



SKILLED AND UNSKILLED LOCAL AND FOREIGN LABOUR AS DETERMINANTS OF LABOUR PRODUCTIVITY IN MALAYSIA: A LONG-RUN FMOLS ANALYSIS

Saffiah Mohammad Nor¹, Zahariah Sahudin^{2*}

¹Faculty of Business, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia

 siffy1@yahoo.com

 <https://orcid.org/0009-0003-7297-6109>

²Faculty of Business, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia

 zahariah128@uitm.edu.my

 <https://orcid.org/0000-0002-4404-6575>

*Corresponding Author

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Abstract:

Labour productivity is a contributing factor of economic growth, which reflects the efficiency of utilising workforce and production inputs by the economy. The constant gaps of productivity across industries in Malaysia have increased some issues concerning the roles of capital accumulation, labour composition, and intermediate input efficiency. This study examines the long-term relationship between labour productivity and labour composition, emphasising on skilled and unskilled local and foreign labour throughout major Malaysian industries, comprising agriculture, manufacturing, construction, along with accommodation and food services. The analysis adopts the Fully Modified Ordinary Least Squares (FMOLS) estimation technique to correct endogeneity and serial correlation in cointegrated panel models by using annual panel data from 2010 to 2021, thus providing robust long-run flexibility estimates. Empiric findings shows that intermediate inputs and capital are the primary factors of long-term labour productivity, where intermediate inputs significantly having positive impacts. Conversely, incompetent domestic workers significantly reduce productivity, resulting in the reduction of marginal returns, whereas competent domestic workers contributed significantly to the technical skills sectors such as manufacturing. Meanwhile, competent and incompetent immigrant workers show inadequate accumulated productivity impacts, signifying low spillovers and less absorption capacity. On the other hand, salary has no significant long-term impact on productivity, suggesting the lack of a strong wage-efficient mechanism. All in all, the findings revealed that Malaysia's long-term

productivity growth is predominantly driven by capital accumulation and efficient intermediate input, consistent with the conservative production theory and the Solow growth framework. Policy implications are corresponded to Malaysia's Shared Prosperity Vision 2030 that focus on upgrading skills, organisational transformation, and innovation-driven investment to achieve sustainable productivity-led growth.

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Labour Productivity, Skilled Labour, Unskilled Labour, Foreign Labour, FMOLS, Malaysia, Vision 2030



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Introduction

Labour productivity is highly recognised as a key determinant of economic growth, competitiveness, and sustainable development. Countries with high labour productivity are able to produce greater outputs using the equal level of inputs, thus contributing to the economic development, growth in wages, and enhancement in the quality of life. In the context of Malaysia, labour productivity enhancement is crucial as the nation aspires to transform from a middle-income, labour-intensive economy towards a high-income, knowledge- and innovation-driven economy under the Shared Prosperity Vision 2030 (SPV 2030) (Economic Planning Unit [EPU], 2019). Malaysia continues to face challenges in productivity for both manufacturing and service sectors, regardless the significant investments put in capital and infrastructure. This situation highlighted the needs to investigate the accumulation factor, as well as labour quality and composition as the key drivers of productivity growth.

Even though the conventional growth models highlighted capital accumulation and technological progress as the key determinants of output per worker (Solow, 1956; Barro & Sala-i-Martin, 2004), there is a growing acceptance the productivity outcomes are significantly influenced by the heterogeneity of the workforce. The long-term dynamics of productivity can be best understood if the difference between competent and incompetent labour are differentiated, same goes with domestic and foreign workers. Competent workers usually have higher education, technical proficiency, and sufficient trainings; thus they are able to produce higher efficiency, innovation, and advanced production approaches (Becker, 1964). Contrarily, although incompetent workers generated more outputs in a production-oriented manner, their contribution might have less marginal productivity if they are overemployed, specifically in sectors with low technological intensity (Lewis, 1954; Alemayehu et al., 2024). The presence of foreign workers further complicated this dynamic, as they are frequently concentrated in

laborious jobs with low income, limiting their potential for long-term significant contributions and knowledge transfer (Vasic et al, 2023).

Labour market in Malaysia is represented by diverse structures that relied heavily on foreign workers. Among the sectors that are highly dependence on foreign workers to fill in the immediate workforce insufficiencies are construction, accommodation and food services industries, as well as certain manufacturing subsectors. These sectors are concurrently experiencing comparatively low productivity growth. This dual system arose concerns on the long-term proficiency and sustainability of Malaysia's job-centred growth model. Eventually, experimental evidence on the long-term impact of labour composition on productivity in Malaysia is inadequate. Regardless of the significance of these issues, studies particularly that distinguished competency and workers' origin across multiple sectors are still lacking.

