

Explaining labor shortage in agriculture sector in Cambodia: A descriptive approach

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Abstract

Labor shortage in agriculture sector in Cambodia has been emphasized in a number of reports in recent years, but no work has been undertaken to provide underlying causes of this phenomenon. This paper qualitatively shows that there are supply-side and demand-side factors that put strong upward pressure on real wage in the agriculture labor market resulting in labor shortage in the sector as wage is not paid at market clearing level (equilibrium wage). The supply-side factors that negatively affect labor supply include change in industry structure, urbanization and migration. The demand-side factors that positively affect labor demand are increase in cultivated land of cereals and rising stock of FDI in agriculture, while increase in agriculture mechanization affects labor demand in the opposite direction, but with smaller magnitude.

Keywords: Labor shortage, Agriculture, Cambodia

JEL Classification:

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I. Introduction

Cambodia has undergone notable structural transformation during the last two decades after it started to open its economy to the region and the world in late 1980s by allowing cross-border, as well as international, trade to exist and privatization of state-owned enterprises to be on its way. Market liberalization was also underway allowing foreign direct investment from countries in the region, such as mainland China, Hong Kong, Taiwan, Thailand, and Malaysia to flock into the country by concentrating in textile and garment industry and hotels and restaurants industry. The two emerging industries, the former in particular, created the demand for low-skilled labor and started to gradually absorb the labor pool from the traditional agricultural sector since then. After gaining its genuine peace and political stability in 1998, when Khmer Rouge rebels were dismantled and integrated with government armed forces, the two industries continued to expand further as Cambodia further deepened its economic, trade and investment relation with countries in the region and the world by becoming a member of the Association of South-East Asian Nations (ASEAN) in 1999 and a member of the World Trade Organization (WTO) in 2004.

The liberalization effort in past decades has helped Cambodia to attain strong economic growth with the average annual GDP growth of around 7% during the last decade, supported by stable and low rate of consumer price inflation averaging of less than 3% during the same period. In addition, there has been significant transformation in economic structure during the last three decades by moving from agrarian economy in early 1990s to labor-intensive manufacturing-based and service-based economy in the last decade.

Urbanization has also been on the rapid expansion path as urban population has been risen quite dramatically in the last decade. Moreover, internal and international migration of low-skilled workforce has also been an emerging phenomenon given the size and pace of migration flow as well as the size of internal (rural-urban) and international remittance. The three forces generate negative effect of labor supply in agriculture sector by putting upward pressure on real wage in the sector. The upward pressure has also been felt through the increase in size of cultivated land of cereals and the rise in stock of foreign direct investment in agriculture sector, although offset by the hike in the mechanization use in agriculture sector. These factors collectively drive up real wage creating labor shortage in the sector as real wage is currently paid below the market clearing wage (equilibrium wage).

This paper is intended to qualitatively explain factors that drive real wage in the agriculture labor market in Cambodia since a number of reports by international organization and government institution have claimed that there has been labor shortage in agriculture sector in Cambodia in recent years (OECD, 2017; MAFF, 2017). It uses economics intuition based on available data and existing studies to explain this phenomenon without trying to quantify the magnitude of workforce that agriculture sector losses. The paper is structured as follows. Next section provides conceptual framework of how to explain factors that lead to labor shortage in agriculture sector in Cambodia followed by Section III describing analytical method and data sources. Section IV presents results of the analysis. Section V concludes.

II. Conceptual framework

This section provides a simple conceptual framework explaining how factors other than wage, be it demand-side or supply-side, could affect agricultural labor market outcomes, real wage in particular, in a small open developing economy. Time span of the analysis is the last two decades. Figure 1 presents both demand- and supply-side factors that most likely affect real wage in agricultural labor market in Cambodia. In setting of Cambodia the demand-side factors comprise expansion of agricultural land, increased use in mechanization and increase in foreign direct investment in agriculture, while the supply-side factors consist of internal (rural-urban) and cross-border and international migration, change in industry structure, and urbanization. The net effect of the demand-side factors on real wage tends to be positive, while that of the supply-side shocks is likely negative, which likely results in a positive total effect on real wage. Nevertheless, since the currently paid real wage in the sector is below the resulted real equilibrium wage labor shortage emerges.

Figure 2 provides a graphical representation of agricultural labor market at both equilibrium real wage and new equilibrium real wage after the total effects of demand-side and supply factors. S and D are labor supply and labor demand curves, respectively, and each is a function of real wage (W). Quantity of labor demanded and supplied changes by moving along their respective curves when real wage changes, but quantity of labor demanded and supplied changes by shifting their respective curves accordingly when factors other than real wage (e.g. expansion of agricultural land) change. We assume that agricultural labor market started at its equilibrium wage at W_0 and labor at L_0 with the demand and supply of D_0 and S_0 , respectively.

Supply-side non-wage factors: During the last two decades we observe significant transformation in Cambodian economic structure from largely agriculture-based to labor-intensive manufacturing-based and low-skilled service-based industries. This suggests notable implication for agricultural labor market in the country. Substantive growth in labor-intensive textile and garment industry is one, while significant growth in hotels and restaurants and construction is another. These sectors appear to absorb labor from agriculture sector. This causes labor supply curve to shift to the left pushing real wage to rise as represented by S_1 in Figure 2.

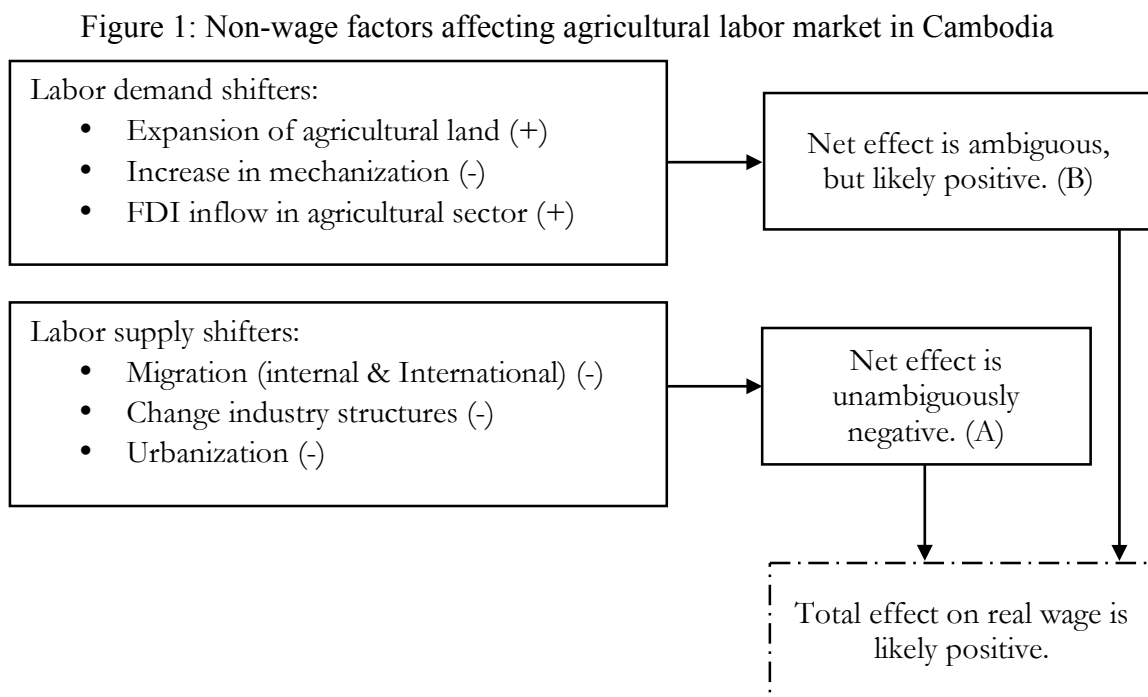
The supply curve arrives at the new equilibrium (2) as a result of two other factors. One is urbanization as evident through construction boom in the capital city of Phnom Penh and the increase in population density in the urban areas. The rise in the amenities that often do not exist in most rural communities, as well as remote areas needless to say has drawn and continues to woo more rural agricultural workforce to the urban areas. The other factor is migration (rural-urban, cross-border and international). Rural-urban migration results primarily from changes in Cambodia's economic structures which incentivize workforce to move from traditional agriculture sector to modern labor-intensive sectors. The prevalence of rural-urban migration in Cambodia is also revealed in the report of the Cambodian rural-urban migration project (CRUMP) (MOP, 2012).

