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The Economic Impact of International Migrant Workers
in Thailand

ผลกระทบทางเศรษฐกิจของแรงงานข้ามชาติในประเทศไทย

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Abstract

This study investigates the impact of international migrant workers on Thailand's GDP by employing an extended Cobb-Douglas production function that disaggregates labor into native, high-skilled migrant, and low-skilled migrant inputs, using data from 2007 to 2023. Based on secondary time-series and panel data, the findings confirm the dominant role of capital in driving GDP, while labor contributions vary by skill level and sector. Notably, high-skilled migrant labor is typically associated with a positive and statistically significant output elasticity across multiple model specifications. In contrast, low-skilled labor shows a more limited effect in long-run aggregated data but exhibits sector-specific relevance in short-term, quarterly models. The results highlight the importance of skill-based migration strategies to enhance productivity and long-term development.

Keywords: Migrant Labor; High-Skilled Migrant; Low-skilled Migrant; Economic Growth

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บทคัดย่อ

การศึกษานี้ได้สำรวจผลกระทบของแรงงานข้ามชาติที่มีต่อการเจริญเติบโตทางเศรษฐกิจของประเทศไทยโดยใช้ฟังก์ชันการผลิตแบบ Cobb–Douglas ที่ปรับแยกส่วนปัจจัยการผลิตแรงงานออกเป็น แรงงานท้องถิ่น แรงงานข้ามชาติที่มีทักษะสูง และแรงงานข้ามชาติที่มีทักษะต่ำในช่วงปี พ.ศ. 2550 ถึงปี พ.ศ. 2566 โดยอิงจากข้อมูลอนุกรมเวลาและข้อมูลทุติยภูมิแบบแผน ผลการศึกษายืนยันถึงบทบาทสำคัญของทุนในการขับเคลื่อนผลิตภัณฑ์มวลรวมในประเทศ (GDP) ขณะที่บทบาทของแรงงานมีความแตกต่างกันไปตามระดับทักษะและภาคเศรษฐกิจ ที่น่าสังเกต คือ โดยภาพรวม แรงงานข้ามชาติที่มีทักษะสูงมีความสัมพันธ์ในเชิงบวกกับค่าความยืดหยุ่นของผลผลิตอย่างมีนัยสำคัญทางสถิติในหลายแบบจำลอง ขณะที่แรงงานข้ามชาติที่มีทักษะต่ำแสดงผลกระทบที่จำกัดในข้อมูลรวมรายปี แต่มีบทบาทเฉพาะในบางภาคเศรษฐกิจในแบบจำลองรายไตรมาส ผลการศึกษานี้ ยังเน้นย้ำถึงความสำคัญของนโยบายการอพยพของแรงงานที่มีทักษะในการสนับสนุนให้เกิดประสิทธิภาพและการพัฒนาในระยะยาว

คำสำคัญ: แรงงานข้ามชาติ แรงงานข้ามชาติที่มีทักษะสูง แรงงานข้ามชาติที่มีทักษะต่ำ การเจริญเติบโตทางเศรษฐกิจ

Introduction

It is undeniable that foreign migrant workers have played an increasingly vital role in Thailand's economic development over the past two decades (Sparreboom, Puttanapong, Limskul, & Bowonthumrongchai, 2017). They serve as a driving force behind the growth of key sectors, including agriculture, industry, and services, with particularly significant contributions to the construction and agricultural industries. Additionally, their presence has become increasingly prominent in the service sector, particularly in elderly care and tourism (United Nations Network on Migration, 2024). In this context, the demand for foreign labor in Thailand is shaped by multiple factors, which vary depending on workers' skill levels-whether high-skilled or low-skilled-as well as broader economic, social, and political determinants at both domestic and international levels. These factors include wage levels, overall economic conditions, Thailand's aging population, and domestic and international political and social dynamics, among others (Chalamwong, 2011; Pholphirul, 2012).

Given these influences, foreign-born workers constitute a crucial component of the labor force, making significant contributions to economic growth in both short and long term (Jitsuchon, 2014; IOM, 2024). Any unexpected circumstances that lead to the return migration of foreign labor would inevitably have profound consequences for the Thai economy. Therefore, these potential effects underscore the necessity of conducting comprehensive studies to assess their recent impact, particularly on economic growth, to ensure effective policy responses and the sustainable management of economic and labor market dynamics.

While existing literature has affirmed the overall positive economic impact of migrant workers on Thailand's Gross Domestic Product (GDP) (Sparreboom et al., 2017; Bhula-or, 2021), a deeper understanding of the differential contributions of high-skilled versus low-skilled migrant workers to this growth-especially in comparison to native-born workers using contemporary data-remains limited. Moreover, prior research often treats migrant workers as a homogeneous group or primarily focuses on the impact of low-skilled labor (Pholphirul, 2012; Sparreboom et al., 2017). Although some studies have begun to explore the distinctions between high-skilled and low-skilled migrants (Chaichanavichakit, 2016; Tipayalai, 2020), a comprehensive analysis that integrates native workers into the comparison, employs a standard econometric framework and utilizes recent sectoral data is still lacking.

