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Wage Rise for Unskilled Workers in Cambodia

Was Labour Migration to Thailand the Cause?

Kenijiro Yagura

The real wages of agricultural workers and unskilled workers in non-agricultural sectors in Cambodia remained at low levels during the 2000s, but experienced a rapid increase in the 2010s when labour migration from Cambodia to Thailand increased. Analysing wage data from 2000 to 2018 using the Vector Error Correction Model (VECM), this study found that, in the 2010s, the rise in Thailand's minimum wage led to large wage increases among agricultural workers in Cambodia, further leading to an increase in wages for unskilled garment factory and construction workers. These findings suggest that Thailand's wage increase led to an increase in labour migration from rural areas in Cambodia to Thailand, resulting in a decrease in labour supply in rural areas and a reduction in migration from rural areas to non-agricultural sectors in urban areas. These findings also suggest that labour migration to Thailand negatively affects the development of the garment industry by raising labour costs.

Keywords: Cambodia, international labour migration, dual economy, surplus labour, migrant networks

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1. Introduction

Cambodia has experienced significant economic growth since the 2000s. While the real wages of unskilled labour in the agricultural and industrial sectors remained stagnant in the 2000s, they have witnessed rapid increases in the 2010s.

Various data suggest that this is a result of economic development in line with the classical dual economy model proposed by Lewis (1954). First, Cambodia's garment industry, corresponding to the modern sector in the dual economy model, began to flourish around 2000, absorbing the labour force

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from rural areas despite low wages. Second, in the 2000s, the agricultural workforce increased at a higher rate than the non-agricultural workforce,[1] indicating that the surplus labour in rural areas was not fully absorbed, hence implying an "unlimited" labour supply to the garment industry. Third, in the 2010s, the non-agricultural workforce continued to grow while the agricultural workforce started to decline.[2] This suggests the depletion of surplus labour in rural areas, resulting in an upward-sloping labour supply curve from rural to modern sectors and consequently leading to an increase in real wages for unskilled workers. Fourth, also in the 2010s, the introduction of labour-saving technologies such as mechanization and direct seeding coincided with the increase in real wages in the agricultural sector, resulting in a rapid rise in labour productivity in the primary sector.[3] This is consistent with the situation in rural areas after reaching the "turning point" in the dual economy model.

However, in Cambodia, a situation that deviates from the conventional dual economy model also exists; labour migration to Thailand started increasing significantly around the time when real wages began to rise rapidly. The number of Cambodians residing in Thailand grew from 0.37 million in 2005 to 1.15 million in 2018. The scale of this figure can be compared to Cambodia's total employment of 8.6 million and its garment industry employment of 910,000 individuals in 2019.

The primary senders of migrant workers to Thailand are households from rural areas with limited agricultural land and assets (Molyaneth 2012; Yagura 2018). These households likely overlap with those that have supplied labour for domestic agricultural wage employment and unskilled labour in urban non-agricultural sectors such as garment and construction industries. This suggests that the increase in labour migration to Thailand not only potentially contributed to the rise in agricultural wages by reducing labour supply in the agricultural sector, but also potentially raised wages in urban non-agricultural sectors by decreasing labour migration from rural areas to urban centres.

A question arises as to whether the increase in labour migration from Cambodia to Thailand and the wage growth in Thailand that would facilitate it have led to an increase in agricultural wages within Cambodia and whether it has also had a spillover effect on the wages of unskilled workers in the non-agricultural sector. The answer to this has profound implications for Cambodian governmental policy on labour migration. For instance, if the increase in labour migration to Thailand led to wage increases for unskilled workers in the non-agricultural sector, it would suggest that the Cambodian government should promote labour migration to Thailand. However, this also implies that the rise in wages in the non-agricultural sector is not driven by improved productivity or increased labour demand within the sector, but rather by exogenous labour cost increases. Consequently, the increased labour migration may hinder the development of the non-agricultural sector. Particularly, Cambodia's garment industry, being an export-oriented industry with cheap labour as a key source of international competitiveness, is highly likely to be significantly impeded by exogenous labour cost increases. As such, it can be concluded that labour migration to Thailand should not be promoted indiscriminately.

However, no previous studies have addressed this inquiry. Shrestha (2019) analysed the impact of the increasing statutory minimum wages in the garment industry on wages in other industries in Cambodia, but did not examine the effects of wage increases in Thailand or its rise of labour migrants. Although several studies (Gupta 1991; Chaudhuri 2004; Beladi, Chaudhuri, and Yabuuchi 2008; Chaudhuri 2008) proposed theoretical models that incorporated overseas labour migration into the dual economy framework, they did not conduct empirical analysis. Furthermore, the assumptions underlying these studies are not tailored to the Cambodian context,[4] making it inappropriate to directly apply the proposed theoretical models.

There have been very few prior studies that empirically analyse the effects of international labour out-migration on domestic wages. These studies have employed two main approaches. The first approach examines whether regions with a higher proportion of emigrants have higher wages, assuming that regions with a larger number of emigrants will experience a decrease in labour supply. Employing this approach, Filipski et al. (2020) suggested that labour migration had a positive effect on rural wages in

Myanmar, where there is a significant outflow of migrant workers to Thailand. The second approach involves grouping workers based on attributes, such as years of schooling, and examining whether the domestic wages of groups with a higher proportion of overseas migrants are higher compared to other groups. Mishra (2007) used this method and found that labour migration to the United States increased wages in Mexico.

However, these studies did not investigate whether wage increases in the destination country directly affected domestic wages or whether wage increases occurring in certain sectors or regions due to labour migration had spillover effects on wages in other sectors or regions. Additionally, these studies employed cross-sectional analyses instead of capturing the effects of wage changes over time.

Therefore, this study adopts the Vector Error Correction Model (VECM) to estimate the "causal relationship" between the wages in Cambodia and Thailand. By revealing such relationships in wage time series data, it is possible to indirectly verify whether the increase in labour migration to Thailand is one of the factors contributing to the rise in wages in Cambodia. Furthermore, this method allows us to determine whether wage increase in a particular sector because of migration to Thailand has spilled over to other sectors through intersectoral labour mobility within Cambodia. To the author's knowledge, no study has employed VECM to examine the effect of labour migration or increase in wages in destination countries on domestic wages.