Cross-border migration is more prevalent at Cambodia-Thailand border, but much less common at Lao PDR and Vietnam borders. The migrants engage mostly in agricultural activities, while the drastic rise in the wave of the outflow of Cambodian migrants to countries in the region, such as Malaysia and South Korea in the last decade leaves shortage of labor not only in agriculture sector, but also in other modern labor-intensive sectors, such as textile and garment, construction and hotels and restaurants (OECD, 2017 and NEA, 2016). Since the three factors negatively affect labor supply in agriculture sector real wage unambiguously increases.

Demand-side non-wage factors: There are three potential sources of demand-side factors that affect labor demand and real wage differently during the last two decades. According to UN Food and Agriculture Organization's (FAO) statistics total agricultural land in Cambodia went up quite dramatically during the 1998-2005 period reflecting the positive effect of Cambodia's

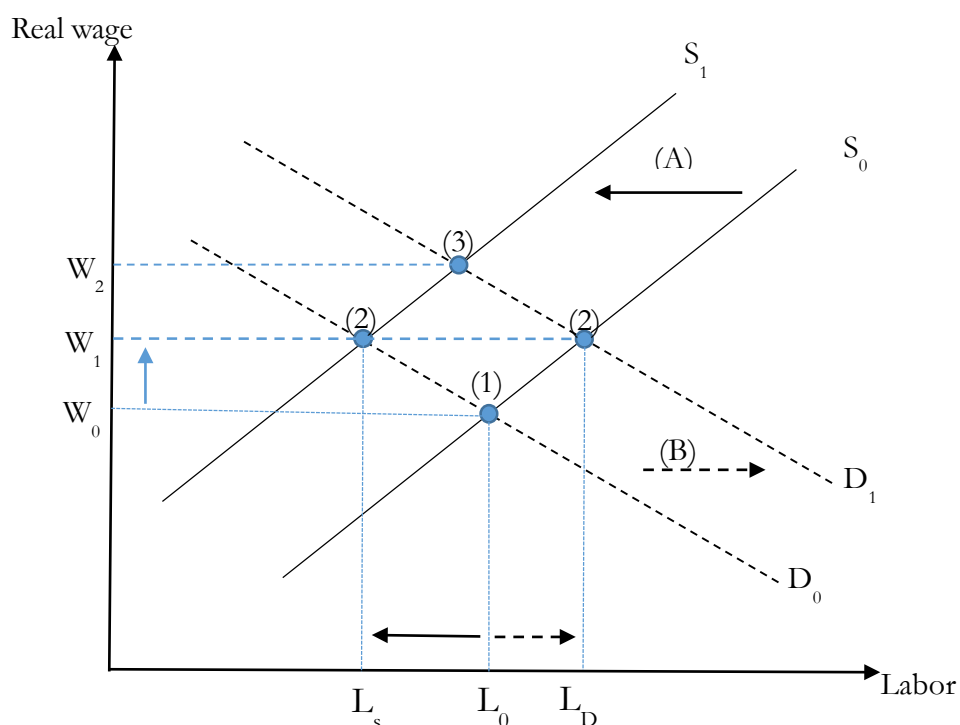
gain of genuine peace after demobilization of Khmer Rouge rebel fighters in 1998 (FAO, 2019). The expansion continues up until recent years, but at a gradual and slower pace. This continued expansion creates demand for agriculture labor, which likely leads to an increase in real wage. The positive effect is likely reinforced by the substantive rise in foreign direct investment in agriculture (FDI), reflected by the increase in stock of FDI in agriculture. The two factors jointly shift the demand curve to the right.

Nonetheless, recent report by the Ministry of Agriculture, Forestry and Fishery (MAFF) suggests that there has been increase in mechanization use on agricultural land suggesting that such adoption may compensate for the increase in demand for agriculture labor in recent years; thereby, slowing, but not likely reversing, the shift of the labor demand curve to the right. This is because the latter factor is unlikely to dominate the two former shocks. As a results, the total effect likely ends up at D_1 with a new equilibrium real wage W_2 at point (3) higher than the initial equilibrium real wage at W_0 .



Source: Authors' compilation

Figure 2: Change in Cambodia's agricultural labor market



Source: Authors' compilation

However, since real wage in the sector is currently paid at W_1 lower than the new market equilibrium wage the consequence is the sector's labor shortage as measured by the distance between L_s and L_d . In effect, we do not know for sure how long the labor market will arrive at the new equilibrium wage and labor (3) since W_2 is relative to real wage of migrants working in urban Cambodia and in Thailand, Malaysia and Korea. Nonetheless, option available for addressing the labor shortage is through the increase in mechanization use in the agriculture sector, while introducing incentive schemes such as cash and in-kind agricultural subsidies is an alternative to discourage internal and international migration.

III. Analytical method and data sources

We use data from various sources and apply qualitative or descriptive approach in order to explain causes of labor shortage in agriculture sector in Cambodia. First, a desk review is conducted to compile existing evidence of labor shortage in agriculture sector in Cambodia. Then, secondary data are tabulated and graphed in order to qualitatively explain factors that lead to an increase in real wage in agriculture sector following the demand and supply framework of agriculture labor market. Data are from World Bank's World Development Indicators (WDI), Food and Agriculture Organization (FAO), National Institute of Statistics

(NIS) of the Ministry of Planning (MOP), International Trade Center’s Trade Map (ITC’s Trade Map), and University of Oxford’s Global Change Data Lab.

Table 1: Variables and sources of data

| Variables | Sources of data |
|---|---|
| -Per capita GDP (constant 2010) -Employment share of agriculture in total employment (ILO model) -Employment share of industry in total employment (ILO model) -Employment share of service in total employment (ILO model) -Remittance received in million USD | -World Bank’s World Development Indicators 2019 (WB-WDI) |
| -Share of urban population in total population | -University of Oxford’s Global Change Data Lab 2019 |
| -Total agricultural land in thousands ha -Total harvested land of cereals in thousands ha -Net fixed capital formation in agriculture in million USD | -United Nation’s Food and Agriculture Organization (UN-FAO) |
| -Index of import value of agricultural machinery (HS 8432 & HS 8436) | -International Trade Center – Trade Map (2019) |
| -Stock of Cambodian emigrants to the world | -Global migration data portal (2019) |
| -Country destinations of Cambodian emigrants | -UN DESA (2019) |

IV. Analysis

We use demand and supply framework of labor market in agriculture sector to explain causes leading to labor shortage in the sector; however, we do not intend to quantify the magnitude of the labor market response, i.e. changes in quantity of labor demanded and supplied and real wage. However, we only qualitatively show that there are potential sources of shocks, be it

demand- or supply-side, that likely affect labor market outcomes in agriculture sector. This study is an exercise that opens door for future in-depth analysis of agricultural labor market in Cambodia.

