage	Clerk lnrwage	Service worker lnrwage	Agricultural worker lnrwage	Craft worker lnrwage	Operator/Assembler lnrwage	Other occupation lnrwage
education	0.01 (0.29)	0.03 (0.92)	0.04*** (2.90)	0.06*** (3.31)	-0.00 (-0.09)	0.01 (0.41)	0.00 (0.22)	0.01 (0.82)	0.03*** (3.04)	0.02*** (4.98)
sex	-0.21 (-0.49)	-0.13 (-0.30)	0.08 (0.78)	-0.02 (-0.13)	0.79*** (2.83)	0.02 (0.16)	0.04 (0.53)	0.09** (2.19)	0.05 (0.78)	0.11*** (5.14)
age	-0.01 (-1.03)	0.00 (0.08)	-0.00 (-0.51)	0.01 (1.23)	-0.01 (-0.79)	0.00 (0.65)	0.01** (2.31)	0.01*** (3.93)	0.00 (0.59)	0.00*** (2.93)
totland_owned	-0.00 (-1.11)	-0.00 (-1.03)	0.00 (0.72)	-0.00 (-0.61)	0.00 (1.26)	-0.00 (-1.46)	0.00 (1.49)	-0.00 (-0.58)	0.00 (0.66)	0.00 (0.61)
infrastructure	-0.00 (-1.77)	-0.00* (-1.81)	0.00 (0.07)	0.00 (0.07)	0.00 (0.04)	-0.00** (-2.39)	0.00 (0.07)	-0.00*** (-3.91)	-0.00*** (-3.16)	-0.00*** (-5.41)
d_manufacture	.	.	0.40** (2.09)	.	.	-0.69 (-1.00)	0.09 (0.58)	0.12 (0.32)	0.19 (0.71)	0.14*** (5.09)
d_service	.	0.53 (0.79)	.	.	0.12 (0.16)	-0.87* (-1.73)	-0.24 (-0.69)	0.42 (1.13)	0.23 (0.84)	0.20*** (6.84)
d_havest	0.03 (0.17)	.	-0.06 (-0.36)	0.71 (0.99)	-0.29 (-0.69)	0.21 (1.29)	0.05 (0.26)	0.07 (1.00)	0.04 (0.51)	0.10*** (2.80)
d_plant	.	.	0.18 (1.00)	-0.09 (-0.11)	-0.05 (-0.09)	0.09 (0.51)	-0.14 (-0.51)	0.03 (0.45)	0.25*** (3.21)	0.09** (2.23)
2007	.	0.41 (0.71)	-0.40** (-2.50)	-0.59* (-1.71)	0.28 (0.52)	0.61*** (2.96)	0.06* (0.55)	0.31*** (5.98)	-0.13 (-1.14)	0.16*** (5.09)
2009	-0.33 (-1.04)	0.26 (0.40)	-0.38** (-2.30)	0.13 (0.33)	-0.01 (-0.01)	0.28 (1.30)	-0.03 (-0.19)	0.21*** (2.89)	0.30* (1.82)	0.06 (1.61)
2011	0.44 (0.87)	.	-0.21 (-0.84)	1.07 (1.10)	-0.00 (-0.00)	0.60** (2.19)	0.09* (0.36)	0.53*** (5.62)	0.70* (1.80)	0.35*** (7.10)
_cons	13.95*** (17.18)	11.62*** (17.11)	11.71*** (46.12)	11.58*** (34.34)	11.82*** (12.60)	12.90*** (24.62)	11.45*** (84.63)	11.52*** (30.86)	11.86*** (37.87)	11.59*** (249.61)
N	21	35	137	83	37	101	224	531	231	1925
adj. R ²	0.21	-0.05	0.06	0.12	0.06	0.07	0.00	0.19	0.21	0.12
AIC	23.69	66.12	225.96	160.81	75.56	146.26	285.69	431.57	195.24	2259.61