This study reveals that the increase in minimum wages in Thailand raises agricultural wages in Cambodia, which, in turn, has a spillover effect on the wages of unskilled workers in non-agricultural sectors such as the garment and construction industries. The significance of this finding lies in demonstrating that, in cases like Cambodia, the increase in international labour migration can lead to wage increases for both agricultural and non-agricultural unskilled workers, even in the absence of sufficient development in modern sectors domestically.

The following section examines the trends in wages for unskilled workers in Cambodia and the minimum wages in Thailand. The third section presents a theoretical framework based on the situation in Cambodia. The subsequent explains the methodology, and the fifth section presents the analysis results. The final section summarizes the findings and discusses the implications.

2. Evidence of Wage Increases

The wages within Cambodia used for analysis include those of rice farming labourers, garment factory workers, and unskilled construction workers. Rice is the primary crop in Cambodian agriculture and requires a significant amount of labour within a short period. Therefore, even small-scale farmers may hire labourers. The garment industry represents Cambodia's modern sector. The construction industry is the second-largest employer within the secondary sector, following the garment industry, and experienced significant growth during the 2010s.[5] Similar to the garment industry, it is presumed that a substantial number of its workers originate from rural areas.

Figure 1 illustrates the trends in real daily wages for rice farming, garment factory, and unskilled construction workers in Cambodia. Wages in all three categories remained stagnant during the 2000s, but increased sharply during the 2010s. It should be noted that the spike in wages for rice farming and construction workers in 2008 was due to the impact of domestic rice price increasing following the global rise in grain prices.

Figure 2 presents the nominal wage trends in US dollars, including legally mandated minimum wages in Thailand. There is no available statistical data on the wages of Cambodian workers in Thailand. However, a study that analysed Thai government statistics indicates that during 2011–15, 53 per cent of foreign migrant workers in Thailand received wages equivalent to the minimum wage, 22 per cent received wages below the minimum wage, and 25 per cent received wages above the minimum wage

FIGURE 1
Daily Real Wages of Unskilled Workers in Cambodia (Nov 2000 price)

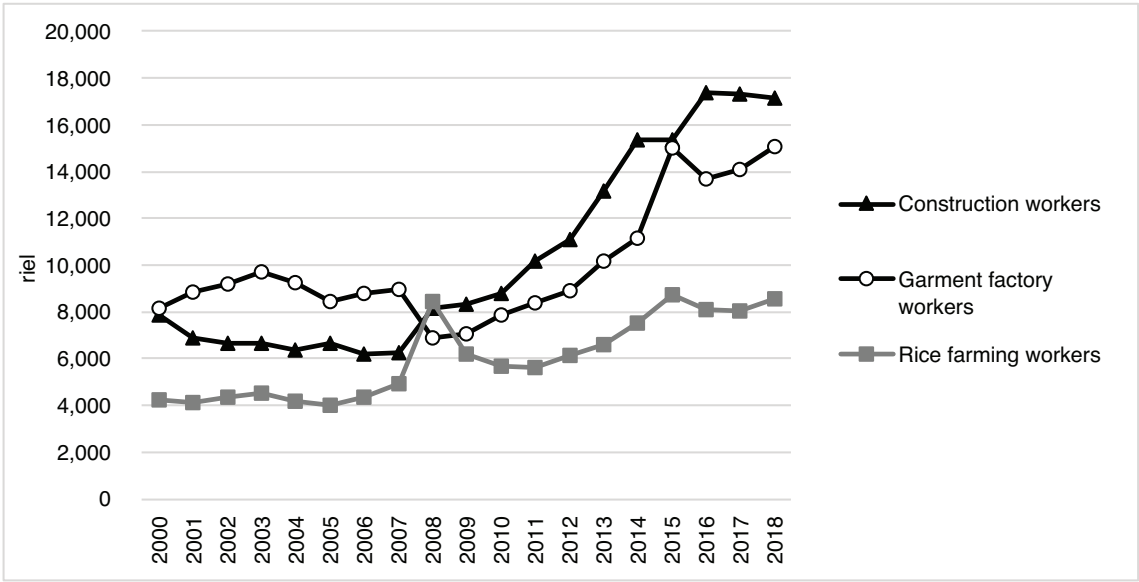
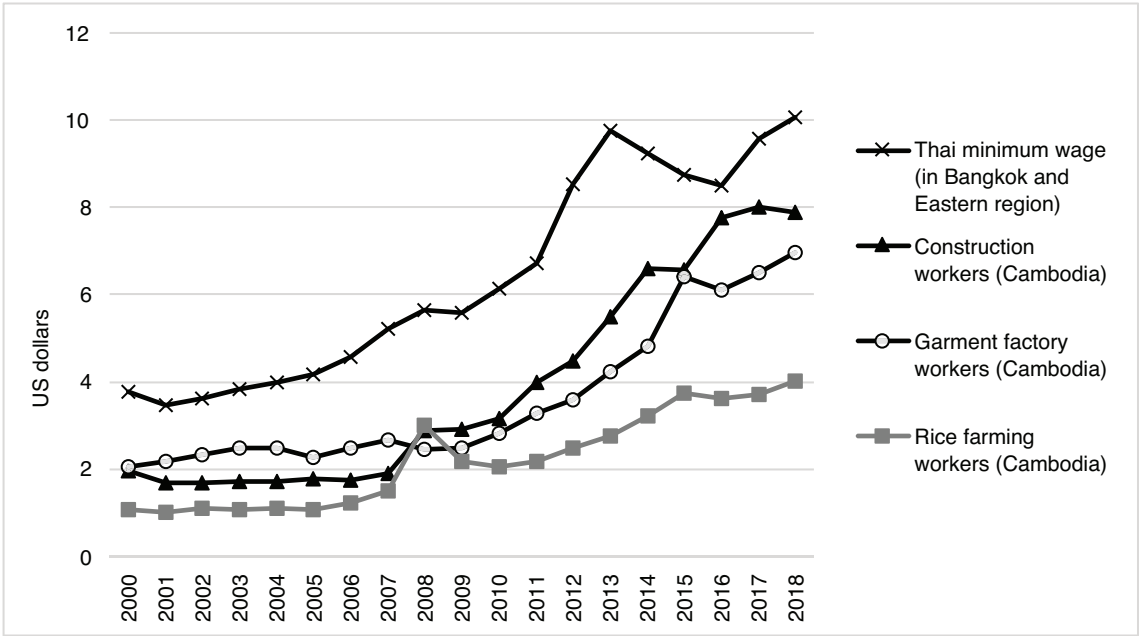


FIGURE 2
Nominal Wages of Unskilled Workers in Cambodia and Thailand's Legal Minimum Wage



(Boonwara and Jirawat 2019). Therefore, this study assumes the legally mandated minimum wage in Thailand as the average wage for migrant workers. In Figure 2, there are periods when Thailand's minimum wage decreased, but this reflects the depreciation of the Thai baht and does not imply a reduction in the minimum wage itself.