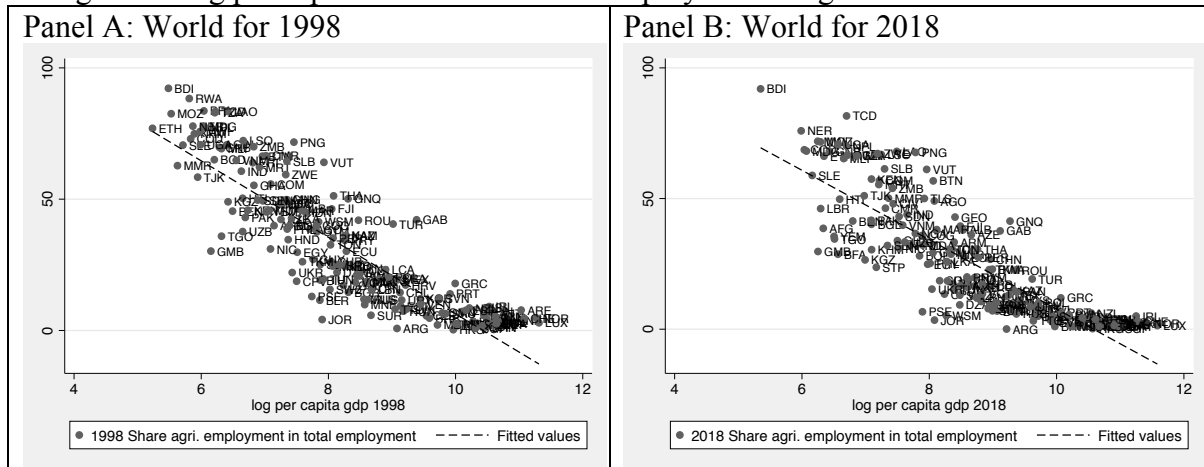
a. Supply-side factors

Change in industry structure

As a country goes through sequential stages of development, namely from agrarian economy to manufacturing- and service-based economy, there is also adjustment in labor markets across economic sectors. At agrarian stage a country depends largely on agricultural production, and large pool of workforce is employed in this sector, which is evident in many developing economies around the world, which is also consistent with the Lewis' two-sector model (Figure 3: Panel A and Panel B). In addition, as country production base starts gradually to move to labor-intensive manufacturing industries notable rise in demand for low-skilled labor in the industries emerges creating gap in real wages between agriculture sector and the other labor-intensive manufacturing industry. This creates an incentive for agricultural laborers to seek for higher-paid, but low-skilled, employment opportunities in the labor-intensive manufacturing industries.

Figure 3 shows a positive association between level of development of a country as measured by log per capita GDP in 2010 price for both 1998 and 2018. Panel A shows that in 1998 around 38.5% of the 184 countries in the sample had share of agriculture employment above 50%, but two decades' later this share of countries went down to 32.6% as indicated in Panel B. In other words, 11 countries experienced the shift. The negative association between the two variables for the sample of 184 countries was about 14.6% in 1998 and 13.3% in 2018, which is substantial. When further decomposing the sample by income levels (high income, upper middle, lower middle and low), we still find the negative association between share of agriculture employment and log per capita GDP for both 1998 and 2018. Such negative association is also observed across regions (East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia and Sub-Saharan Africa) for both 1998 and 2018.

Figure 3: Log per capita GDP and share of employment in agriculture around the world

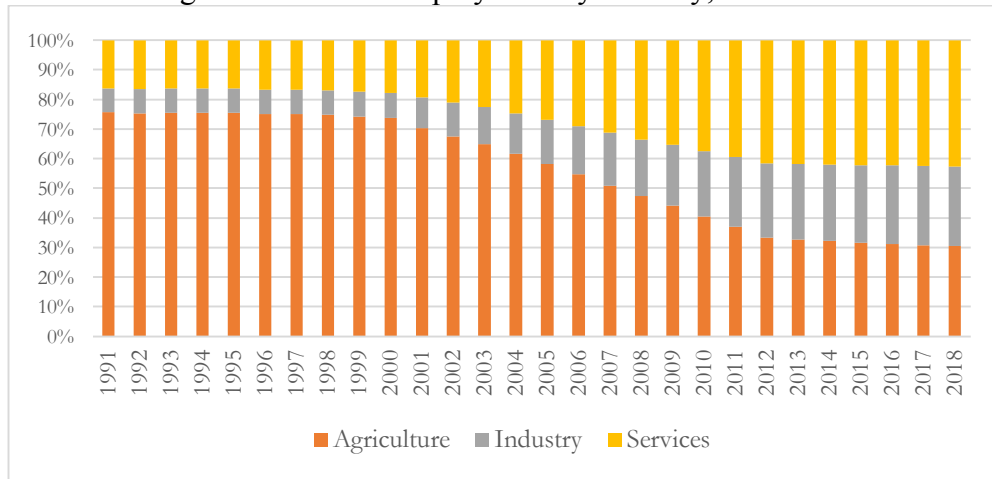


Source: World Bank's World Development Indicators, 2019

International experience suggests that low-income Cambodia may exhibit the same experience. Using historical data of employment share of agriculture in total employment, we show that such pattern of the negative relationship between level of per capita GDP and employment share of agriculture sector is also observed in Cambodia. Real per capita GDP at 2010 price in Cambodia was only 362 USD in 1998, while share of agriculture employment in total employment was 74.8% in the same year, which is also indicated in Figure 4 below. Two decades later, Cambodia's real per capita GDP jumped to 1,205 USD, while in similar vein its share of agriculture employment in total employment went down to just 30.4% in 2018.

Figure 4 also shows a clear and rapid transformation of Cambodian economy from an agriculture-based economy to a more industry- and service-based between early 2000s and 2018. Share of employment in agriculture in total employment was 66% during the 2000-2005 period, while shares of employment in industry and services were 12% and 22%, respectively during the same period. In the 2013-2018 period share of employment in agriculture was only 31%, while shares in industry and services were 26% and 42%, respectively. This clearly suggests that demand for workforce in the industry and services has been on the rise and the pattern will also continue for at least another decade because Cambodia has benefited from the young labor force, "the Demographic Bonus", which is expected to last until 2038 (NIS, 2015 cited in OECD, 2017).