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This study aims to address this gap by investigating and quantifying the output elasticities of three distinct labor types-high-skilled migrant workers, low-skilled migrant workers, and native Thai workers-contributing to Thailand's Gross Domestic Product (GDP) during 2007–2023. By estimating the elasticity coefficients within an extended Cobb-Douglas production function, the study provides a rigorous measure of the impact of each labor type on output. In the second stage, the analysis extends to sectoral levels such as agriculture, industry, and services-using quarterly panel data from 2016 to 2023 to estimate sector-specific elasticities.

Accordingly, this study is based on two key research questions:

(1) To what extent do high-skilled and low-skilled international migrant workers contribute to Thailand's aggregate GDP compared to native Thai labor?

(2) How do these contributions vary across Thailand's major economic sectors?

To briefly outline the empirical strategy, the study employs a quantitative framework using both time-series and panel data. It applies a log-linear form of the Cobb-Douglas production function, disaggregating labor into native, high-skilled migrant, and low-skilled migrant inputs. This enables the identification of output elasticities by labor type, which serves as the basis for evaluating economic contributions across skills and sectors.

Research Objectives

This study has two primary objectives:

1. To estimate the impact of native labor, high-skilled migrant labor, and low-skilled migrant labor on Thailand's GDP using annual data from 2007 to 2023.

2. To examine the effects of these labor types on sector-specific GDP across agriculture, industry, and services using quarterly data from 2016 to 2023.

Literature Review

International migrant workers have played a fundamental role in sustaining Thailand's economic development over the past decades. Migrants, particularly those classified as low-skilled, have been critical in alleviating persistent labor shortages across agriculture, manufacturing, construction, and service sectors-fields increasingly avoided by Thai workers (IOM, 2024). Several empirical studies have estimated the economic contribution of migrant labor, applying a range of econometric methodologies and macroeconomic simulation models to assess both their direct and indirect impacts on Thailand's GDP.

Pholphirul, & Kamlai (2014) utilized three methodologies-macroeconomic simulation based on Thailand's Macroeconomic Model developed by the Ministry of Finance, growth accounting, and econometric analysis-to quantify the contributions of low-skilled migrants over the period 1990 to 2008. Through a counterfactual simulation for the year 2007, they found that low-skilled immigrant workers contributed approximately 0.75 percent to Thailand's real GDP growth, with the agricultural sector particularly benefitting from over 1.33 percentage growth due to migrant labor inputs. Growth accounting results further confirmed that although the overall contribution of immigrant workers was modest compared to native labor and capital, it showed a notable upward trend after 2004, coinciding with the introduction of formal migrant registration policies. Their econometric estimations revealed that a 10-percentage increase in the immigrant share of the workforce was associated with a 1.24 to 2.51 percentage increase in real GDP, depending on model specification.

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However, an important concern was noted: a rising immigrant share reduced labor productivity, particularly by 0.88 to 1 percent in the manufacturing sector and 1.35 percent in services, reflecting the substitution of high-productivity capital or labor with low-skilled workers.

Similarly, the OECD (2017) conducted a computable general equilibrium (CGE) model analysis using data from 2000 to 2010 to estimate the broader economic impacts of immigration. The findings indicated that foreign-born workers, concentrated in manufacturing, construction, and private household services, contributed between 4.3 and 6.6 percent to Thailand's GDP in 2010, despite representing only 4.7 percent of the total employed population. These figures imply that, on average, migrant workers contributed proportionally more to economic output relative to their share of the labor force. Furthermore, the employment-to-population ratio among immigrants was significantly higher than Thai nationals, 83 and 74 percent respectively, contributing positively to overall income per capita. Nevertheless, the study also cautioned that the lower educational attainment of migrants could constrain productivity growth in the long term, suggesting that the economic benefits of immigration might be tempered without policies to upgrade skills among migrants.

In addition to these national-level findings, Chaichanavichakit (2016) focused specifically on the structural reliance of Thailand's export-oriented economy on low-skilled migrant workers, analyzing data over the late 1980s to 2010s. The econometric estimations suggested that migrant workers contributed between 0.55 and 1.25 percent to Thailand's GDP during various periods, particularly through labor-intensive industries such as seafood processing and garment manufacturing. However, the study proposes that excessive dependence on low-paid migrant workers discouraged firms from investing in innovation and workforce development. For every 10% increase in the migrant share of employment, a significant decline in firm-level R&D and skills training investment was observed, further intensifying concerns about the middle-income trap.