Existing research in Malaysia and other middle-income countries, albeit providing fundamental insights, often emphasised on accumulated labour productivity or considered manpower as a homogeneous input. For instance, Rahman et al. (2020) Baptist and Hepburn (2013) revealed the significance of intermediate inputs and capital accumulation for productivity growth without distinguishing the impacts of competent against incompetent workers or domestic versus foreign workers. Correspondingly, whilst those studies investigated the short-terms impacts of foreign labour on wages and productivity (Alemayehu et al., 2024; OECD, 2019), there is a lack of vigorous long-term evidence that examines the industry-specific dynamics and the interaction between labour quality and regional technology. These gaps are exceptionally critical in Malaysia, where the workforce structure and industrial composition differ greatly across sectors.

This study addresses these gaps by examining long-terms impacts of skilled and unskilled local and foreign labour on labour productivity throughout primary Malaysian industries, comprising agriculture, manufacturing, construction, as well as accommodation and food services. The industry-level panel data and the Fully Modified Ordinary Least Squares (FMOLS) estimator were adopted in this study as the FMOLS approach is highly relevant for estimating the long-term relationships in cointegrated panel data. FMOLS corrects for endogeneity, serial correlation, and cross-sectional heterogeneity, offering constant and efficient estimates of long-term flexibilities (Phillips & Hansen, 1990; Pedroni, 2001). Adding up to that, this study also considered fundamental physical factors influencing productivity beyond labour composition as it includes the intermediate inputs, capital, and salary as control variables.

The foundation for theoretical frameworks of this study was derived from various viewpoints, commencing with classical production theory that provides a basis for understanding decreasing returns to labour, specifically in low-skilled intensive sectors. Human capital theory stressed skilled labour's potential in increasing productivity, subjected to the relevant industry's profile and technology adoption (Becker, 1964), whilst segmented labour market theory offers perspectives on various roles of foreign labour, emphasising barriers in overflowing productivity when foreign workers are constrained in subsidiary labour markets with insufficient training and career development opportunities (Doeringer & Piore, 1971; Vasic et al., 2023). By integrating these frameworks, this study is able to estimate the long-term empirical relationships, as well as providing theoretical interpretations of observed patterns, contributing to the literature on labour heterogeneity and productivity in middle-income countries.

This study has a significant impact in terms of theory and policy. From a theoretical approach, it increases awareness on the interaction of labour heterogeneity with capital and inputs in forming productivity, expanding the existing human capital and growth theories. Findings from this study are significantly relevant to Malaysia's Shared Prosperity Vision 2030, that focuses on the advancement driven by productivity, high quality employment, and strategic human capital development. Therefore, they are able to provide some insights for policymakers in formulating specific interventions for long-term productivity growth by separating the types of labour that motivate or hinder productivity through skill development programmes, sector-specific foreign labour policies, along with investment in technology and automation.

Conclusively, by focusing on various roles of competent and incompetent, domestic and foreign labour, this study offers a comprehensive analysis of labour productivity determinants in Malaysia that bridges the gaps in literature through evidence-based foresights, that are crucial in achieving the objectives of Vision 2030. This paper commences with Section 2 that presents the reviewed literature relevant to labour productivity determinants in Malaysia, focusing on the Solow Growth Model framework. Subsequently, Section 3 outlines the methodology, data sources, and FMOLS estimation technique used in this study, followed by Section 4 that tabulates experimental findings and discussion. Finally, this study is concluded in Section 5, by underlining the policy implications and recommendations for managing industrial development and workforce in Malaysia.

Literature Review

One of the fundamental components of economic growth, competitiveness, and sustainability is labour productivity. It relies heavily on the quantity and quality of the work force, composition, and characteristics of the sectors. When the economy relied heavily on domestic and foreign workers throughout various industries, understanding the long-term determinants of productivity is critical in achieving the goals of the Shared Prosperity Vision 2030 (SPV 2030) (Economic Planning Unit [EPU], 2019).

Labour Quality and Productivity

Labour quality is widely recognised as a primary driver of productivity as it is commonly represented by education, training, and skill level (Becker, 1964; Mankiw, Romer, & Weil, 1992; Jordaan, 2018). Previous studies steadily revealed that competent labour enhanced efficiency, facilitated technology adoption, and motivated innovation, specifically in manufacturing and high-technology sectors (Jordaan, 2018). In contrast, incompetent workers might increase outputs immediately, but they evidently decreased marginal returns, particularly within limited technology and capital environment such as labour-intensive sectors (Lewis, 1954; Barro & Sala-i-Martin, 2004).

Rahmah et al. (2016) highlighted that competent labour has a significant impact on labour productivity in manufacturing sector in Malaysia, whilst incompetent labour has no significant impact in agriculture and construction sectors. Meanwhile, Yusoff and Ismail (2021) highlighted the importance of aligning skills and industry requirements, recognising that competency and structural employment could lead to poor productivity outcomes. These findings stressed the importance of distinguishing labour types in productivity assessment, as their contributions are sector-specific, depending on technological intensity.

Foreign Labour and Productivity Spillovers

Foreign labour are the key players of labour market in Malaysia, especially in construction, services, and low-wage manufacturing sectors (Alemayehu et al., 2024; World Bank, 2020). Although foreign workers could immediately fill in labour shortages, the impacts on productivity are indefinite. According to the segmented labour market theory, immigrant workers are commonly clustered in secondary labour markets, characterised by low incomes, minimal training, and weak career development, thus, limiting knowledge transfer and overflowing productivity (Doeringer & Piore, 1971; Vasic et al., 2023).