From Figure 2, while Cambodia's wages remained stagnant during the 2000s, Thailand's minimum wages had already begun to rise, and both countries experienced wage increases during the 2010s. This is consistent with the hypothesis that the increase in wages in Thailand prompted an increase in labour migration from Cambodia to Thailand, resulting in a decrease in labour supply domestically and subsequent wage increases in Cambodia.

Furthermore, the increase in Thailand's minimum wage began in the mid-2000s, and the wage gap between Thailand and Cambodia has been significant since then. However, it is noteworthy that the surge in labour migration to Thailand occurred in the 2010s, despite this disparity in wages. This timing discrepancy in the rapid increase of labour migration can be attributed to the formation of migrant networks, which are social networks composed of family members, relatives, and acquaintances engaged in labour migration. It is assumed that such networks mitigate the costs and uncertainties associated with labour migration by facilitating the transmission of information about destination countries and providing support for entry and job search upon arrival, thereby making labour migration more accessible.[6]

To facilitate the acceptance of workers from its three neighbouring countries, Thailand entered into Memorandums of Understanding (MOU) with Laos, Cambodia and Myanmar in the early 2000s, which outlined the conditions and procedures for their workers' entry and employment. According to the MOU, Cambodian workers are allowed to enter and work in Thailand through the mediation of private recruitment agencies approved by both governments. However, only a small minority of migrant workers have been recruited through the MOU (Natali, McDougall, and Stubbington 2014; Harkins 2019) and hence the majority of migrant workers used informal channels based on migrant networks.

In the 2000s, it is believed that labour migration from Cambodia to Thailand was still limited, and as a result, the migrant networks were underdeveloped. However, as the number of migrant workers gradually increased, the migrant networks expanded, and hence labour migration became easier during the 2010s.

3. Theoretical Framework and Hypotheses

Previous studies suggest that there is a considerable outflow of migrant workers from rural Cambodia to Thailand, with a sizeable portion being individuals from landless or small-scale farm households (Yagura 2018). Hence, it can be inferred that the migrant workers to Thailand overlap with the labourers engaged in agricultural wage labour in rural areas. Furthermore, the migration to Thailand makes use of migrant networks. Under these circumstances, if wages in Thailand increase, this information spreads through the migration networks, potentially leading to an increase in migration. Consequently, the supply of agricultural wage labour decreases, resulting in an increase in agricultural wages.

Even if Cambodians going to Thailand for work are not agricultural wage labourers while in Cambodia but rather unpaid family farm workers, the increase in migration to Thailand reduces the supply of family labour in agriculture. To counterbalance this, the demand for agricultural wage labour increases, thereby potentially raising agricultural wages.

Moreover, if the households in rural areas sending workers to Thailand also overlap with households sending workers to the non-agricultural sector within Cambodia, the increase in migration to Thailand and the consequent rise in agricultural wages would likely reduce labour mobility from such households to the nonagricultural sector in urban areas, thereby potentially increasing wages in the non-agricultural sector.

In cases where the households sending workers to Thailand do not overlap with households sending workers to the non-agricultural sector within Cambodia, but individuals in the non-agricultural sector in urban areas primarily originate from households engaged in family farming or households supplying agricultural wage labour, the increase in agricultural wages may lead to an increase in wages in the non-agricultural sector. This is because an increase in agricultural wages or a shortage of labour in agriculture may result in reduced labour mobility from such households to the non-agricultural sector or encourage the return of labourers already working in the non-agricultural sector to their rural homes, thereby potentially decreasing the labour supply in the non-agricultural sector.

On the other hand, if farmers respond to the increase in agricultural wages or the labour shortage by adopting labour-saving technologies, the demand for agricultural wage labour may decrease, prompting labourers previously engaged in agricultural wage labour to seek employment in the non-agricultural sector. This implies an increase in labour supply to the non-agricultural sector, potentially exerting downward pressure on wages in that sector.

In all the mentioned cases, the migrant workers going to Thailand are predominantly rural labourers; thus, the wages in the domestic non-agricultural sector increase following the rise in agricultural wages due to the spillover effect. If a significant proportion of the migrant workers going to Thailand are unskilled workers in the domestic urban non-agricultural sector, the wage increase in Thailand will directly increase the domestic non-agricultural sector. The wage increases in the domestic non-agricultural sector will lead to increased labour migration from rural to urban areas, and hence agricultural wages may rise. In other words, agricultural wages increase due to the spillover effect.

However, there is a theoretical possibility that the wage increase in Thailand could raise wages within Cambodia even if labour migration from Cambodia to Thailand did not increase in response to the wage increase. This could occur if Thai producers, in response to the rise in production costs due to wage increases, relocate their production bases to Cambodia. However, such a situation is unlikely to be observed between Cambodia and Thailand. Specifically, many Cambodian workers in Thailand are employed in the primary sector, and mining and manufacturing industries (OECD/ILO 2017). Among these, the primary sector and mining depend on natural resources within Thailand, so relocation of production bases is meaningless. Although manufacturing companies in Thailand can relocate factories to Cambodia in response to wage increases, in reality, there is little direct investment from Thailand to Cambodia by manufacturing companies, particularly in the garment industry.[7]

Based on the above, it is possible to infer the main sources of migrant workers from Cambodia to Thailand and the economic situation in Cambodia from the wage relationships identified through the analysis of wage data. If Thailand's wage increase directly leads to an increase in agricultural wages, it suggests that a significant proportion of migrant workers originate from households engaged in agriculture in rural areas. If the wage increase in Thailand directly leads to an increase in wages in the non-agricultural sector, then a considerable portion of migrant workers are workers in the urban non-agricultural sector. Furthermore, if a positive effect is observed from agricultural wages to domestic non-agricultural wages or vice versa as a spillover effect, it suggests that many of the unskilled labourers in the domestic non-agricultural sector come from households engaged in agriculture in rural areas. If the increase in agricultural wages does not positively affect non-agricultural wages, it suggests that the spread of labour-saving technologies in agriculture in response to wage increases has resulted in an increase in labour migration from rural areas to the non-agricultural sector.