While the literature has largely focused on low-skilled workers, recent studies have increasingly emphasized the importance of high-skilled immigration. Tipayalai (2020) analyzed regional-level panel data from 2003 to 2015 across seven sub-regions in Thailand, applying a production function model to differentiate the effects of high-skilled and low-skilled migrant workers. The results showed that a 10 percentage increase in high-skilled migrant employment led to a 0.8 to 0.9 percentage rise in regional GDP and labor productivity, whereas low-skilled migrant employment produced minimal or statistically insignificant effects on output growth. Moreover, the concentration of high-skilled immigrants in Eastern, Western, and Central Thailand reflects strategic regional development efforts under Thailand 4.0 and the EEC project, aimed at enhancing innovation capacity.

Beyond economic outputs, Bhula-or (2019) proposed an integrative framework that incorporated economic, social, and environmental dimensions into the analysis of migration and sustainable development. Drawing from a broad review of empirical and theoretical work, the study noted that while migrant labor supports GDP growth, heavy reliance on low-skilled workers without corresponding improvements in productivity risks entrenching Thailand within the middle-income trap. The study also pointed out that migration patterns could be influenced by environmental factors, such as climate change-induced agricultural disruptions, which could intensify both internal rural-urban migration and cross-border migration from neighboring countries.

Overall, the accumulated evidence suggests that while international labor migration has substantially enhanced Thailand's economic growth and labor market flexibility, the quality of migrant labor-particularly the

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skill level-plays a decisive role in shaping long-term development outcomes. This means that high-skilled migration emerges as a critical factor for sustaining GDP growth and enhancing productivity, whereas low-skilled migration, though beneficial in filling immediate labor shortages, carries risks of suppressing innovation and deepening economic vulnerabilities unless carefully managed.

In response to these structural challenges, recent policy frameworks such as Thailand 4.0 and the Eastern Economic Corridor (EEC) highlight the government's emphasis on innovation, digital transformation, and high-skilled labor as drivers of future growth. These strategies reflect a broader shift toward attracting and retaining skilled migrant workers, in line with long-term economic development goals. Additionally, the literature increasingly highlights the role of skills development and workforce training policies as essential complements to labor migration. Effective integration of migrant labor into national human capital strategies—through education, certification, and upskilling—can mitigate risks associated with over-reliance on low-skilled labor and support inclusive, productivity-driven growth.

Research Methodology

Data Collection

This study adopts a quantitative research approach using secondary data to analyze the relationship between labor inputs and economic output in Thailand. All data were collected from reputable government sources to ensure accuracy and consistency. These include the National Statistical Office (NSO), the Office of the National Economic and Social Development Council (NESDC), and the Foreign Worker Administration Office under the Ministry of Labour.

The key variables used in the analysis are defined as follows. The dependent variable, Gross Domestic Product (GDP), is measured by chain volume with reference year 2002 in million Thai Baht, as reported by NESDC. Capital is proxied by net capital stock, also measured by chain volume with the same base year and obtained from NESDC. Furthermore, labor inputs are disaggregated into three categories. Native labor is defined as the number of employed Thai nationals, based on employment statistics from the National Statistical Office (NSO). High-skilled migrant labor refers to the number of legally registered foreign workers from non-neighboring countries who are employed in high-skill occupations. Low-skilled migrant labor includes workers from neighboring countries-Cambodia, Laos, Myanmar, and Vietnam—who are employed in low-skilled occupations. Data for both high-skilled and low-skilled migrant labor are compiled from the Foreign Worker Administration Office under the Ministry of Labour. All labor variables are measured by number of persons employed.

However, it is important to note that this classification of migrant labor by country of origin rather than by specific occupation reflects a data limitation. In particular, disaggregated occupational data for migrant workers are not systematically available at the national level. As such, this proxy classification represents both an assumption and a constraint of the present study. Nonetheless, this approach is consistent with prior empirical literature, which has similarly relied on nationality-based distinctions to differentiate between high-skilled and low-skilled migrant labor in the absence of more detailed occupational data.

In terms of temporal structure, two types of time-series data are employed. The first includes annual and quarterly aggregate data covering all economic sectors, spanning from the first quarter of 2007 to the fourth quarter of 2023. The second consists of quarterly data disaggregated by economic sector, covering the period

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from the first quarter of 2016 to the fourth quarter of 2023. This dual dataset structure allows for both macroeconomic and sector-specific analysis of labor and capital inputs over time. Consequently, this panel structure enables the study to explore sector-specific dynamics and address unobserved heterogeneity across sectors.

Model Specification

This study employs a standard econometric model based on the Cobb-Douglas production function to analyze the contributions of labor and capital inputs to Thailand's GDP. The baseline form of the Cobb-Douglas production function is expressed as a function of capital and labor inputs as follows:

$$Y_t = A \cdot K_t^{\alpha} \cdot L_t^{\beta} \tag{1}$$

where:

- Y_t is output at time t,
- A_t is total factor productivity at time t,
- K_t is capital at time t,
- L_t is labor at time t,
- α and β are the output elasticities of capital and labor, respectively.