Figure 4: Share of employment by industry, 1991-2018



Source: World Bank's World Development Indicators, 2019

Urbanization

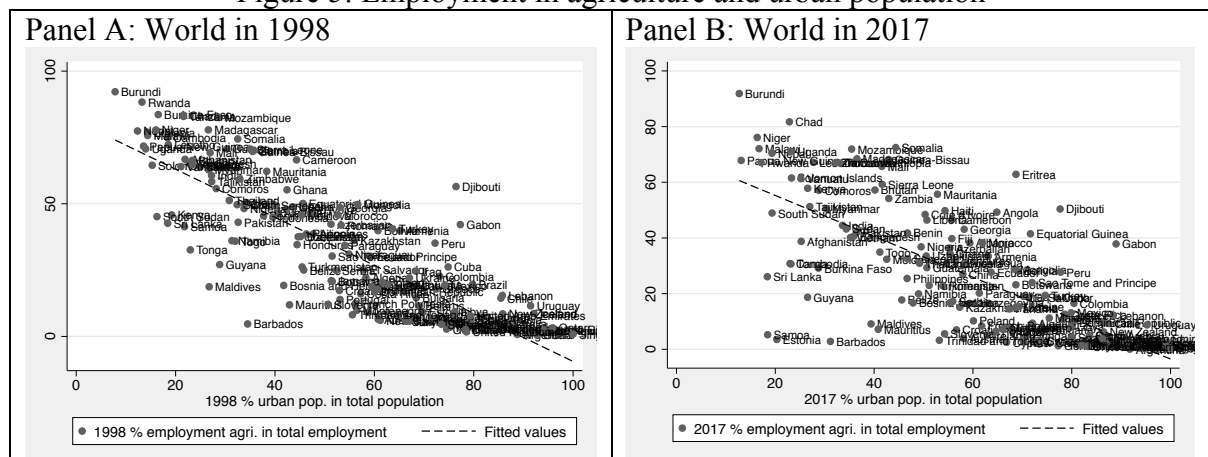
According to the UN, the world population is around 7.6 billion people in 2018, 55 percent of whom live in the urban area, and is projected to be around 9.8 billion by 2050, approximately 68% of whom will be living in urban area, suggesting a remarkable urban expansion in the next three decades (Ritchie and Roser, 2019). It is important to note also that urbanization moves in parallel with the level of development as measured by per capita GDP. Such pattern is also observed when decomposing country groups by levels of income and regions around the world (Ritchie and Roser, 2019). This suggests that through its process of attracting workforce, both skilled and unskilled, from the rural areas urbanization in a way reinforces pace of development, as well as the transformation of industry structures of the economy, to further create employment opportunities in the city as well as to increase income of the urban workforce (Chen et al., 2016).

Lu et al. (2012) cited in Chen et al., (2016) show that urban size has a positive effect on employment, in other words, a 1 percent increase in urban population raises individual's employment probability by between 0.044 and 0.050 percent. Such effect results primarily from the high concentration of high-skilled workers who demand for basic consumer goods and services (non-tradable) provided by low-skilled workers in large cities. Since workforce in agriculture sector are generally low-skilled and urban-agriculture wage gap exists agriculture workforce are likely drawn to the urban cities.

Figure 5 shows negative association between urbanization and share of agriculture employment in total employment around the world for both 1998 (Panel A) and 2017 (Panel B). Country with higher share of urban population in total population tends to experience lower share of employment in agriculture in total employment. By regressing share of employment in agriculture in total employment on percentage of urban population in total population for a sample of 181 countries for 1998 and 2017 separately, we show that a percent increase in share of urban population is associated with about 0.9% drop in share of employment in agriculture for 1998 and 0.7% drop for 2017.

We further investigate the relationship across levels of country income and regions around the world. The relationship for both high income and upper middle income countries is rather inelastic for both 1998 and 2017 because these countries are already advanced economies and have small share of employment in agriculture in total employment. However, the association between the two variables for lower middle and low income countries is generally higher than those in high and upper middle income economies for both 1998 and 2017. The relationship still exists across regions, namely East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, South Asia, Middle East and North Africa, and Sub-Saharan Africa.

Figure 5: Employment in agriculture and urban population



Source: World Bank, 2019 & Global Change Data Lab, 2019

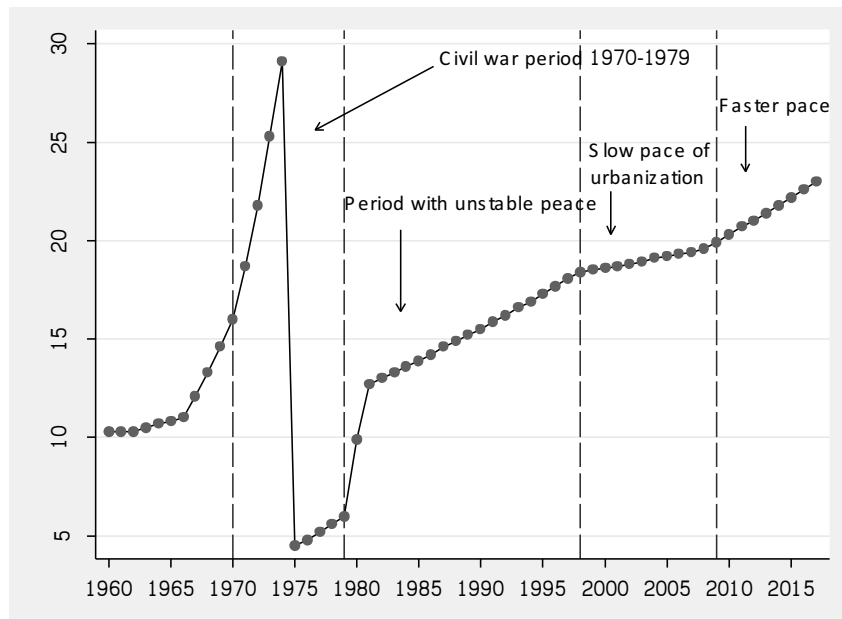
Since the relationship between urbanization and employment in agriculture is evident across regions and countries' income level including also lower middle income Cambodia. In other words, urbanization as a labor supply shock likely negatively affect employment in agriculture sector in Cambodia. Figure 6 shows the evolution of Cambodia's urbanization since 1960. After gaining independence from

French colony in 1953, Cambodia started to gradually advance forward, although remained agrarian economy. Under King Sihanouk's ambitious economic development and industrialization plan in early 1960s urbanization started to gain momentum in mid 1960s thanks to the King's massive development projects across the country as well as the capital city of Phnom Penh.

Nonetheless, the big jump between 1970 and 1974 was not the result of the massive development projects in mid 1960s, but rather from U.S. massive bombing campaign along the Cambodia-Vietnam border that pushed around a third of the population to seek shelter in the capital city of Phnom Penh. The drop of urban population from the peak in 1974 to the trough in 1975 was a result of a forced evacuation out of Phnom Penh city imposed by the new regime, Khmer Rouge, that toppled the Lon Nol (Khmer Republic) regime on 17th April 1975, which was when the rural forced labor camp and the genocide began and last until 7th January 1979. After the liberation forced labor camps were dismantled the population returned to their home residence and urbanization resumed with gradual pace despite unstable peace caused by the remaining Khmer Rouge soldiers. Notably, it took around two decades for Cambodia to return to its urbanization level in 1970.

After gaining a complete and genuine peace in 1998 when the Khmer Rouge soldiers were demobilized and integrated with the Royal Cambodian Armed Force Cambodia experienced two episodes of urbanization: slow pace, but without disruption (1999-2009) and more rapid pace of expansion (2010-2017). As indicated in Figure 4 there is also a remarkable decline in share of employment in agriculture during the first episode of slow and gradual rise in urbanization which suggests a meager role of urbanization in attracting agricultural workforce. The second episode of rapid expansion of urbanization tends to paint a clearer picture of the relationship between urbanization and employment in agriculture sector as share of employment in agriculture in total employment also went down significantly during this period. Additionally, nationally represented survey of rural-urban migration in Cambodia in 2011 conducted by the National Institute of Statistics of the Ministry of Planning shows that around 54% of the migrants were absorbed by the capital city of Phnom Penh, while the other 30% and 20% went abroad and other locations in the country, respectively (NIS, 2015). This implies that urbanization, especially Phnom Penh city, in its last episode serves as a negative shock to labor supply in agriculture sector in Cambodia.