Empirical evidence in Malaysia indicated that foreign labour could have mixed effects. Tajuddin et al. (2023) showed that skilled foreign labour contributed significantly towards manufacturing productivity, whilst unskilled foreign labour has minimal or negative impact in construction and services. It is supported by Alemayehu et al (2024) that highlighted foreign labour filled labour gaps but might suppress domestic productivity if local workers are displaced or their complementary skills are weak. These studies suggested that foreign labour's contribution to productivity is exceedingly context-specific, and effective policy design should consider industry-specific absorption capacity and interdependence skills.

Capital, Intermediate Inputs, and Wages

Conventional production theory and augmented Solow growth models emphasised the joint roles of capital accumulation, intermediate inputs, and labour in determining productivity (Solow, 1956; Mankiw et al., 1992). Capital deepening allows employers to utilise more advanced machinery and technology, enhancing output per worker whilst intermediate inputs, consisting of raw materials, energy, and services, encourage production processes and improve efficiency. Successively, wages can influence productivity through the impacts of wage efficiency, incentivising higher effort, and reducing turnover (Stiglitz, 1974).

Rahman et al. (2020) showed that intermediate inputs are constantly being the key drivers of productivity across sectors in Malaysia, whilst capital accumulation plays a moderate role. Eventually, salary systems have insignificant impacts, reflected by minimal representation of productivity induced remuneration systems in many sectors. These findings showed that input-reliant growth could overpower production-oriented growth, indicating a potential barrier for productivity transformation under Vision 2030 of Malaysia.

Theoretical Frameworks

Classical Production Theory

In classical production theory, productivity is determined by combining labour and capital, which is subjected to the reduce in marginal returns (Barro & Sala-i-Martin, 2004). This notion is supported by experimental findings in Malaysia, where incompetent labour has no significant contribution towards productivity in several industries (Rahmah et al., 2016). This theory formed a basis for understanding why increasing incompetent labour could lead to productivity reduction, specifically in saturated sectors such as agriculture and construction.

Human Capital Theory

Human capital theory highlighted the advantages of education, training, and skills development in productivity gains (Becker, 1964). It recognised the capacity of competent labour in enhancing efficiency, supporting digital transformation, and fostering innovation. In addition, this theory underscored the importance of skill utilisation and accumulation towards productivity growth in Malaysia as returns to skills are influenced by regional technology, capital intensity, and organisational capacity (Yusoff & Ismail, 2021),

Solow Growth Model and Augmented Growth Theory

The Solow growth model attributed the long-term productivity growth to technological advancement and capital gain rather than labour quantity (Solow, 1956). Expanded models incorporated human capital and labour quality, offering a framework for assessing skill heterogeneity (Mankiw et al., 1992). Malaysia's experience demonstrated that capital and technology alone are inadequate for productivity transformation, where labour quality and skill proportion are equally important.

Segmented Labour Market Theory

Segmented labour market theory explained how organisational units between primary and secondary labour markets impacted productivity and wages (Doeringer & Piore, 1971). Foreign workers are commonly restrained to secondary markets, limiting their skill transfer and excess productivity. Empirical evidence from Malaysia confirmed that foreign labour has a minor contribution towards productivity unless it is complemented by domestic absorptive capacity (Vasic et al., 1998; Hii & Lau, 2025).

Methodological Approaches in Literature

Long-term productivity studies increasingly employed panel data estimators that justified cointegration, endogeneity, and serial correlation. Fully Modified Ordinary Least Squares (FMOLS) is suitable for estimating long-term flexibilities in panel cointegration frameworks, as it corrected simultaneity and serial correlation (Phillips & Hansen, 1990; Pedroni, 2001). Prior studies in Malaysia and equivalent economies often relied on pooled OLS, dynamic panel, or FMOLS estimators to explore the relationships between labour, capital, and productivity (Rahman et al., 2020; Jordaan, 2018). This study adopted FMOLS to produce robust long-term estimates on various impacts of skilled and unskilled local and foreign labour, controlling for capital, intermediate inputs, and wages across industries.

Policy Context and Vision 2030 Alignment

Labour productivity is the foundation of Malaysia's Shared Prosperity Vision 2030 that emphasises the transformation towards high-income, technology driven growth, and high-quality employment (EPU, 2019). Existing evidence suggested that to achieve long-term productivity gains, Malaysia needs policies that focus on skill development, organisational transformation, and selective foreign labour management. The effectiveness of both competent and foreign labour in enhancing productivity can be improved by upgrading vocational and technical education, stimulating technology adoption, and reforming labour market regulations.

This study highlighted the sector-specific and dependent nature of labour productivity determinants through a comprehensive review of literature. These foresights are crucial in achieving the objective of this study, which is to provide strong, industry-level evidence on the long-term impacts of labour composition in Malaysia. Therefore, this study provides significant contribution to the academic knowledge through policy guidance for productivity transformation agenda of the country.