If the wage increase in Thailand does not bring about an increase in wages in any industry within Cambodia, it implies three possibilities. The first possibility is that the labour migration from Cambodia to Thailand is not occurring in response to changes in wages in Thailand. The second possibility is that, even if workers decide to migrate to Thailand in response to wage increases in Thailand, there may be a time lag until the migration and/or its effect actually takes place for any reason. The third possibility is

that rural areas in Cambodia are in a stage before the turning point according to the dual economy theory, where there is still a high natural population growth, and a significant amount of surplus labour exists. In such a situation, even if there is an increase in migration in response to wage increases, the labour supply in agriculture would not decrease, and domestic wages would not rise.

4. Analytical Method and Data

4.1 Vector Error Correction Model (VECM)

VECM is a model used to examine the extent to which changes in two or more time series variables Y_k (k = 1, 2, …, k), are influenced by the values of each Y_k in the prior period t – 1 and the changes in each Y_k from periods prior to t – 1. The condition for applying VECM is that there exists a long-term equilibrium relationship called "cointegration" among $Y_k s$. Essentially, their linear combinations ("cointegrating equations") are stationary—their expected values, variances, and covariances across different time points are unaffected by time. For $Y_k s$ to satisfy this condition, all of them need to be integrated of order one, meaning that their first-order differences ($\Delta Y_{kt} = Y_{kt} - Y_{kt-1}$) are stationary.

Following Johansen (1995), the following equation was estimated using the maximum likelihood method. Taking the case where the number of endogenous variables is three (Y_{1t}, Y_{2t}, and Y_{3t}) and ΔY_{1t} is the dependent variable, the equation is:

$$\Delta Y_{1t} = \sum_{r=1}^{R} \alpha_{1r}(\beta_{1r}Y_{1t-1} + \beta_{2r}Y_{2t-1} + \beta_{3r}Y_{3t-1} + c_r + \rho_{rt}) + \sum_{l=1}^{L-1} (\gamma_{1l}\Delta Y_{1t-l} + \gamma_{2l}\Delta Y_{2t-l} + \gamma_{3l}\Delta Y_{3t-l}) + \boldsymbol{\theta}_{\mathbf{j}}' \mathbf{X}_{\mathbf{j}} + c_1 + e_{1t} \quad \text{(Equation 1)}$$

where R (=1 or 2) is the number of cointegration equations identified; L is the number of lags; α_{1r}, β_{kr}, γ_{kl} (k = 1,2,3) are coefficients; $\mathbf{X_j}$ and $\boldsymbol{\theta}_{\mathbf{j}}$ (j = 1,2,3,,) are the vector of exogenous variables and associated coefficients, respectively; c_1 and c_r are constant terms; and ρ_r is the coefficient for time trend t. For the model to be estimable, β_{1r} and β_{2r} are normalized to 1 or 0 based on Johansen's method (Johansen 1995).

In this equation, $\Sigma_r^R \alpha_{1r} \beta_{kr}$, known as the "long-term effect", represents the effect on ΔY_{1t} of the deviation of the value of the endogenous variable Y_k ($k \neq 1$) at t – 1 from the long-term equilibrium relationship expressed in the cointegrating equation. On the other hand, γ_{kl} represents the effect of the previous changes in Y_k, known as the "short-term effect".

The specific procedure is:[8]

(1) Conducting the unit-root test (Augmented Dickey-Fuller (ADF) test) to confirm whether Y_{1t}, Y_{2t}, and Y_{3t} are all integrated of order one.
(2) Testing for the optimal lag length (L) based on the endogenous and exogenous variables included in the model.
(3) Testing for the number of cointegrating equations (R) under lag length L.
(4) Estimating the VECM (equation 1) based on L and R.
(5) Based on the estimation results of VECM, conducting tests for: (a) stability conditions of the model (whether R is correct or if the estimated cointegrating equations are stationary);[9] (b) presence of autocorrelation in disturbance terms in each equation;[10] and (c) normality of disturbance terms.[11]

Only the estimation results that pass all these tests are retained.

4.2 Data

We used quarterly data (February, May, August and November) of the daily wages of rice farming, garment factory, and unskilled construction workers,[12] alongside Thailand's daily statutory minimum wage, with each represented as A_t, G_t, C_t, and T_t. All variables were measured in nominal values in US dollars and transformed into natural logarithms. Among these variables, the endogenous variables were wages within Cambodia, and the dependent variables were the first-order differences of these three wage variables (ΔA_t, ΔG_t, and ΔC_t).

Thailand's statutory minimum wage was not treated as an endogenous variable, but included in the model as an exogenous explanatory variable, represented by the first-order difference of one period prior (ΔT_{t-1}). This decision was based on the understanding that Thailand's statutory minimum wage is determined by the government and is not influenced by changes in wages within Cambodia. Additionally, since the statutory minimum wage varies by province, the population-weighted averages of the minimum wages in Bangkok and provinces in the eastern region, where a significant number of Cambodian workers are assumed to be employed, were used. The ADF test rejected the null hypothesis that ΔT_t was non-stationary. Therefore, correlations between ΔT_{t-1} and the dependent variables in the model, if they are observed, are not spurious correlations.

The statutory minimum wage in US dollars is also set for Cambodian garment factory workers. However, the data used represent actual wages received by workers, which may not necessarily correspond to the statutory minimum wage for the garment sector in Cambodia. Furthermore, the data include overtime wages, which can vary depending on the amount of overtime worked. The extent of overtime is determined by factors such as the demand for garment products and labour supply. Thus, the fluctuation in wages of garment factory workers can be considered as reflecting changes in labour supply and demand.