Figure 6: Percentage of urban population in total population in Cambodia

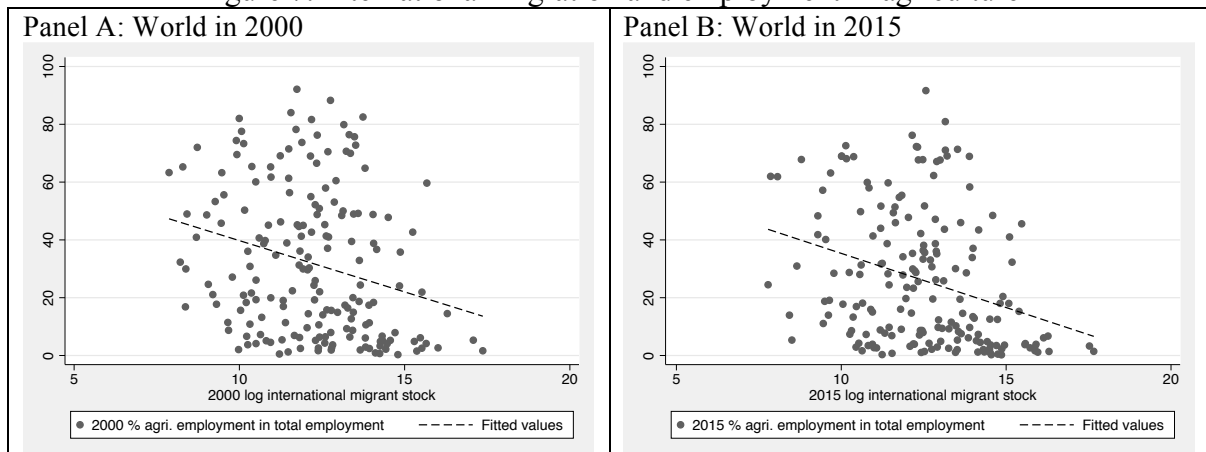


Source: University of Oxford's Global Change Data Lab, 2019

Migration (internal and international migration)

International evidence seems to suggest that there is a negative association between share of employment in agriculture and international migrant stock. Figure 7 reveals this relationship from a sample of 184 countries for both 2000 and 2015, while the relationship is statistically significant at 1% level for both years. However, since we would like to relate international experience to Cambodia we further decompose the relationship by income level of the countries. Our decomposition shows that the association remains negative for low, lower middle and upper middle income groups, but it is not statistically significant at any conventional level suggesting that there is no strong direct relationship between international migration and employment in agriculture.

Figure 7: International migration and employment in agriculture

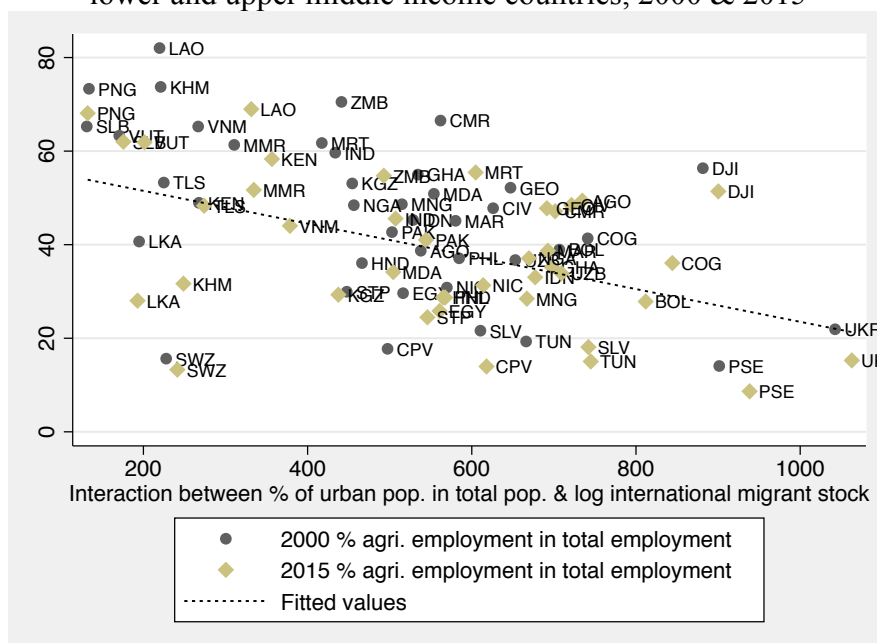


Source: World Development Indicator, 2019

Nonetheless, we suspect that there might be interaction effect between internal and international migration on employment in agriculture. We therefore use share of urban population in total population as a proxy for internal (rural-urban) migration and interact it with international migrant stock to investigate the association between this interaction term and share of employment in agriculture. We find a strong negative relationship between them for the total sample of 183 countries for both 2000 and 2015. The negative relationship also stays for both low income and lower middle income groups for both years, which suggests that international and internal migration is jointly associated with employment in agriculture.

Figure 8 shows the negative association between the interaction term (of share of urban population and international migrant stock) and share of agriculture employment in total employment in 2000 and 2015. We observe the right-hand shift of the relationship for most countries, including Cambodia, Lao PDR, Myanmar and Vietnam, between 2000 and 2015. Cambodia exhibited much smaller shift in the association relative to those for Lao PDR, Myanmar and Vietnam, but it experienced large drop in agriculture employment share between the two periods.

Figure 8: Joint effect of internal and international migration on employment in agriculture in lower and upper middle income countries, 2000 & 2015



Source: World Development Indicators, 2019

Although the association between international migration and employment in agriculture has been shown to be statistically insignificant, the effect of international migration on agriculture

employment should not be underestimated given its increase in magnitude during the last two decades. Cambodia’s international migrant stock was only 335,400 people in 1990, but later jumped to 674,500 people in 2005 and 1.1 million people in August 2019, which is astounding (Figure 9, Panel A). Furthermore, in 1992 total remittance received from abroad was only USD 9 million, but later went up to 142.2 million in 2009 (Figure 9, Panel B). Since then, total remittance received rose exponentially reaching the peak of USD 1.4 billion in 2018. Popular destinations for Cambodian emigrants has been its neighboring Thailand which absorbed more than half of the Cambodian emigrants, while few other popular destinations include USA, France, Australia, Canada, Bangladesh, Malaysia and Korea (Figure 10).