Summary of Literature Gaps

Several critical gaps have been identified through existing research that focused on labour, capital, and productivity in Malaysia:

1. The limitation of distinction between skilled and unskilled labour, specifically in long-term productivity studies.
2. Foreign labour and its heterogeneous impacts throughout the sectors in Malaysia are still underexplored.
3. The lack of strong long-term evidence using FMOLS or cointegration methods.
4. Frameworks integration, such as human capital and segmented labour market theory, in interpreting empirical results are still lacking.

By applying FMOLS on industry-level panel data, characterising labour types, and positioning findings within both conservative and current productivity theories, this study is able to fill in those gaps. At the same time, this study also provides some novel understandings on Malaysia's long-term labour productivity dynamics, aligning policies relevant to Vision 2030.

Methodology

Introduction of Theoretical Framework

Towards interpreting the long-term determinants of labour productivity and positioning the empirical findings within established economic theory, a robust theoretical framework is needed. This study integrated classical production theory, human capital theory, Solow growth models, and segmented labour market theory to describe labour heterogeneity by distinguishing the skilled and unskilled, local and foreign workers that interacts with capital, intermediate inputs, and wages in shaping productivity outcomes across Malaysian industries.

The framework lined up three underlying principles observed in Malaysia:

1. The diverse impacts of competent and incompetent labour on productivity.
2. Inadequate productivity spillovers from foreign labour.
3. The roles played by capital, intermediate inputs, and salary in mitigating labour productivity outcomes.

The integration of these specific theories provides a multifaceted dimension for this study in interpreting the results, as well as formulating policy consequences that is aligned with Malaysia's Shared Prosperity Vision 2030.

Classical Production Theory

Classical production theory provided a foundation for understanding the relationship between inputs and outputs in the production process. The output (Y) is a function of labour (L), capital (K), and intermediate inputs (M) are commonly used to represent the Cobb-Douglas production function. It is commonly used in productivity growth study for its simplicity, flexibility, and

empirical robustness. Moreover, this functional form allows the output flexibilities or production inputs to be estimated, enabling the identification of the returns to scale and relative contributions of each input to productivity. According to Noor et al. (2011) and Noor et al. (2023), the basic production function is shown as:

$$Y_t = AK_t^a L_t^B Mat_t^\theta \quad (\text{Equation 1})$$

where Y_t is the total output, K_t is capital, L_t is labour, and Mat_t is intermediate input used in the production process. A represented the total factor productivity, assumed to be captured indirectly through the efficiency of the inputs used in this study. Each variable is divided by the total number of workers to transform the function into a labour productivity equation and concentrate the analysis on labour productivity. To understand the structural composition of Malaysia's labour market, labour (L_t) is divided into local labour and foreign labour. This decomposition allows the evaluation of different roles played by local and foreign labour forces, which is relevant for Malaysia's economic structure, where foreign labour represented a significant proportion of the workforce in agriculture, manufacturing, and construction industries (Hii & Lau, 2025).

The extended functional form, expressed in logarithmic equation to simplify the relationships and stabilise the variance, is as follows:

$$\ln LPR_{it} = \alpha + \beta_1 \ln K_{it} + \beta_2 \ln SLL_{it} + \beta_3 \ln UnSLL_{it} + \beta_4 \ln SFL_{it} + \beta_5 \ln UnSFL_{it} + \beta_6 \ln INT_{it} + \beta_7 \ln W_{it} + \epsilon_{it} \quad (\text{Equation 2})$$

where:

- $i=1, \dots, N$ represents the industry (agriculture, mining, manufacturing, construction, etc.),
- $t=1, \dots, T$ denotes the time period (2010–2021),
- LPR_{it} = labour productivity, measured as the ratio of GDP to total employment,
- K_{it} = capital intensity, calculated as fixed assets per worker,
- SLL_{it} = Skilled local labour share (number of skilled local workers divided by total workers),
- $UnSLL_{it}$ = UnSkilled local labour share (number of unskilled local workers divided by total workers),
- SFL_{it} = Skilled foreign labour share (number of skilled foreign workers divided by total workers),
 - $UnSFL_{it}$ = UnSkilled foreign labour share (number of unskilled foreign workers divided by total workers),
- INT_{it} = intermediate input per worker,
- W_{it} = wage rate per worker,

- ϵ_{it} = error term capturing unobserved factors.

The coefficients can be interpreted as flexibilities, demonstrated by the changes in labour productivity as a response to a one percent modification in each determinant by transforming all variables into natural logarithms. It is aligned with the Solow growth framework, where changes in output per worker are determined by corresponding changes in input factors and technological efficiency (Ross, McGregor & Swales, 2024).