As for other exogenous variables, monthly dummies were included, along with the first-order difference in the export price of fragrant rice from Bangkok one period prior ($\Delta P_{t-1} = P_{t-1} - P_{t-2}$) and the price change over the past year ($\Delta_4 P_{t-1} = P_{t-1} - P_{t-5}$). The export price from Thailand serves as a key indicator of international rice prices. As Cambodia also exports a significant amount of fragrant rice, the international price of fragrant rice can influence producers' and retail prices of rice in Cambodia. ΔP_{t-1} was assumed primarily to reflect changes in retail prices of rice and is expected to impact labour supply by wage workers. For example, an increase in the cost of living due to rising rice prices would likely lead to an increase in labour supply. In contrast, $\Delta_4 P_{t-1}$ is expected to influence rice cultivation decisions by farmers, thereby affecting the demand for wage labour in agriculture. As farmers in Cambodia mostly grow rice once a year, they are likely to consider recent price changes and changes over the past year when making decisions regarding rice cultivation.

Until 2007, the wages of garment factory workers consistently exceeded those in construction workers until 2009, when this relationship reversed (Figure 1). This implies that, even if a long-term equilibrium relationship (cointegration) exists among these wages, it is different before, and after 2008. Additionally, agricultural wages experienced a sharp increase in 2008 followed by a steep decline in 2009 and the wages in garment factories experienced a sharp decline in 2008. The former is presumed to be influenced by the global increase in grain prices at the time, while the latter is attributed to the decreased demand for garment products worldwide due to the impact of the global financial crisis. As both of these are significant deviations from the trend, 2008 and 2009 are not suitable for conducting VECM analysis based on the assumption of cointegration. Therefore, the data from 2008 and 2009 were excluded, and the data were divided into two periods: 2000–7 and 2010–18. VECM estimation was performed separately for each period. By separately estimating the model for the two time periods, we can also understand the effects of labour migration to Thailand more clearly. Since there was a significant increase in labour

migration to Thailand and a rise in domestic wages in the 2010s, a significant effect of the increase in Thai wages on domestic wages is expected to be observed only from 2010 to 2018.

5. Estimation Results

ADF Test

Before estimating the VECM, it is important to examine whether the three domestic wage variables were integrated of order one according to the Augmented Dickey-Fuller test (ADF test). Similar to VECM, we divided the data into the periods of 2000–7 and the 2010s and conducted the tests for each period. As shown in Figure 2, domestic wages did not exhibit an increasing trend between 2000 and 2007, but showed an upward trend in the 2010s. Therefore, we performed the tests for 2000–7 without including a constant term in the model and for 2010–18 with drift (i.e., including a constant term). We adopted the lag orders that minimized the Bayesian information criterion. As a result, the null hypothesis of the existence of a unit root could not be rejected for the level variables at a 10 per cent significance level but was rejected for their first-order differences at a 1 per cent significance level. Therefore, it was confirmed that these wage variables are integrated of order one and satisfy the necessary condition for the existence of a cointegrating relationship.

5.1 Period 1: 2000–7

For 2000–7, the optimal number of lags (L) was four (Table 1) and the number of cointegration equation (R) was one when L = 4 (Table 2). However, as shown in Table 3, when we estimated the VECM with R = 1 and L = 4, the stability condition was not satisfied, regardless of whether, or not the time trend was included in the cointegrating equation. Therefore, we estimated the VECM with L = 2 and R = 1 and with L = 3 and R = 2 but found that the stability condition, the absence of autocorrelation, or the normality of the disturbance terms were not met for all these models. Eventually, all of these conditions were met only when L = 1 and R = 2, so we adopted those estimation results.

TABLE 1
Test of the Optimal Number of Lags (L)

Period	*L*	*AIC*		*HQIC*		*SBIC*	
2000–7	1	–4.73	(4)	–4.30	(4)	–3.29	(1)
	2	–4.93	(3)	–4.38	(3)	–3.06	(4)
	3	–5.45	(2)	–4.76	(2)	–3.15	(3)
	4	–5.88	(1)	–5.07	(1)	–3.15	(2)
2010–18	1	–4.80	(2)	–4.34	(1)	–3.47	(1)
	2	–4.87	(1)	–4.27	(2)	–3.14	(2)
	3	–4.66	(3)	–3.92	(3)	–2.52	(3)
	4	–4.60	(4)	–3.72	(4)	–2.06	(4)

NOTES: AIC: Akaike information criterion; HQIC: Hannan-Quinn information criterion; SBIC: Schwarz information criterion. Figures in the parentheses indicate the ascending order of the value of the information criteria.
SOURCE: Author's calculations.

TABLE 2
Test of the Number of Cointegration Equations (R) (Trace Statistic)

Period	*L*	*Trend*	*R = 0*	*R = 1*		*R = 2*	
2000–7	1	without trend	52.77	20.36		0.59	*
	1	with trend	64.45	29.38		8.90	*
	2	without trend	50.40	15.21	*	1.77	
	2	with trend	60.71	17.93	*	4.48	
	3	without trend	57.24	27.84		6.72	
	3	with trend	65.85	28.49		7.32	*
	4	without trend	57.01	12.54	*	0.59	
	4	with trend	62.66	14.80	*	2.35	
2010–18	1	without trend	53.39	17.28		1.28	*
	1	with trend	66.37	29.07		5.93	*

NOTES: "with trend" and "without trend" respectively mean cointegration equations included a trend term or not.
* indicate the value of the trace statistic is smaller than the 5 per cent critical value, meaning that the null hypothesis that the corresponding number of cointegration equations is the maximum cannot be rejected.
SOURCE: Author's calculations.

TABLE 3
Results of the Post-estimation Tests of VECM

Period	*Model*			*Stability Condition*	*Disturbance Terms*	
	L	*R*	*Trend*		*No Autocorrelation*	*Normal Distribution*
2000–7	1	2	without trend	✓	✓	✓
	1	2	with trend	✓	✓	✓
	2	1	without trend			
	2	1	with trend	✓		✓
	3	2	with trend		✓	✓
	4	1	without trend		✓	
	4	1	with trend		✓	
2010–18	1	2	without trend	✓	✓	✓
	1	2	with trend	✓	✓	✓

NOTES: A check mark indicates that the model passed the test.
SOURCE: Author's calculations.

As shown in Tables 4a and 4b, regardless of whether the time trend was included in the cointegrating equation or not, none of the domestic wages were significantly correlated with the first difference in the minimum wage in Thailand. This implies that, as a whole, the changes in Thailand's minimum wage did not have a significant impact on domestic wages during 2000–7. This result suggests that it was difficult for Cambodian workers to migrate to Thailand during this period because migrant networks had not yet developed.