In addition, a constant returns to scale assumption can be applied to this function by setting $(\alpha + \beta) = 1$

To account for heterogeneity in the labor force (Borjas; 2006, 2019), this study extends the traditional Cobb-Douglas production function by disaggregating labor into three distinct components: native labor (Thai workers), high-skilled migrant labor, and low-skilled migrant labor. In this context, labor heterogeneity is limited to a classification based on nationality. Specifically, low-skilled migrant labor refers to workers from neighboring countries, while high-skilled migrant labor refers to workers from other countries as specified in Section 2. These labor categories are treated as separate inputs in the model to allow for the identification of potential differences in productivity and output elasticities across labor types.

The extended production function is specified as:

$$Y_t = A \cdot K_t^{\alpha} \cdot L_{(N,t)}^{\beta} \cdot L_{(MHS,t)}^{\gamma} \cdot L_{(MLS,t)}^{\delta} \tag{2}$$

where:

- $L_{N,t}$ = Native labor at time t,
- $L_{MHS,t}$ = High-skilled migrant labor at time t,
- $L_{MLS,t}$ = Low-skilled migrant labor at time t,
- $\alpha, \beta, \gamma, \delta$ = Output elasticities of capital, native labor, high-skilled migrant labor, and low-skilled migrant labor, respectively.

Moreover, the model is transformed into the natural logarithmic form:

$$\ln(Y_t) = \ln(A) + \alpha.\ln(K_t) + \beta.\ln(L_{(N,t)}) + \gamma.\ln(L_{(MHS,t)}) + \delta.\ln(L_{(MLS,t)}) \tag{3}$$

This is the log-linear form of the production function, which is suitable for ordinary least squares (OLS) regression, where the coefficients $\alpha, \beta, \gamma, \delta$ can be estimated from the data.

In addition to the pooled time-series regression model, the study further analyzes the relationship at the sectoral level. Specifically, the analysis distinguishes among three major production sectors: agriculture,

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industry, and services. For this purpose, the extended Cobb-Douglas production function is specified for each sector i, where $i \in \{1, 2, 3\}$, corresponding to agriculture, industry, and services, respectively:

$$\ln(Y_{it}) = \ln(A_i) + \alpha.\ln(K_{it}) + \beta.\ln(L_{N,it}) + \gamma.\ln(L_{MHS,it}) + \delta.\ln(L_{MLS,it}) \tag{4}$$

This specification enables an examination of whether the contributions of different types of labor and capital vary across sectors and over time. It also provides sector-specific insights into labor productivity, capital intensity, and potential structural differences within the Thai economy.

Additionally, this study interprets the term $\ln(A_i)$ in the log-linear production function as the Solow residual, representing total factor productivity (TFP) not explained by observable inputs such as capital and labor. In the specified models—both at the aggregate level,

$$\ln(Y_t) = \alpha.\ln(K_t) + \beta.\ln(L_{(N,t)}) + \gamma.\ln(L_{(MHS,t)}) + \delta.\ln(L_{(MLS,t)}) + \varepsilon_t, \tag{5}$$

and at the sectoral level,

$$\ln(Y_{it}) = \alpha.\ln(K_{it}) + \beta.\ln(L_{N,it}) + \gamma.\ln(L_{MHS,it}) + \delta.\ln(L_{MLS,it}) + \varepsilon_{it}, \tag{6}$$

The residual term (ε) captures all other unobserved influences on output that are not included in the regression model, such as technological progress, institutional quality, or sector-specific efficiencies. Rather than controlling for these factors, the residuals reflect their joint impact, and thus serve as a proxy for unexplained productivity variation. In addition, since these unobserved factors are not explicitly included as regressors, their correlation with the included inputs could introduce potential omitted variable bias.

Model Diagnostics and Estimation Strategy

Given the annual frequency of the data used in estimating the Cobb-Douglas production function, particular attention is paid to potential autocorrelation, which is assessed using the Durbin-Watson statistic. To verify the presence of a long-run equilibrium relationship, the Augmented Dickey-Fuller (ADF) test is applied to the regression residuals. Stationarity of the residuals confirms cointegration among capital, labor, and output, thereby validating the use of the regression model for long-run analysis.

Pooled time-series estimations may also be subject to temporal autoregressive issues, multicollinearity, and spatial heterogeneity, especially when aggregating data across sectors and time. To address these concerns, the study incorporates sector-specific panel data models, allowing for more accurate control of unobserved heterogeneity and dynamic effects.

In the panel setting, the fixed effects (FE) model is employed when unobserved sector-specific heterogeneity correlates with explanatory variables. Alternatively, the random effects (RE) model is used when such correlation is not present (Greene, 2012). The choice between FE and RE models is statistically validated using the Hausman test, ensuring consistent and efficient estimators. This combined approach ensures robust estimation of input elasticities by utilizing both time-series and cross-sectional variation.