Figure 9: Stock of Cambodian emigrant and remittance received in Cambodia

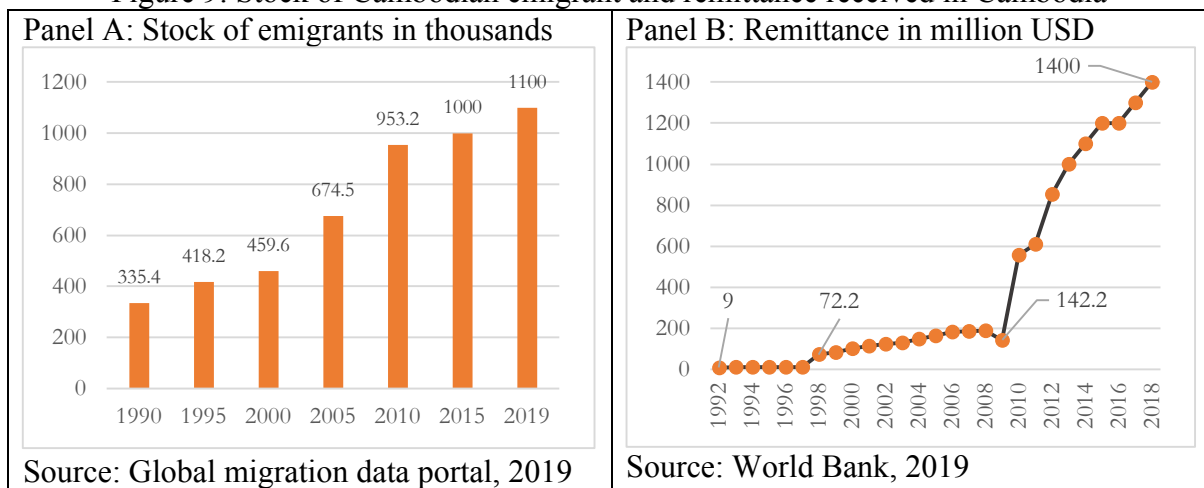
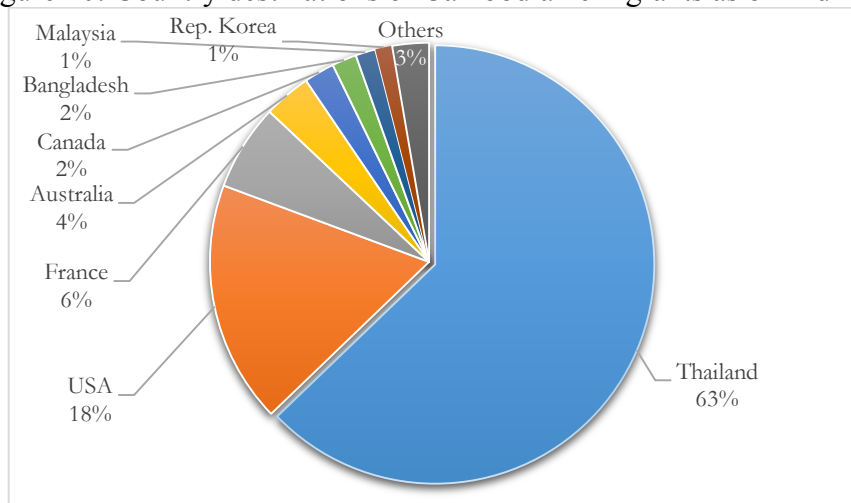


Figure 10: Country destinations of Cambodian emigrants as of mid 2019

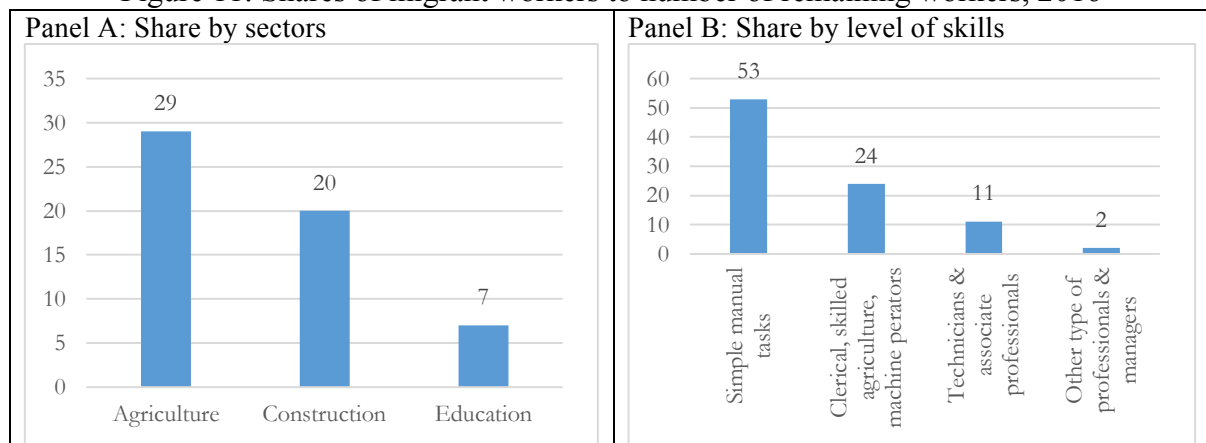


More importantly, the statistically insignificant effect of international emigrant stock might be due to the fact that the international emigrants are both high- and low-skilled people and not all of them are former agriculture workers (OECD’s nationally represented survey of current

migrants in 2016 suggests that around 83% of them were employed before migrating), while workforce in the agriculture are low-skilled laborers. Given the absence of data on stock of international low-skilled migrant workers, we are not able to closely examine the association between international migration and employment in agriculture. Nonetheless, we document the size of Cambodian migrant workers in main destinations such as Thailand, Malaysia and South Korea based on existing studies to show the association between international migration and employment in agriculture.

According to data from OECD’s report in 2017, between 1998 and 2015 a total number of 209,804 migrant workers participated in the state-sponsored labor migration programs. While around half of them went to Thailand, each of the two remaining quarters went to Malaysia and South Korea. Majority of the workers are low-skilled engaging in agriculture, industry and service sectors (OECD, 2017 p.75). For migrant workers in Thailand, majority of them are men (62%) and work mainly in manufacturing and services sectors. By contrast, majority of migrant workers in Malaysia are female (76%) and employed as domestic workers, while the remaining 24% who are male are employed in construction and manufacturing. Migrants in South Korea are mostly men (82%) employed mainly in manufacturing (65%), agriculture (34%) and fisheries (1%). Migration tends to be common among rural households as many of the rural households make a living out of migration (CDRI, 2009; FitzGerald and Sovannarith, 2007; IOM, 2010). Panel B in Figure 11 below shows that more than half of the migrant workers are low-skilled, while additionally agriculture sector lost around a third of workforce in the sector as indicated in Panel A in the same Figure. This suggests that migration has a negative effect on the supply of labor in the agriculture sector.

Figure 11: Shares of migrant workers to number of remaining workers, 2016



Source: Adapted from OECD (2017 p.76), Note: Results are from nationally represented survey of migrant households in 2016 in Cambodia.

Overall, we show that there are three potential sources of shocks all of which negatively affect supply of labor in agriculture sector and cause the labor supply curve to shift to the left (S_0) as shown in Figure 2. For one, the transformation in Cambodia's economic structures from agrarian economy to industry- and service-based during the last two decades has generated employment opportunities for low-skilled agriculture laborers. The last two episodes of gradual and uninterrupted expansion of urbanization further widens gap in real wage between agriculture and urban industry and services, which resulted in the rise in the demand for low-skilled labor in urban areas. The last labor-supply shock is migration because many rural households make a living out of migration. And migration may also interact with urbanization to affect agriculture labor supply, where urbanization serves as a pull factor through agriculture- and urban-based industry wage gap.