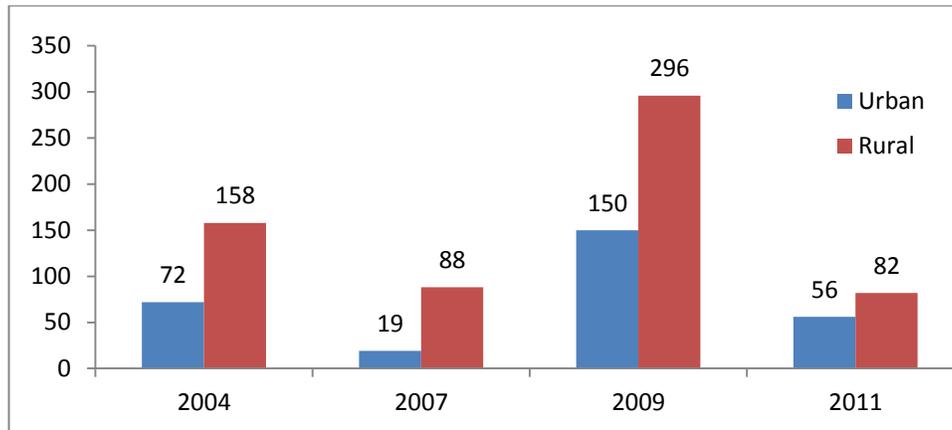
Table A9: Controlling for Productivity Improvement in Agriculture

	All lnrwage	Rural lnrwage
education	0.03*** (8.16)	0.01* (1.91)
sex	0.10*** (4.22)	0.11*** (3.97)
age	0.00 (0.99)	-0.00 (-0.16)
land	0.00 (0.07)	0.00 (0.65)
Infra	-0.00*** (-2.78)	-0.00*** (-4.40)
d_urban	0.09*** (3.58)	
d_manufacture	0.20*** (6.09)	0.20*** (6.07)
d_service	0.19*** (5.47)	0.18*** (4.62)
d_havest	0.06* (1.86)	0.10*** (3.11)
d_plant	0.08** (2.56)	0.09*** (2.59)
nhtractor	0.08** (2.01)	0.08* (1.65)
2009	-0.04 (-1.51)	-0.07** (-2.52)
2011	0.16*** (4.32)	0.21*** (4.86)
_cons	11.62*** (205.49)	11.87*** (172.15)
<i>N</i>	1794	1125
adj. <i>R</i> ²	0.13	0.10
<i>AIC</i>	2281.02	1183.04

Note: *t* statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Number of hand tractors (nhtractor) is proxy for improvement in agricultural productivity.

Figure A3: Estimated Number of Hand Tractors



Source: CSES 2003-2007

Table A10: Regression Using Fixed and Random Effect Model

	Rural	Rural
	FE model	RE model
	Inrwage	Inrwage
village education	0.02*** (5.82)	0.00 (0.44)
per capita land	0.00*** (6.73)	0.00 (0.53)
infrastructure	-0.00*** (-3.83)	-0.00 (-1.19)
female/population ratio	0.04 (1.53)	-0.19*** (-2.75)
labor age 19_29/population ratio	-0.11 (-1.34)	0.32 (1.11)
2003	0.27*** (7.16)	0.35*** (2.99)
2007	0.23*** (4.73)	0.51*** (3.75)
2008	0.01 (0.23)	0.20 (1.49)
2009	0.06* (1.68)	0.32** (2.29)
2010	0.19*** (4.71)	0.44*** (3.07)
2011	0.27*** (6.52)	0.51*** (3.54)
Constant	11.81*** (282.16)	12.00*** (55.95)
<i>N</i>	2498	2498
<i>R</i> ²		0.18
<i>AIC</i>		-3655.22
<i>N_g</i>	2104.00	2104.00
<i>sigma_u</i>	0.28	0.79
<i>sigma_e</i>	0.30	0.30
Hausman Test: Ho: FE=RE		
Chi-square (10)	39.01	
P-value	0.00	

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$