Findings and Discussion

This study applies an extended Cobb-Douglas production function to examine the impact of capital and labor-both native and migrant-to Thailand's GDP using yearly data from 2007 to 2023. To analyze the relationships between labor and capital to Thailand's real GDP, four model specifications are estimated. Models 1.1 and 1.2 consider total labor inputs without disaggregation, while Models 2.1 and 2.2 incorporate labor heterogeneity by distinguishing between native labor, high-skilled migrant labor, and low-skilled migrant labor.

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Furthermore, each pair of models includes both an unconstrained version (Non-CRS) and a constrained version (CRS), with the latter imposing the assumption of constant returns to scale, i.e., $\alpha + \beta + \gamma + \delta = 1$.

Table 1: Foreign Migrant Workers and Real Gross Domestic Product, 2007-2023

	Model1		Model2	
	Model 1.1	**Model 1.2**	**Model 2.1**	**Model 2.2**
Variable	**(Non-CRS)**	**(CRS)**	**Non-CRS**	**CRS**
Dependent variable: Natural logarithm of real gross domestic product				
$\ln(K)$	1.2797	0.8517966	1.391122	0.7993478
	[0.0605]***	[0.0016]***	[0.3186]***	[0.0082]***
$\ln(L_n)$	-0.3303	0.1482	-0.2698	0.0222
	[0.2710]	[0.0016]***	[0.3809]	[0.0314]
$\ln(L_{mhs})$	-	-	-0.0033	0.1328
	-	-	[0.0887]	[0.0438]***
$\ln(L_{mls})$	-	-	-0.0237	0.0456
	-	-	[0.0429]	[0.0158]**
Constant	-2.2322	-	-4.3914	-
	[2.4815]	-	[4.4061]	-
R-squared	0.9764	0.8835	0.9771	0.9706
Observation	17	17	17	17
Durbin-Watson	1.5	1.5198	1.5714	1.7048

Non-CRS and **CRS** refer to models **without** and **with** the **constant returns to scale (CRS) constraint**, respectively.

Robust standard errors are shown in parentheses.

*, **, *** indicate significant at 10%, 5%, and 1% level of significance, respectively

To begin with, capital input $\ln(K)$ consistently exhibits a strong and statistically significant positive relationship with real GDP across all models. In the non-constrained Model 1.1, the coefficient on capital is 1.2797, significant at a 1-percent level. When the CRS restriction is imposed in Model 1.2, the coefficient decreases to 0.8518, though it remains highly significant. Similarly, Models 2.1 and 2.2 show capital coefficients of 1.3911 and 0.7993, respectively, both of which are also statistically significant at a 1-percent level. These findings clearly underscore the crucial role of capital accumulation in driving Thailand's economic performance, regardless of model specification.

In contrast, the impact of labor inputs varies considerably depending on whether the CRS constraint is applied. Specifically, in Model 1.1, where labor is included as a single aggregate input and no CRS restriction is imposed, the coefficient for labor is negative (-0.3303) and statistically insignificant. However, when CRS is applied in Model 1.2, the coefficient becomes positive (0.1482) and statistically significant at a 1-percent level. This finding suggests that the assumption of constant returns to scale improves model consistency and supports the validity of labor's positive role in the production process.

Moving to Models 2.1 and 2.2, the inclusion of labor heterogeneity allows for a more comprehensive understanding of labor's contribution to output. Without the CRS constraint (Model 2.1), the coefficients for all labor types-including native, high-skilled, and low-skilled migrant labor-are negative and statistically insignificant. This indicates model instability and potentially multicollinear relationships among inputs. However, once CRS is imposed in Model 2.2, the estimates become both stable and interpretable. Notably, high-

skilled migrant labor ($\ln(L_{MHS})$) has a coefficient of 0.1328, statistically significant at a 1-percent level, while low-skilled migrant labor ($\ln(L_{MLS})$) has a coefficient of 0.0456, significant a 5-percent level. Native labor, by contrast, shows a small positive coefficient (0.0222), which is not statistically significant.

These results reveal important distinctions in the productivity of different labor types. In particular, the elasticity of high-skilled migrant labor is approximately three times larger than that of low-skilled migrant labor, though there is a slight overlap in their standard errors. Nonetheless, the consistent positive and significant coefficient of high-skilled labor emphasizes the disproportionately higher contribution of skilled foreign workers to Thailand's GDP. This finding has important policy implications, as it suggests that encouraging high-skilled migration could bring substantial economic benefits, while enhancing the efficiency of low-skilled migrant labor remains essential.

In addition, the model performance statistics lend further credibility to these interpretations. All models demonstrate high explanatory power, with R-squared values ranging from 0.8835 to 0.9771. Although the imposition of CRS slightly reduces R-squared values (as seen in Models 1.2 and 2.2), the gains in model stability and theoretical coherence justify the constraint. Furthermore, Durbin-Watson statistics fall between 1.5 and 1.7 across all specifications, indicating no strong evidence of autocorrelation in the residuals.