Human Capital Theory

Human capital theory showed that productivity is influenced by the quantity of labour, education, skills, and training (Becker, 1964). Competent workers are capable of adopting new technologies, initiating processes, and utilising capital efficiently, which in turns, generated higher output per worker. This theory also suggested that the returns to human capital are sector-specific, commonly found in technological intensive industries where the labour skills are fully utilised (Mankiw et al., 1992). Empirical evidence from Malaysia indicated that skilled local labour significantly enhanced productivity in manufacturing sector that has higher technological adoption, whereas its impact in labour-intensive sectors is insignificant (Rahmah et al., 2016; Yusoff & Ismail, 2021). Therefore, human capital theory provides a theoretical explanation for the conditional productivity effects of skilled labour, demonstrating the importance of coordinating workforce skills with industry demands. In addition, human capital theory emphasises the needs for policy interventions such as technical education, vocational training, and occupational skill development to optimise productivity gains as a core objective of Vision 2030.

Solow Growth Model and Augmented Growth Theory

The Solow growth model envisions a long-term economic growth as a role of labour, capital, and technological progress (Solow, 1956). In this framework, output per worker mainly expanded through capital deepening and improvements in total factor productivity (TFP), whilst extra workforce makes a lesser contribution to the long-term growth once decreasing returns are accounted for. Extended Solow models expand this framework by integrating human capital as an additional factor, enabling the analysis of skill heterogeneity in long-term productivity (Mankiw et al., 1992). This extension is significantly relevant for Malaysia, where skilled labour forms a minor proportion of the total workforce and its contribution is industry specific. Results from FMOLS estimates are aligned with the extended Solow framework. The findings suggested that capital and intermediate inputs are significant productivity drivers, whilst unskilled labour has no significant impact on productivity in the long term.

Segmented Labour Market Theory

Segmented labour market theory is reflected by inadequate productivity spillovers from foreign labour in primary and secondary labour markets (Doeringer & Piore, 1971). Primary markets provide high salaries, employment security, and training opportunities, whilst secondary markets were frequently inhabited by foreign workers with lower salaries, limited career progression, and minimal skill development. In Malaysia, foreign labour dominated secondary markets such as in agriculture, construction, and accommodation services sectors. As explained in segmented labour market theory, this type of labour able to stabilise output immediately but did not significantly increase long-term productivity. The findings from FMOLS further

supported this theory where competent and incompetent foreign labour showed a poor or insignificant coefficients. The theory also suggested that efficient absorptive capacity and skill interconnection are essentials in translating foreign labour inputs into productivity gains.

Integrative Conceptual Framework

This study established an extensive conceptual framework for understanding long-term labour productivity in Malaysia by integrating these four theoretical perspectives:

1. Classical production theory that explained the negative impacts of incompetent labour and the significance of capital and intermediate inputs.
2. Human capital theory that accounted for sector-specific benefits of competent labour with an emphasis on skill utilisation.
3. Solow growth and extended models that contextualised the long-term dynamics of productivity growth, highlighting the relationship between capital, labour, and technology.
4. Segmented labour market theory that described limited contribution of foreign labour on productivity, with an emphasis on organisational and absorptive barriers.

This framework indicated that labour productivity is not determined by labour quantity entirely, as it is also influenced by labour quality, skill composition, capital intensity, intermediate inputs, and organisational arrangements. Therefore, this framework enables a refined interpretation of FMOLS results.

Relevance to Malaysia's Vision 2030

This theoretical framework is also aligned with Malaysia's Shared Prosperity Vision 2030, which focuses on:

- Efficient expansion through effective utilisation of competent labour.
- Organisational transformation from low-productivity, labour-intensive sectors to high-productivity and technologically advanced sectors.
- Selective foreign labour management to balance labour shortages with long term productivity gains.
- Investment in intermediate inputs, capital, and technology to complement labour quality and enhance output per worker.

Inclusion of these principles would provide both experimental and theoretical contributions of this study towards policy discussions on sustainable productivity growth of Malaysia.

Data Description and Sources

This study adopted panel data from four major industries in Malaysia. They are the primary, secondary and tertiary sectors such as agriculture, manufacturing, construction, as well as accommodation and food service activities, covering the period from year 2010 to 2021. The cross-sectional part of the panel comprised four industries ($N=4$). Annual panel data from 2010 until 2021 were used to represent the time-series part ($T=12$). There was a total of 48 observations carried out in this study ($N \times T=48$). These sectors were selected as they are the productive pillars of Malaysia's economy, represented a large proportion of employment, foreign labour absorption, and capital formation.

Data used in this study were obtained from the Department of Statistics Malaysia (DOSM). They mainly came from the Annual Economic Survey, Labour Force Survey, and the National Accounts Database, compiled in annual basis to ensure consistency throughout industries and time. They were then converted into logarithmic form to facilitate econometric estimation and reduce the issues of heteroscedasticity.

Each variable is described as follow:

- Labour Productivity (LPR): Calculated as the ratio of industry's added value (in consistent prices) to the total employment in that industry. This measure reflected the capacity of labour input in producing output that is consistent with productivity metrics adopted by OECD and DOSM.
- Capital (K): Represented fixed assets divided by total employment. This ratio is a proxy for capital intensity that showed the degree of physical capital contribution to output generation.
- Local Labour (LL): The proportion of local workers to total employment, capturing the relative contributions of domestic workers in each industry.
- Foreign Labour (FL): The proportion of foreign workers to total employment. This variable captured the impact of migrant labour on productivity, reflecting Malaysia's dependence on foreign manpower.
- Intermediate Input (INT): Materials, energy, and services used in production, divided by total employment, representing the role of efficient supply chain and resource utilisation in productivity performance.
- Wages (W): The total compensation paid to employees divided by the total number of workers, capturing wage-productivity relationship with market efficiency.