TABLE 4a
Estimation Result of VECM (2000–7) (without Trend Term)

	Cointegration Equation 1 (CE1)			*Cointegration Equation 2 (CE2)*		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*	
$\ln A_t$ (β_1)	1.00			0.00		
$\ln G_t$ (β_2)	0.00			1.00		
$\ln C_t$ (β_3)	–7.70	(1.66)	***	–3.02	(0.78)	*
constant	3.21			3.99		
χ^2	21.52***			15.06***		
	Dependent Variables					
	ΔlnA_t			ΔlnG_t		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*	
CE1 (α_1)	–0.36	(0.24)		0.36	(0.12)	*
CE2 (α_2)	0.71	(0.53)		–0.94	(0.26)	*
$\Delta \ln T_{t-1}$	–1.03	(1.45)		–1.07	(0.71)	
$\Delta \ln P_{t-1}$	0.52	(0.35)		0.05	(0.17)	
$\Delta_4 \ln P_{t-1}$	–0.20	(0.17)		0.16	(0.08)	
May	–0.03	(0.11)		–0.09	(0.05)	*
August	–0.04	(0.11)		–0.01	(0.05)	
November	–0.04	(0.10)		–0.05	(0.05)	
constant	0.03	(0.07)		0.02	(0.03)	
$\Sigma\alpha\beta$						
$\ln A_{t-1}$	–0.36	(0.24)		0.36	(0.12)	*
$\ln G_{t-1}$	0.71	(0.53)		–0.94	(0.26)	*
$\ln C_{t-1}$	0.60	(0.41)		0.06	(0.20)	
R^2	0.29			0.79		
N	27			27		

	ΔlnC_t		
	Coeff.	*(S.E.)*	
CE1 (α_1)	0.11	(0.22)	
CE2 (α_2)	0.03	(0.49)	
$\Delta \ln T_{t-1}$	1.46	(1.35)	
$\Delta \ln P_{t-1}$	–0.19	(0.32)	
$\Delta_4 \ln P_{t-1}$	0.08	(0.16)	
May	0.11	(0.10)	
August	0.08	(0.10)	
November	0.04	(0.09)	
constant	0.02	(0.07)	
$\Sigma\alpha\beta$			
$\ln A_{t-1}$	0.11	(0.22)	
$\ln G_{t-1}$	0.03	(0.49)	
$\ln C_{t-1}$	–0.92	(0.38)	*
R^2	0.57		
N	27		

NOTES: S.E.: the standard errors of the coefficient; *p < 0.10; **p < 0.05; ***p < 0.01.
SOURCE: Author's calculations.

TABLE 4b
Estimation Result of VECM (2000–7) (with Trend Term)

	Cointegration Equation 1 (CE1)			*Cointegration Equation 2 (CE2)*		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*	
$\ln A_t$ (β_1)	1.00			0.00		
$\ln G_t$ (β_2)	0.00			1.00		
$\ln C_t$ (β_3)	–4.05	(0.92)	***	–0.78	(0.31)	***
trend	–0.01	(0.01)		–0.01	(0.00)	
constant	1.79			–0.49		
χ^2	19.31***			6.22**		
	Dependent Variables					
	ΔlnA_t			ΔlnG_t			ΔlnC_t		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*		*Coeff.*	*(S.E.)*	
CE1 (α_1)	–0.21	(0.20)		0.22	(0.10)	**	0.26	(0.19)	
CE2 (α_2)	0.39	(0.62)		–1.07	(0.30)	***	–0.18	(0.58)	
$\Delta \ln T_{t-1}$	–1.09	(1.53)		–1.16	(0.75)		1.42	(1.44)	
$\Delta \ln P_{t-1}$	0.55	(0.36)		0.01	(0.18)		–0.15	(0.34)	
$\Delta_4 \ln P_{t-1}$	–0.15	(0.18)		0.18	(0.09)	**	0.11	(0.17)	
May	–0.04	(0.11)		–0.08	(0.06)		0.10	(0.11)	
August	–0.08	(0.12)		0.00	(0.06)		0.05	(0.11)	
November	–0.04	(0.10)		–0.03	(0.05)		0.04	(0.09)	
constant	0.04	(0.07)		0.01	(0.04)		0.02	(0.07)	
$\Sigma\alpha\beta$									
$\ln A_{t-1}$	–0.21	(0.20)		0.22	(0.10)	**	0.26	(0.19)	
$\ln G_{t-1}$	0.39	(0.62)		–1.07	(0.30)	***	–0.18	(0.58)	
$\ln C_{t-1}$	0.56	(0.44)		–0.04	(0.22)		–0.92	(0.42)	**
R^2	0.26			0.78			0.54		
N	27			27			27		

NOTES: See Table 4a notes.
SOURCE: Author's calculations.

On the other hand, agricultural wages did not show a statistically significant response to the changes in garment factory or construction worker wages, or even to its own changes. This suggests that, during this period, Cambodia's rural areas had not yet reached the turning point in the dual economy model, and, therefore, wage levels were mostly fixed at the "institutional wage". If that were the case, the lack of response of agricultural wages to the increase in the minimum wage in Thailand during this period could be a result of the abundant surplus labour in rural areas and the continued increase in labour supply.

However, garment factory wages did increase in response to the rise in agricultural wages, indicating that garment factory workers were primarily being sent from rural households, especially those engaged in agriculture.

5.2 Period 2: 2010–18

As shown in Tables 1 and 2, for 2010–18, L = 1 was optimal and R = 2 under L = 1. The estimation result of VECM with L = 1 and R = 2 passed all of the post-estimation tests as indicated in Table 3. Though not shown in the tables, when VECM was estimated with L= 2, 3, or 4, with the corresponding number of cointegration equations (R), none of them passed the post-estimation tests. Therefore, the model with L = 1 and R = 2 was adopted.