In summary, the regression results provide several important insights. First, capital input plays a dominant role in explaining real gross domestic product throughout the period. Second, labor's impact becomes more apparent and statistically valid under the CRS assumption. Third, the disaggregated analysis confirms that high-skilled migrant labor significantly contributes to output, while low-skilled labor also adds value, albeit to a lesser extent. Overall, the findings highlight the importance of appropriately modeling labor heterogeneity and respecting theoretical production constraints in empirical analysis.

These findings can be further contextualized through the lens of human capital theory and endogenous growth models (Becker, 1964; Romer, 1990). According to human capital theory, workers with higher levels of education and skills are more productive because they contribute greater knowledge, problem-solving capacity, and adaptability to the workplace. This aligns with the empirical findings, in which high-skilled migrant labor exhibits stronger output elasticity than low-skilled labor. Similarly, endogenous growth models emphasize the role of human capital accumulation—through education, training, and skill-biased migration—in fostering long-term technological advancement and innovation. This theoretical framing helps explain the differential contributions of labor types observed in the empirical results.

Table 2 provides results based on quarterly panel data from 2016 to 2023 across major sectors of the Thai economy-agriculture, industry, and services. All models are estimated under the assumption of constant returns to scale (CRS), and three econometric techniques are employed: Pooled Ordinary Least Squares (Pooled-OLS), Fixed Effects (FE), and Random Effects (RE). Each method is presented in two variants: one with only native labor included (Models 3, 5, 7), and one with disaggregated labor inputs including high-skilled (L_{mhs}) and low-skilled migrant labor (L_{mls}) (Models 4, 6, 8).

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Table 2: Foreign Migrant Workers and Real Gross Domestic Product in Thailand, 2016Q1 – 2023Q4

Dependent variable: Natural logarithm of real gross domestic product

	Pooled-OLS		Fixed-effect		Random-effect	
Variable	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$\ln(K)$	0.6353	0.4548	1.1789	1.1724	1.2335	0.9866
	[0.0081]***	[0.0272]***	[0.2662]**	[0.3434]***	[0.0159]***	[0.3086]***
$\ln(L_n)$	0.3646	0.0763	-0.1789	-0.2739	-0.2335	-0.2671
	[0.0081]***	[0.0156] ***	[0.2662]	[0.2978]	[0.0159]***	[0.1517]*
$\ln(L_{mhs})$	-	0.2136	-	0.1151	-	0.0883
	-	[0.0074]***	-	[0.1305]	-	[0.1018]
$\ln(L_{mls})$	-	0.2551	-	-0.0136	-	0.1921
	-	[0.0438]***	-	[0.0617]	-	[0.0675]***
Constant	-	-	-1.00E-07	-1.11E-07	-2.3833	-0.5632
	-	-	[0.0121]	[0.0122]	[0.2883]***	[2.0291]
R-squared	0.7374	0.9797	0.0545	0.0649	0.9855	0.9857
Observation	96	96	96	96	96	96
Hausman test					χ2 (3) =0.4987	χ2 (5) =0.0281

All models are estimated under the **constant returns to scale (CRS)** constraint.

Robust standard errors are shown in parentheses. *, **, *** indicate significant at 10%, 5%, and 1% level of significance, respectively

Starting with the pooled OLS estimations (Models 3), the coefficients on capital ($\ln(K)$) and native labor ($\ln(L_n)$) are both positive and statistically significant. In Model 3, the capital coefficient is 0.6353 and that of native labor is 0.3646, both significant at a 1-percent level. When labor heterogeneity is added in Model 4, the coefficients for capital and native labor slightly decline to 0.4548 and 0.0763, respectively, and both variables remain statistically significant. Importantly, both high-skilled and low-skilled migrant labor show positive and significant effects on GDP. High-skilled migrant labor ($\ln(L_{mhs})$) has a coefficient of 0.2136 and low-skilled labor ($\ln(L_{mls})$) has a slightly higher coefficient of 0.2551, both significant at a 1-percent level. These findings suggest that migrant labor-especially low-skilled migrants-play a meaningful role in enhancing output across sectors when analyzed at a macro-sectoral level.

The fixed-effect models (Models 5 and 6), which control for unobserved heterogeneity across sectors, produce less robust estimates. In Model 5, capital remains positively associated with GDP (1.1789, with a 5-percent level of significance), but native labor shows a negative and insignificant effect (-0.1789). When disaggregated migrant labor is introduced in Model 6, the capital effect remains significant (1.1724), while native labor becomes more negative (-0.2739) and still insignificant. Interestingly, high-skilled migrant labor shows a positive but statistically insignificant effect (0.1151), and low-skilled migrant labor turns negative (−0.0136), also without significance. This instability may reflect sector-specific shocks or data limitations, especially in quarterly migrant labor records.