Estimation Technique: FMOLS Approach

FMOLS estimation technique is adopted in this study to evaluate the long-term relationships among variables. It is established by Phillips and Hansen (1990) and suitable to be used for panel data with cointegrated non-stationary series, where variables eventually moved together despite being individually non-stationary. This approach is exceptionally suitable for long-term estimations in productivity and growth studies as it is able to overcome the general issues of integrated variables in conventional OLS estimation by correcting serial correlation and endogeneity bias (Ahmed et al., 2016; Aziz & Othman, 2019). FMOLS estimation is conducted in two ways:

1. Group-Mean FMOLS: Estimation of an average long-term relationship throughout all industries.
2. Individual FMOLS: Estimation of separate long-term flexibilities for each industry, allowing for industry-specific heterogeneity in the productivity determinants.

Several preliminary tests are conducted prior to FMOLS estimator application to ensure data suitability and robustness:

Unit Root Test

The first step commenced with testing the stationarity of each variable using the ADF-Fisher Chi-square test for panel unit roots which integrated the individual Augmented Dickey-Fuller (ADF) tests for each industry. This was carried out to determine whether the variables are

stationary at the initial level, or become stationary after first differencing. Stationarity is crucial in ensuring that the time series properties of the variables do not produce spurious regression results.

Cointegration Test

Once stationarity is confirmed, the Kao panel cointegration test was used to verify the presence of a long-term equilibrium relationship among variables. The presence of cointegration showed that variables shared a stable long-term relationship, a fundamental condition for FMOLS application. The Kao test looks into the null hypothesis of no cointegration against the alternative of cointegration based on residual analysis. The null hypothesis rejection is used to validate a long-term relationship between labour productivity, capital, intermediate input, local and foreign labour, as well as wages.

Estimation and Interpretation

The FMOLS estimation is conducted using pooled and individual industry-specific estimators after the cointegration is established. Coefficients obtained from the result reflected long-term flexibilities, capturing the changes in labour productivity as a result from one percent change in each explanatory variable. Meanwhile, increment in capital, intermediate input, and wages could increase labour productivity, reflected by positive coefficients in the findings which is in line with the Solow growth framework. Conversely, negative coefficients for foreign labour, a common pattern recorded in previous studies might indicate decreasing returns to productivity caused by high dependence on incompetent migrant workers, (Huerta de Soto, 2024).

Analytical Scope and Justification

This methodological framework has several advantages for this study. Initially, the analysis is able to capture cross-sectional variations among industries and temporal dynamics over the two-decade period by employing panel data at the industry level. This dual dimension extent the effectiveness of statistical analysis and explanatory capacity of the estimates used in this study (Baltagi, 2021). Consequently, the dual labour market structure in Malaysia can be represented by integrating the foreign and domestic labour as different variables. By separating these types of labour, critical policy perspectives on whether such dependence enhances or reduces long-term productivity growth can be identified, specifically in agriculture and construction industries as they relied heavily on foreign workers. To assure unbiased and consistent long term parameter estimates, FMOLS estimator is used to correct potential endogeneity when inputs such as capital or salaries are simultaneously evaluated with output.

To conclude, this methodological approach is aligned with the conditions of Vision 2030 that focuses on enhancing productivity through efficient resource allocation, technological upgrades, and labour market reformations. The experimental design of this study is able to provide evidence-based understandings in formulating policy to achieve sustainable productivity growth within Malaysian industries.

Summary of Methodological Steps

1. **Model Specification:** This study commenced with the Solow-based Cob Douglas production function. It was then reformulated into a labour productivity model by incorporating key inputs including capital, intermediate input, local and foreign labour, as well as wages.
2. **Data Collection:** Industry-level data (2010–2020) gathered from the Department of Statistics Malaysia.
3. **Transformation:** All variables were converted into logarithmic form to interpret coefficients as elasticities.
4. **Unit Root Testing:** ADF-Fisher test was adopted to verify stationarity.
5. **Cointegration Testing:** Kao panel cointegration test was applied to confirm long-term relationships.
6. **Estimation:** FMOLS was used to estimate long term elasticities both for pooled and industry-specific models.
7. **Interpretation:** Results were analysed to determine the most influential factors affecting labour productivity across industries.

This methodological framework enables a comprehensive evaluation of the long-term determinants of labour productivity in Malaysia's primary and secondary industries.