b. Demand-side shocks

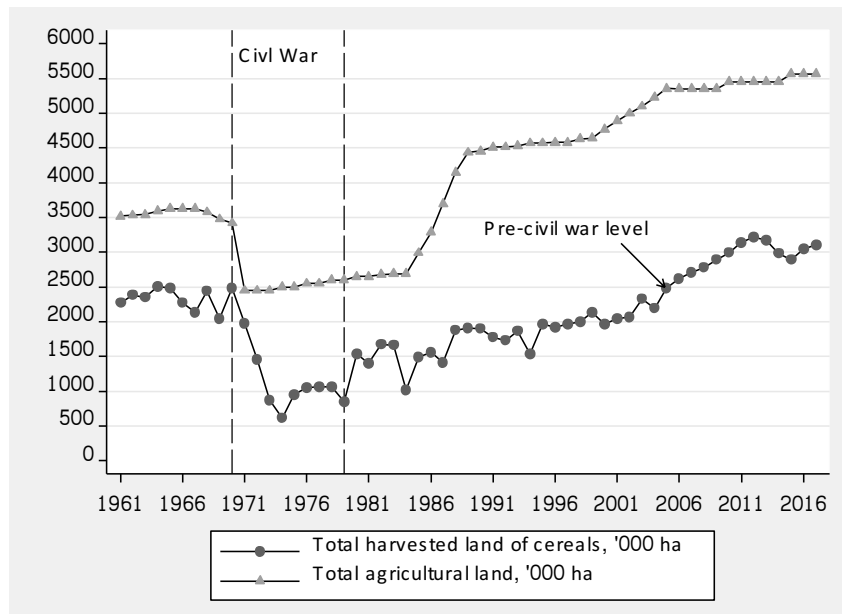
Expansion of agricultural land

Agriculture land use in Cambodia had been largely marred by the chronic civil war that last for almost three decades between 1970 and 1998. About a decade prior to the onset of the civil war in 1970 total agricultural land which includes both arable land and land under permanent crops stayed around 3.5 million hectares, when the total population was around 6-7 million. After the civil war broke out in 1970 total agricultural land nosedived to 2.5 million hectares and stayed around that figure until 1984 before it started to rise abruptly in the following years. Because of the civil war it took 17 years for Cambodia to recover its agricultural land to the pre-civil war level in 1987 when the total population was around 8.2 million. Despite continued civil war, which last until 1998, we observe exponential rise in agricultural land during the 1985-1989 period as more farmers returned to their farms. We observe another round of remarkable increase in agricultural land, which is during the 1999-2005 period, and the total agricultural land stayed around 5.5 million hectares during the last decade.

To be sure, we turn to another indicator of agricultural land use, which is total harvested land of cereals, as cereals contribute to a large proportion of all agricultural products (i.e. livestock, poultry, fisheries and forestry) and change in its size tend to more likely affect demand for labor in agriculture than total agricultural land does. Using this indicator, we observe that it took almost 35 years for Cambodia to return to its pre-civil war level of harvested land for cereals. Since then the harvested land of cereals went up quite rapidly during the last decade

suggesting that there is marked rise in demand for labor in cereal sector or agriculture as whole during this period causing the demand curve to shift to the right, but this may be offset by the increasing use of mechanization which is discussed in the next section.

Figure 11: Evolution of agricultural land in Cambodia, '000 ha



Source: UN's Food and Agriculture Organization 2019

Increase in mechanization use

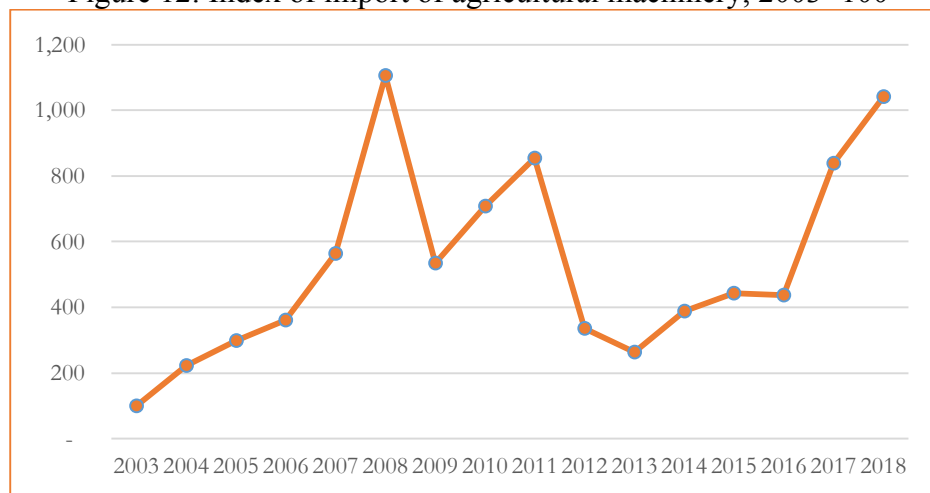
Past international experience, especially in developed economies, suggests that agricultural mechanization, i.e. increase use of machine such as tractors, tend to displace employment opportunities in the rural communities, particularly agriculture-based ones, but it is not always the case. Hamid (1972) shows that adoption of large tractors on farms in Pakistan reduced demand for labor, while Herdt and Duff (1985) also find similar evidence in the case of the Philippines. On the contrary, there is also evidence of increase in demand for labor as a result of agricultural mechanization, for instance, Prihar and Sidhu (1985) for Punjab in India and Ramsay (1985) for Thailand. Therefore, mechanization in agriculture could either reduce or increase labor demand.

Unlike the above experience, agricultural mechanization in Cambodia is one option to offset loss of rural workforce due to migration, urbanization and change in Cambodia's economic structures as indicated in previous sub-sections. Chhim et al (2015) shows that there had been significant increase in agricultural machinery, such as tractors, power tillers, water pumps, threshers and rice mills between 2001 and 2012 consistent with the substantial rise in area

ploughed by machine from 500,000 ha in 2001 to 2 million ha in 2012. We also observe continued upward trend of area ploughed by machine between 2012 and 2017 and the decline of area ploughed by cattle during the same period as indicated in MAFF (2017, p.14). Similar experience, but in a much more rapid process of mechanization, is also seen in Japan during the 1960s and 1970s according to Oshiro (1985).

Using import of agriculture machinery as a proxy for agricultural mechanization, we consistently show continued rise in import of agricultural machinery between 2003 and 2018 (Figure 12). Data from MAFF in 2016 indicates that around 91% of wet season rice field and 97.5% of dry season rice field were ploughed by machine (MAFF, 2017). On the farm labor use, gradual decline in number of workers per ha is also observed during the 2001-2012 period (Chhim et al., 2015 p.5). Using Cambodia Socio-Economic Survey in 2011, Chhim et al., (2015) shows that households losing members to off-farm work were more likely to invest in agricultural machinery. This clearly suggests that there is a compensating role of agricultural mechanization for loss or shortage of labor in agriculture in Cambodia. This increase in agricultural mechanization slows down the right-hand shift of the demand curve.