In contrast, the random-effect models (Models 7 and 8) yield more stable and interpretable results, aligning more closely with the pooled OLS findings. Capital input continues to have a strong and significant positive impact on GDP across both models, with coefficients of 1.2335 and 0.9866, respectively. Although native labor displays a negative relationship with output in both models, the coefficient in Model 8 (-0.2671) is only marginally significant at a 10-percent level. Crucially, when disaggregated labor is included in Model 8, both high-skilled and low-skilled migrant labor are positively and significantly associated with GDP. High-skilled

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migrant labor has a coefficient of 0.0883 and low-skilled labor shows a larger effect at 0.1921, both significant at conventional levels (10-percent and 1-percent, respectively). These results reaffirm the importance of migrant labor—particularly low-skilled workers-in supporting Thailand's economic output, especially within labor-intensive sectors. Lastly, the Hausman tests assist in choosing between the fixed-effect and random-effect estimators. The test results ($\chi^2(3) = 0.4987$; $\chi^2(5) = 0.0281$) suggest that random effects are preferable for Model 3 and potentially Model 4 as well, confirming the suitability of RE models for capturing both within- and between-sector variations in this dataset.

Building on these findings, the comparison between Table 1 and Table 2 reveals a notable contrast in the relative contributions of high-skilled and low-skilled migrant labor to Thailand's GDP. In the yearly model, high-skilled migrant labor shows a higher elasticity (0.1328) than low-skilled labor (0.0456), indicating a stronger aggregate impact over time. Conversely, in the quarterly sectoral model, low-skilled migrant labor exhibits a larger coefficient (0.1921) than high-skilled labor (0.0883), suggesting a greater short-term contribution across labor-intensive sectors. This discrepancy can be theoretically explained by differences in temporal dynamics and labor utilization patterns. High-skilled migrant labor tends to influence output through long-term mechanisms such as innovation, knowledge transfer, and productivity spillovers, which are better captured in annual data. In contrast, low-skilled labor is typically concentrated in labor-intensive industries with shorter production cycles, making its impact more visible in quarterly data. Furthermore, quarterly models are more sensitive to short-term fluctuations in labor supply, such as seasonal employment and cyclical demand in sectors like agriculture and construction. This interpretation aligns with economic theory on the differential roles of skill types in production functions and underscores the importance of using appropriate temporal scales in empirical modeling.

Table 3 presents sector-specific regression results examining the contributions of native labor, high-skilled migrant labor, and low-skilled migrant labor to GDP across agriculture, industry, and services. All models are estimated under the assumption of constant returns to scale (CRS), using quarterly data from 2016 to 2023.

Table 3: Foreign Migrant Workers and Real Gross Domestic Product by Sector in Thailand, Q1 2016 – Q4 2023

Dependent variable: Natural logarithm of real gross domestic product

Variable	Agriculture		Industry		Service	
	Model 9	Model 10	Model 11	Model 12	Model 13	Mode 14
ln(K)	0.4982	0.6009	0.6965	0.6981	0.652	0.569
	[0.0069]***	[0.1302]***	[0.0012]***	[0.0522]***	[0.0012]***	[0.0283]***
ln(L_n)	0.5018	-0.1293	0.3035	0.2293	0.3479	0.1792
	[0.0069]***	[0.4404]	[0.0012]***	[0.1191]*	[0.0012]***	[0.0706]***
ln(L_mhs)	-	0.3784	-	0.1296	-	0.2002
	-	[0.2725]	-	[0.1667]	-	[0.0986]**
ln(L_mls)	-	0.1499	-	-0.0571	-	0.0514
	-	[0.1548]	-	[0.0372]	-	[0.0328]
R-squared	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999
Observation	32	32	32	32	32	32
Durbin-Watson	2.4605	2.4116	1.5268	1.6594	1.5991	1.7683

All models are estimated under the **constant returns to scale (CRS)** constraint.

Robust standard errors are shown in parentheses. *, **, *** indicate significant at 10%, 5%, and 1% level of significance, respectively

In the agriculture sector, native labor (ln(Ln)) demonstrates a statistically significant and positive relationship with output, highlighting the continued importance of local labor in supporting agricultural productivity. In contrast, both high-skilled and low-skilled migrant labor exhibit statistically insignificant coefficients, indicating that foreign workers have not made a direct or measurable contribution to agricultural output, potentially due to the informal or seasonal nature of agricultural employment.

In the industry sector, capital continues to serve as the dominant driver of output, while native labor shows a small positive coefficient (0.0196) that is statistically insignificant. This suggests that Thai labor plays a limited or stable role in influencing industrial GDP. Similarly, both high-skilled and low-skilled migrant labor do not show statistically significant effects in this sector, implying that their productivity impact may be constrained by sector-specific factors such as skill mismatches, or reliance on temporary labor arrangements.