Results and Discussion

Unit Root Test

Table 1 presented results of the Fisher-ADF unit root tests for all variables at both levels and first differences:

Table 1: Unit Root Test Levels and First Difference

Variables	Fisher-ADF at Levels		Fisher-ADF at First Difference	
	Intercepts	Intercepts and Trends	Intercepts	Intercepts and Trends
Labour Productivity	3.1251	14.6040	23.8001	13.6642
Intermediate Input	0.9263	0.0673	0.0025	0.0909
Skilled Local Labour	5.3938	13.3042	26.6900	15.6659
Unskilled Local Labour	0.7148	0.1018	0.0008	0.0474
Skilled Foreign Labour	7.2782	7.3113	27.6804	26.0279
Unskilled Foreign Labour	0.3006	0.3270	0.0005	0.0010
Labour Productivity	8.3379	8.8877	36.6933	21.6805
Intermediate Input	0.4734	0.4614	0.0000	0.0055
Skilled Local Labour	7.3920	8.1043	35.0740	24.5655
Unskilled Local Labour	0.3500	0.4003	0.0000	0.0018
Skilled Foreign Labour	6.6067	7.6749	39.5968	35.5801
Unskilled Foreign Labour	0.2720	0.4659	0.0000	0.0000

Variables	Fisher-ADF at Levels		Fisher-ADF at First Difference	
	Intercepts	Intercepts and Trends	Intercepts	Intercepts and Trends
Fixed Assets	2.4459	13.7757	24.6174	16.8351
	0.9642	0.0878	0.0018	0.0319
Salary	1.0845	12.4866	28.3728	17.5720
	0.9977	0.1308	0.0004	0.0247

Note: Statistics Are Given in Parenthetic

Notes: *** Significant at Level 1%, ** Significant at Level 5%, and * Significant at Level 10%

Source: Author's Computation Based on Eviews9

As shown in Table 1, most variables such as labour productivity, intermediate input, skilled local labour, unskilled local labour, skilled foreign labour, unskilled foreign labour, fixed assets (capital), and salary showed non-stationary at all levels, but then changed into stationary after first differencing. This pattern showed that each series is integrated of order one, I(1). On the other hand, labour productivity, local labour, and foreign labour showed stationarities at the level with intercept and trend term, but their statistical significance is not strong enough to reject the null hypothesis of a unit root across all model specifications.

This finding met the precondition for panel cointegration analysis that requires variables to show non-stationarity in levels but stationarity in first difference. The result showed that these macroeconomic and industrial variables evolved over time despite sharing stable long-term relationships. This supported the logic of the Solow Growth Model, in which economies converged to a steady-state equilibrium when output growth per worker depends on capital accumulation, labour inputs, and technological progression (Solow, 1956). Therefore, the existence of unit roots in levels but stationarity at first differences indicated that productivity growth and factor accumulation evolved dynamically, but maintained a long-term equilibrium path.

These findings supporting the studies conducted by Noor et al. (2011) which identified the comparable integration orders for labour productivity and input factors, further revealing that macroeconomic productivity indicators in Malaysia frequently showed an I(1) process (Nor et al., 2023). It showed the organisational persistence and adjustment mechanisms within industrial sectors. The presence of I(1) variables indicated that constant sectoral shocks such as salary changes, labour migration, or capital investments have a significant impact on productivity growth in both primary and secondary industries.

Cointegration Result

The Kao (1999) residual-based cointegration test was carried out to determine whether these variables share a long-term balanced relationship, the.

Table 2: Kao Test Regression

Series	ADF-Statistics	
	Statistics	Prob
LLPR = LIN + LSKILLED LOC + LUN SKILLED LOC + LSKILLED FOR + LUN SKILLED FOR + LSAL+ LCAP	-6.4306***	0.0000

Notes: ***, ** And * Imply Significance Level At 1%, 5% And 10% Respectively.

Source: Author's Computation Based on Eviews9

Table 2 displayed the null hypothesis of no cointegration is rejected at the 1% significance level, suggesting that labour productivity, intermediate inputs, local labour, foreign labour, salary, and capital have a long-term cointegration. It showed that changes in factor inputs and salaries have no significant impact on productivity growth in Malaysia's industrial sectors over time. This finding revealed that Malaysia's industries are in steady-state convergence, where output per worker is collectively determined by capital intensity and effective labour, thus supporting the Solow Growth Model theory. The hypothesis is further supported by long-term relationship between capital accumulation, factor efficiency, and labour composition could collectively determine the path of productivity growth. Eventually, industries would be adjusted towards balanced levels of productivity, continuously contributed to their structural factor and technological capabilities.

The findings corroborated Dehdasht et al. (2022) where a significant cointegration between capital and productivity was found in the construction industry of Malaysia, along with Shahzad & Miao (2025) that highlighted the long-term relationship between capital-labour ratio and manufacturing productivity. The result from Kao test therefore confirmed that a long-term balanced mechanism governed the dynamics of productivity across Malaysia's primary and secondary industries, reinforcing the theoretical validity of applying the Solow framework in this study.

Fully Modified OLS (FMOLS) Estimation

The Fully Modified Ordinary Least Squares (FMOLS) estimator was adopted to investigate the long-term coefficients of the relationship between labour productivity and its determinants for each industry, as shown in Table 3.