Figure 12: Index of import of agricultural machinery, 2003=100



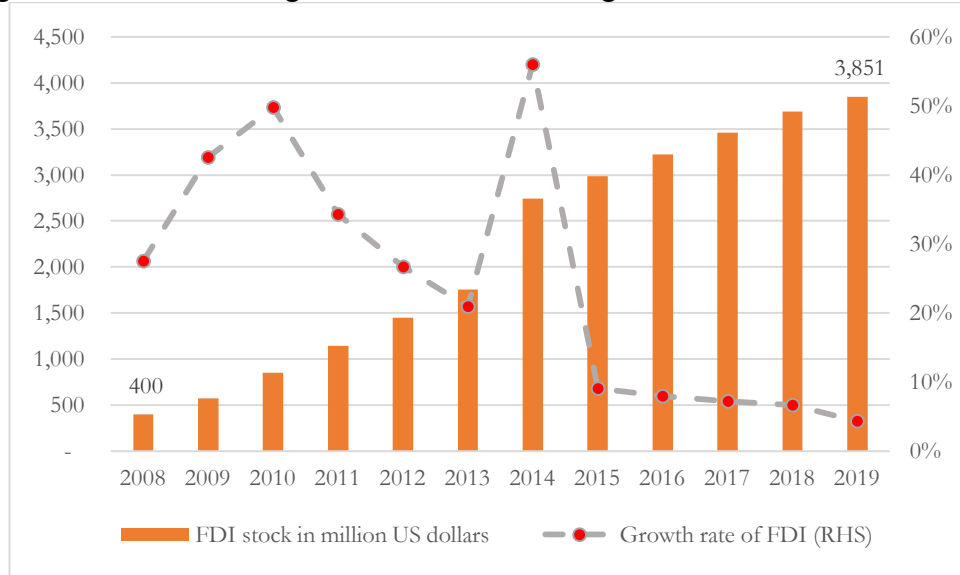
Source: ITC’s Trade Map 2019; Note: The index is the sum of two products, namely HS 8432 & HS 8436 (HS 8432: Agricultural, horticultural or forestry machinery for soil preparation or cultivation, excluding sprayers and dusters; law or sports grown rollers; HS 8436: Agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery).

FDI inflow into agriculture sector

Beside the above two drivers, substantial inflow of foreign direct investment into agriculture sector during the last decade may contribute in part to the labor shortage by driving up real wage. Figure 13 shows that stock of foreign direct investment was only USD 400 million in

2008 but later jumped abruptly to USD 2.7 billion in 2014 and USD 3.8 billion in August 2019. This may suggest the positive effect of the rise of FDI on labor demand in agriculture sector in the last decade.

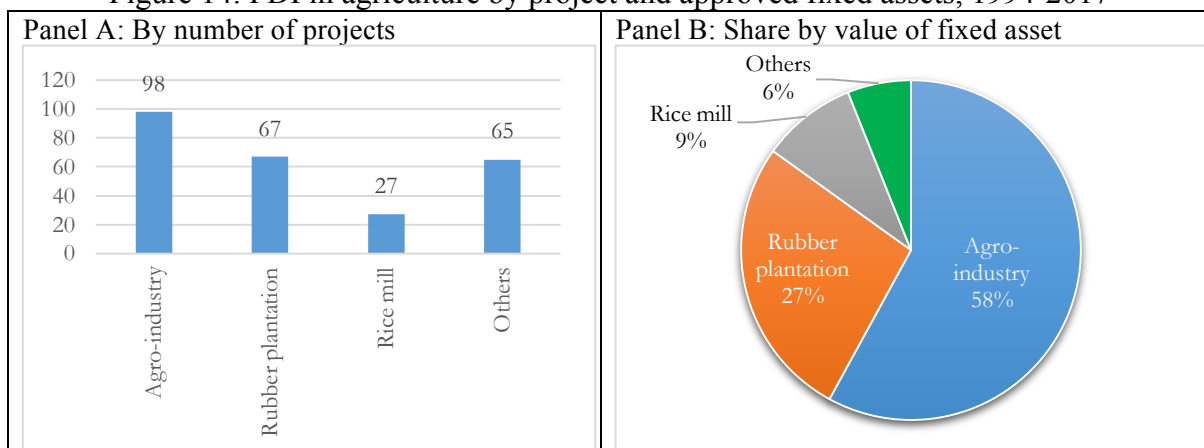
Figure 13: Stock of foreign direct investment in agriculture sector in million USD



Source: National Bank of Cambodia, 2019; Note: Figure in 2019 is as of August 2019.

Using data on approved fixed assets and projects in agriculture from the Council for Development of Cambodia between 1994 and 2017, Oxfam (2019) shows that there are three main agriculture subsectors that absorbed large share of foreign direct investment during the 1994-2017 period suggesting that there is demand for labor in these sub-sectors, namely agro-industry, rubber plantation and rice mill (Figure 14).

Figure 14: FDI in agriculture by project and approved fixed assets, 1994-2017



Source: Council for Development of Cambodia, 2018 adapted from Oxfam, 2019

In sum, urbanization and foreign direct investment in agriculture generate demand for labor in agriculture sector, which is offset by the increase in mechanization use in sector during the last

decade or so. In effect, despite the absence of the exact figure to show the net effect of these factors we conjecture that the effect of the former likely dominates that of the latter; and thus putting more upward pressure on real wage in the sector.

Summary of shocks to labor market in agriculture sector

Table 2 provides a summary of the total net effect of supply-side and demand-side factors on labor market in agriculture sector. Obviously, all supply-side factors, i.e. change in economic structures, urbanization and migration, affected labor supply negatively, while the demand-side factors affected labor demand in both directions. Although expansion of cultivated land of cereals and increase in stock of FDI affected labor demand positively, while increase in mechanization use in agriculture affected labor demand negatively, we conjecture that the positive effect likely dominates the negative one given the significant expansion of cultivated land of cereals during the last decade and mechanization does not seem to likely replace workforce completely.

Table 2: Summary of factors affecting labor market in agriculture sector

| Type of factors | | Direction of effect |
|------------------------|--|----------------------------|
| <i>Supply side</i> | Change in economic structures | - |
| | Urbanization | - |
| | Migration (internal and international) | - |
| <i>Demand side</i> | Expansion of cultivated land of cereals | + |
| | Increase in mechanization use in agriculture | - |
| | Increase in FDI stock in agriculture | + |

Source: Authors' compilation

In sum, both demand-side and supply-side factors put upward pressure on real wage in the agriculture sector during the last decade. Since the current real wage is paid at W_1 lower than the new equilibrium wage W_2 this creates labor shortage in the sector. Such labor market condition does not clear any time soon because W_2 moves in parallel with real wages of migrants working in urban Cambodia and in Thailand, Malaysia and Korea. However, increase use of mechanization will gradually ease the current labor market condition in the sector.

V. Conclusion

In the last three decades since it gained genuine peace and political stability in 1998 Cambodia has gone through significant economic transformation by moving from agrarian economy in early 1990s to labor-intensive industry-based and service-based economy in last decade. This has been due primarily to Cambodia's relentless effort in deepening its regional and global

economic, trade and investment integration by becoming a member of ASEAN in 1999 and WTO in 2004. This transformation has also had implications for agriculture labor market. A number of reports by international organization and government institutions have emphasized that there has been labor shortage in agriculture sector in Cambodia, but no work has been undertaken to provide drivers underlying this phenomenon. This study is therefore intended to qualitatively document evidence of causes underlying this labor shortage without trying to quantify the magnitude of labor shortage in this sector.

Our analysis shows that there are three supply-side factors, namely change in economic structure from agriculture-based to labor-intensive industry-based and service-based economy, urbanization and migration, that negatively affect labor supply in agriculture sector resulting in a left-hand shift in labor supply curve pushing upward pressure on real wage in the sector. The demand-side factors that also put upward pressure on real wage are expansion of cultivated land of cereals and increase in stock of FDI in agriculture although the pressure is somehow compensated by increase in agricultural mechanization in recent years. In effect, real wage pressure comes from both demand and supply sides suggesting strong pressure on real wage. Since the resulting market clearing or equilibrium wage moves in parallel with real wage of migrants working in urban Cambodia and in Thailand, Malaysia and Korea, which is substantially higher than normal wage in agriculture sector in Cambodia it is therefore impossible that real wage is paid at the equilibrium wage. Consequently, wage is paid lower than market clearing wage, which results ultimately in shortage of labor in the sector.

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