In contrast, the services sector shows a different pattern: high-skilled migrant labor exhibits a statistically significant and positive coefficient (0.2002), suggesting that skilled foreign workers contribute meaningfully to productivity in this sector. Low-skilled labor also shows a positive coefficient, albeit small and not statistically significant. Overall, these findings illustrate that migrant labor impacts vary considerably by sector, with high-skilled migrants contributing most visibly to the service economy, and capital remaining the dominant factor across all sectors. Moreover, while native labor remains relevant, the limited significance of migrant labor in some sectors may indicate mismatches between worker skills and sectoral needs, or data limitations in capturing informal or undocumented employment.

Conclusion

This study provides empirical findings on the role of international migrant workers in Thailand's economic development, emphasizing both aggregate and sectoral contributions. By applying an extended Cobb-Douglas production function to annual and quarterly data spanning 2007 to 2023, the analysis distinguishes between capital, native labor, high-skilled migrant labor, and low-skilled migrant labor. The findings consistently confirm the central role of capital accumulation in driving Thailand's GDP across all model specifications and economic sectors. However, labor's contribution-particularly that of migrant workers-varies significantly depending on the level of skill and the sector under consideration.

In the aggregate analysis using yearly data, high-skilled migrant labor emerges as a significant contributor to GDP, with an elasticity nearly three times greater than that of low-skilled migrant labor. This result suggests that, over the long term, skilled migrants contribute more to Thailand's GDP, likely through knowledge transfer, innovation, and greater complementarities with capital. In contrast, low-skilled migrants, while still statistically significant, exhibit a smaller elasticity, reflecting their role in labor-intensive and often lower-value-added sectors. Native labor, although included as a separate factor, showed limited significance in the models, indicating a relatively stable contribution that is perhaps already embedded in Thailand's existing production structure. This means that native labor has long served as a foundational and consistent component of the country's economic system-present across all major sectors-such that its contribution is already internalized and shows limited variation over time in empirical models. From a policy perspective, labor policies should focus on promoting the migration of high-skilled workers, while simultaneously improving the efficiency and productivity of low-skilled labor in labor-intensive sectors.

The quarterly sectoral analysis reveals a more comprehensive view. In the agriculture sector, only native labor and capital show statistically significant effects, while both high- and low-skilled migrant labor appear insignificant, possibly due to seasonal work patterns or underreporting. In industry, capital dominates once again, but neither type of migrant labor shows a statistically significant contribution, which may reflect inefficiencies or mismatches between skills and production needs. The services sector stands out as the only one in which high-skilled migrant labor has a significant positive impact, underscoring the strategic role of skilled foreign workers in service-driven, innovation-led growth under initiatives such as Thailand 4.0 and the Eastern Economic Corridor (EEC).

Nonetheless, this study acknowledges some limitations. Quarterly labor data, particularly for migrant workers, may be subject to reporting inconsistencies or classification constraints. Additionally, the informal labor market-significant in Thailand's economy-is not fully captured in the official statistics used. These limitations should be considered when interpreting the results.

Policy implications and Suggestions for Further Research

Overall, the findings suggest that while migrant workers-particularly low-skilled-help fill critical labor shortages and support short-term output, their long-run contribution to Thailand' GDP is limited unless paired with effective policies that promote skill development and integration. By contrast, high-skilled migrants have the potential to drive more sustainable growth, especially in modern sectors. These conclusions have direct policy implications. Enhancing the skill level of the migrant workforce, improving labor matching mechanisms, and reducing informal labor market dependence are essential strategies to realize the full economic potential of migration.

In policy terms, this could involve developing training programs that combine language acquisition with industry-specific skills-such as agriculture, construction, or services-in collaboration with the Department of Skill Development. Additionally, introducing incentives for employers to formally register migrant workers, including tax reductions or streamlined visa renewal procedures, could reduce informality and enhance labor regulation and support mechanisms. Finally, the study highlights the importance of considering both skill levels and sectoral contexts when designing labor and migration policies aimed at promoting inclusive and innovation-led economic development in Thailand.

Building on these findings, future research should explore several avenues to enhance the empirical understanding and policy relevance of migrant labor dynamics in Thailand. First, there is a critical need to enhance the level of detail in official labor statistics, particularly by disaggregating migrant workers by skill level, industry, and legal status. Developing a more robust labor information system would allow for more accurate modeling and targeted policy design. Second, researchers should explicitly address the role of informal labor markets, which are substantial in sectors such as agriculture and construction. Incorporating proxy variables or alternative estimation techniques may capture the contributions of undocumented or informally employed workers that are not reflected in official data. Third, future studies could assess the institutional capacity of government agencies-such as the Department of Employment and Ministry of Labor-to manage and modernize migrant labor databases using digital platforms and interoperable systems. Finally, cross-country comparative research with other ASEAN nations could provide valuable insights into regional patterns of labor migration, particularly when labor is disaggregated into high-skilled migrant, low-skilled migrant, and native labor. Such analyses would facilitate more coordinated

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and evidence-based labor mobility policies across Southeast Asia, especially in aligning migration strategies with sector-specific development needs.

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