The estimation result is presented in Tables 5a and 5b. Regardless of whether the time trend was included or not in the cointegrating equation, it was confirmed that there was a positive and significant effect of the change in Thailand's minimum wage on agricultural wages. According to the estimated coefficients, this effect was substantial, as a 1 per cent increase in the Thai minimum wage led to a

TABLE 5a
Estimation Result of VECM (2010–18) (without Trend Term)

	Cointegration Equation 1 (CE1)			*Cointegration Equation 2 (CE2)*		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*	
$\ln A_t$ (β_1)	1.00			0.00		
$\ln G_t$ (β_2)	0.00			1.00		
$\ln C_t$ (β_3)	–0.83	(0.09)	***	–1.05	(0.10)	***
constant	0.41			0.31		
χ^2	96.16***			120.15***		

	Dependent Variables								
	$\Delta \ln A_t$			$\Delta \ln G_t$			$\Delta \ln C_t$		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*		*Coeff.*	*(S.E.)*	
CE1 (α_1)	–1.13	(0.19)	***	0.18	(0.11)	*	–0.06	(0.21)	
CE2 (α_2)	0.79	(0.19)	***	–0.28	(0.11)	**	0.45	(0.22)	**
$\Delta \ln T_{t-1}$	0.73	(0.36)	**	0.04	(0.21)		0.04	(0.40)	
$\Delta \ln P_{t-1}$	–0.63	(0.27)	**	–0.11	(0.16)		0.11	(0.31)	
$\Delta_4 \ln P_{t-1}$	0.18	(0.12)		0.03	(0.07)		–0.04	(0.14)	
May	–0.03	(0.06)		–0.07	(0.03)	**	–0.03	(0.06)	
August	0.14	(0.06)		0.02	(0.03)		–0.04	(0.06)	
November	0.00	(0.07)		–0.04	(0.04)		0.06	(0.08)	
constant	0.01	(0.04)		0.05	(0.02)		0.02	(0.05)	
$\Sigma \alpha\beta$									
$\ln A_{t-1}$	–1.13	(0.19)	***	0.18	(0.11)	*	–0.06	(0.21)	
$\ln G_{t-1}$	0.79	(0.19)	***	–0.28	(0.11)	**	0.45	(0.22)	**
$\ln C_{t-1}$	0.11	(0.17)		0.15	(0.10)		–0.43	(0.19)	**
R^2	0.76			0.47			0.34		
N	35			35			35		

NOTES: See Table 4a notes.
SOURCE: Author's calculations.

TABLE 5b
Estimation Result of VECM (2010–18) (with Trend Term)

	Cointegration Equation 1 (CE1)			*Cointegration Equation 2 (CE2)*		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*	
$\ln A_t$ (β_1)	1.00			0.00		
$\ln G_t$ (β_2)	0.00			1.00		
$\ln C_t$ (β_3)	–95.95	(19.97)	***	–101.10	(21.08)	***
trend	2.86	(0.67)	***	3.01	(0.71)	***
constant	119.10			125.17		
χ^2	23.01***			23.00***		
	Dependent Variables					
	ΔlnA_t			ΔlnG_t		
	Coeff.	*(S.E.)*		*Coeff.*	*(S.E.)*	
CE1 (α_1)	–1.07	(0.18)	***	0.22	(0.11)	**
CE2 (α_2)	1.01	(0.18)	***	–0.21	(0.10)	**
$\Delta \ln T_{t-1}$	0.79	(0.38)	**	0.06	(0.22)	
$\Delta \ln P_{t-1}$	–0.61	(0.28)	**	–0.10	(0.16)	
$\Delta_4 \ln P_{t-1}$	0.21	(0.13)		0.03	(0.08)	
May	–0.04	(0.06)		–0.07	(0.03)	**
August	0.15	(0.06)		0.01	(0.04)	
November	–0.02	(0.08)		–0.06	(0.04)	
constant	0.01	(0.04)		0.05	(0.02)	
$\Sigma\alpha\beta$						
$\ln A_{t-1}$	–1.07	(0.18)	***	0.22	(0.11)	**
$\ln G_{t-1}$	1.01	(0.18)	***	–0.21	(0.10)	**
$\ln C_{t-1}$	0.07	(0.20)		0.04	(0.11)	
R^2	0.75			0.44		
N	35			35		

	ΔlnC_t		
	Coeff.	*(S.E.)*	
CE1 (α_1)	–0.05	(0.18)	
CE2 (α_2)	0.06	(0.17)	
$\Delta \ln T_{t-1}$	–0.08	(0.36)	
$\Delta \ln P_{t-1}$	0.07	(0.27)	
$\Delta_4 \ln P_{t-1}$	–0.14	(0.13)	
May	–0.02	(0.06)	
August	–0.06	(0.06)	
November	0.05	(0.07)	
constant	0.00	(0.04)	
$\Sigma\alpha\beta$			
$\ln A_{t-1}$	–0.05	(0.18)	
$\ln G_{t-1}$	0.06	(0.17)	
$\ln C_{t-1}$	–0.72	(0.19)	*
R^2	0.50		
N	35		

NOTES: See Table 4a notes.
SOURCE: Author's calculations.

0.73 per cent or 0.79 per cent increase in agricultural wages. On the other hand, the changes in the Thai minimum wage did not have a significant impact on garment factory and construction worker wages. These results suggest that labour migrants to Thailand were primarily sent from households engaged in agricultural activities in rural areas. One possible reason why the effect of changes in the Thai minimum wage became significant in the 2010s is the development of the migrant networks due to increased labour migration.

Furthermore, unlike 2000–7, agricultural, and garment factory wages had a mutually positive and significant impact on each other. This resembles the relationship between wages in the rural (traditional) sector and the urban (modern) sector after passing the turning point in the dual economy model, suggesting

that surplus labour in rural areas had disappeared by the early 2010s. This may also have contributed to the rise in agricultural wages due to the increase in the Thai minimum wage in the 2010s. Moreover, construction workers' wages were found to be positively influenced by garment factory wages in the model without the time trend in the cointegration equations.

Overall, these results imply that the increase in the Thai minimum wage first elevated agricultural wages, which then spilled over to garment factory wages and further extended to construction workers' wages. This chain suggests a decrease in labour mobility from rural areas to non-agricultural sectors in urban areas (or an increase in the reverse movement) due to increased labour migration from rural areas to Thailand.

Also, unlike garment factory wages, construction worker wages did not respond to the increase in agricultural wages. This suggests the possibility that the negative effect of agricultural wage increases resulting from technological changes in agriculture was larger for the latter. One plausible explanation for this difference is that, compared to garment factory workers, construction workers had a relatively higher proportion of seasonal workers who were originally engaged in agricultural labour and only worked in construction sites during the off-season. If many seasonal construction workers were forced to seek year-round employment in the construction industry, it would likely lead to a decrease in wages for unskilled construction labour. The increase in agricultural wages unlikely had such a negative effect on garment factory workers' wages because it can be inferred that most garment factory workers were employed year-round. This is because garment factory workers are eligible for seniority allowances under Cambodian law, and hence the economic benefits of long-term employment are greater for garment factory workers compared to construction workers.

Furthermore, the increase in garment wages significantly raises construction wages, but the reverse causality was not confirmed. One possible reason is that a significant number of women, who constitute the majority of garment factory workers, preferred the physically less demanding work in garment factories compared to construction labour. On the other hand, among women engaged in construction labour, there may be those who preferred garment factory work but were unable to get a job and consequently became construction workers. In such cases, the increase in garment factory wages could lead to an increase in construction wages. If the increase in garment factory wages is due to labour shortages, it would result in an increase in garment factory job vacancies and, consequently, an increase in the number of female construction workers transitioning to garment factory jobs, thus reducing the labour supply in the construction industry.

6. Conclusion

The results of the econometric analysis revealed that the wages of unskilled labour in Cambodia's agriculture, garment, and construction sectors did not experience significant impacts from the minimum wage in Thailand between 2000 and 2007. However, from 2010 to 2018, agricultural wages were positively and significantly influenced by the increase in Thailand's minimum wage and the increase in agricultural wages led to an increase in garment wages, which further resulted in an increase in construction wages.

These findings have important implications. First, they imply that rural households engaged in agriculture are the primary source of labour migration to Thailand. Second, stimulated by Thailand's rising minimum wage, there has been an increase in labour migration from rural areas to Thailand, consequently leading to a decrease in labour mobility from rural areas to non-agricultural sectors in urban areas, or an increase in the return migration from urban areas to rural areas.

One probable reason for the lack of effect of the Thai minimum wage in the 2000s is the limited volume of labour migration to Thailand at that time. Due to underdeveloped migrant networks, information about wage increases in Thailand might have been less accessible in rural Cambodia. As labour migration

increased, the migrant networks gradually developed, resulting in a swift increase in labour migration to Thailand in response to wage increases.

Furthermore, in the 2000s, Cambodia's rural areas had a surplus of labour, which might have contributed to the lack of increase in agricultural wages despite the rise in labour migration to Thailand. In the 2010s, as labour mobility to both Thailand and domestic urban areas increased, the surplus labour in rural areas diminished. This shift in labour supply dynamics is believed to be the reason behind the increase in agricultural wages.

The academic significance of this study is that, unlike the prediction of the original dual economy theory, agricultural wages can rise even without the expansion of a domestic modern sector if rural agricultural workers migrate to work abroad at a large scale and the wages in the destination countries increase.

Regarding the Cambodian economy, the existence of such a wage increase mechanism is the reason why the real wages started to increase for both agricultural and non-agricultural unskilled labour within a relatively short period of time from the start of the development of the major modern sector, the garment industry.

Furthermore, based on this study, it is considered that the aforementioned effects of labour migration to foreign countries exist only when those who migrate are mostly unskilled workers from rural agricultural households. If the international labour migrants are primarily skilled workers in the domestic non-agricultural sector, the increase in labour migration may lead to wage increases for skilled workers domestically but have a limited impact on the wages of unskilled labour, resulting in an expansion of the existing domestic wage gap.

The policy implications derived is that labour migration to Thailand should be encouraged as it contributes to the wage increases of domestic unskilled workers. However, it should not be promoted without reservation. If labour migration to Thailand is to be promoted, simultaneous efforts to enhance labour productivity in non-agricultural sectors would be necessary to withstand the associated increase in labour costs. To provide more concrete policy guidance, further research is necessary to examine whether and to what extent wage increases in Thailand and the consequent increase in labour migration to Thailand had a negative effect on the employment opportunities for unskilled labour in various industries within Cambodia.

NOTES

1. According to Cambodia's population census, between 1998 and 2008, the employed population in the nonprimary sectors increased by 0.8 million people, while the employed population in the primary sector increased by approximately 1.3 million people.
2. The employment in the primary sector decreased from 5 million people in 2008 to 4.7 million people in 2019.
3. Based on the data of the World Bank's World Development Indicators (https://databank.worldbank.org/source/world-development-indicators), the average annual growth rate of labour productivity in Cambodia's primary sector was 2.1 per cent from 2000 to 2010, but increased to 5.7 per cent from 2010 to 2018.
4. Gupta's (1991) assumption that urban workers migrate abroad contradicts the situation in Cambodia where many migrant workers are from rural areas. Similarly, Chaudhuri (2004), Beladi, Chaudhuri, and Yabuuchi (2008), and Chaudhuri (2008) assumed an imperfect labour market with unemployment in the unskilled labour sector, which contradicts the low unemployment rate observed in Cambodia regardless of workers' attributes.
5. According to population census data, the employed population in the garment industry and construction industry was about 297,000 and 141,000 in 2008 and increased to about 913,000 and 447,000 in 2019, respectively. As of 2019, the former accounted for 56 per cent of the employed population in the secondary sector, while the latter accounted for 28 per cent.
6. To the best of the author's knowledge, Mines and Massey (1985) were the first to provide a detailed description of migration networks in this sense.

7. As of 30 May 2023, out of the 533 garment companies that are members of the Textile, Apparel, Footwear & Travel Goods Association in Cambodia, only nine are Thai companies (Textile, Apparel, Footwear & Travel Goods Association in Cambodia website; https://www.taftac-cambodia.org/ [accessed 30 May 2023].)
8. STATA version 14 was used for the tests and estimation mentioned below. Commands used for each step of the procedure are: (1) dfuller; (2) varsoc; (3) vecrank; (4) vec; (5)(a) vecstable; (5)(b) veclmar, and (5)(c) vecnorm.
9. The stability condition is satisfied if there are K – R unit moduli in the companion matrix, which consists of coefficient values estimated by VECM.
10. Lagrange multiplier test was conducted for each lag order.
11. Three tests were conducted: (1) Jarque-Bera test; (2) Skewness test; and (3) Kurtosis test.
12. These wage data were collected by the Cambodia Development Resource Institute and published on the institute's quarterly journal, Cambodia Development Review.

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