Table 3: Individual Fully Modified OLS Result

Variable	Intermediate Input	Skilled Local Labour	Unskilled Local Labour	Skilled Foreign Labour	Unskilled Foreign Labour	Capital	Salary
Agriculture Industries	1.3292*** (0.0006)	0.3266 (0.1842)	-0.1852 (0.0030)	0.0228 (0.6394)	0.1166 (0.2245)	0.2229 (0.0935)	-0.3898 (0.0781)
Manufacturing Industries	1.3600** (0.0001)	0.9545 (0.0078)	0.0209 (0.0567)	0.2242 (0.0071)	0.0343 (0.0052)	-0.2617 (0.0025)	0.0681 (0.0040)

Construction Industries	0.8382*** (0.0000)	-0.1398 (0.0601)	-0.1104 (0.0003)	-0.0648 (0.0059)	-0.0191 (0.0613)	0.1452 (0.0011)	0.0758 (0.0160)
Accommodation and Food service Activities Industry	0.3503*** (0.0131)	-0.8871 (0.0020)	-0.1132 (0.0017)	-0.2034 (0.0039)	-0.0272 (0.0101)	0.1844 (0.0168)	0.2658 (0.0163)

Notes: ***, ** And * Imply Significance Level at 1%, 5% and 10% Respectively.

Source: Author's Computation Based on Eviews9 (2024)

The FMOLS estimator established by Pedroni (2001) can be used to correct the serial correlation and endogeneity in cointegrated systems as it provided reliable long-term parameter estimates despites small samples. Therefore, this estimator is suitable to be adopted in the industrial data of Malaysia as it exhibits cross-sectoral heterogeneity. Table 3 showed the sector-specific dynamics between productivity and its determinants.

Overview of Long-Run Results

FMOLS estimator is used in this study to investigate the long-term impacts of competent and incompetent foreign labour on labour productivity across selected industries in Malaysia. As this estimator is a able to correct endogeneity and serial correlation in cointegrated systems, it can be well adapted for long-term analysis to produce consistent and efficient parameter estimates (Phillips & Hansen, 1990; Pedroni, 2001). Consequently, the findings were interpreted with the Shared Prosperity Vision 2030 (SPV 2030), which emphasises productivity-driven growth, high quality employment, skills development, and minimal dependence on incompetent labour especially foreign workers (Economic Planning Unit [EPU], 2019). Overall, the findings suggested that productivity performance in Malaysia is significantly sector-specific, with a positive contribution of competent labour in certain industries. Meanwhile, high reliance on incompetent domestic and foreign labour is suppressing the long-term productivity growth.

Agriculture Industry: Input-Driven Growth and Labour Redundancy

FMOLS findings showed that labour productivity in the agricultural sector is mainly accelerated by intermediate inputs, demonstrated by a strong positive and significant statistical impact. It corresponded the classical production theory and the Cobb–Douglas production framework, suggesting that output growth within primary industries is impacted by material inputs and physical assets rather than labour quality (Solow, 1956; Barro & Sala-i-Martin, 2004). Conversely, agricultural sector has limited capacity to absorb or effectively utilise competent workers as the findings showed that competent domestic labour did not exhibit a significant long-term impact on productivity. It reflected structural rigidity and low technological intensity within the sector. Previous studies also documented similar findings within Malaysian industries, arguing that skills accumulation yields limited returns in agriculture unless it is complemented with mechanisation and technological adoption (Tey et al., 2020; Rahman et al., 2019).

Incompetent domestic labour showed a negative and statistically significant impact on labour productivity, indicating decreased marginal returns and labour congestion. This finding is aligned with the hypothesis of dual sector by Lewis (1954), suggesting that excess labour in

conventional sectors discouraged productivity. It also seconded the experimental evidence of surplus labour in agriculture resulted in inefficiency and low output per worker (Rajput et al., 2022). As both the competent and incompetent foreign labour showed insignificant contribution in the long-term, it showed that foreign labour inflows did not significantly enhance agricultural productivity. This finding challenged the notion that foreign labour can be a productivity-enhancing substitute for domestic labour in agriculture, supporting the arguments that foreign workers in this sector are largely confined to low-productivity tasks (Hii & Lau, 2025). These results underscored the urgency of restructuring the agricultural labour market in Vision 2023 by:

- Being less dependence on incompetent labour,
- Promoting smart agriculture and mechanisation,
- Repositioning competent labour in agribusiness, agro-technology, and downstream activities.

These approaches are consistent with SPV 2030's objectives of transforming agriculture into a high-income, technology-driven sector.

Manufacturing Industry: Skill-Led Productivity Growth

Manufacturing sector is different in productivity structure with a significantly positive impact of intermediate inputs on labour productivity as it reflected scale economies and production synergies. This finding supported endogenous growth theory, highlighted the roles of inputs and technology in sustaining long-term productivity growth (Romer, 1990). It is also aligned with human capital theory (Becker, 1964) where competent domestic labour has a positive and significant impact on productivity, suggesting significant contribution of competent workers in enhancing productivity through outstanding technical knowledge, problem-solving capability, and efficient technology utilisation. Additionally, this finding is consistent with previous studies, suggesting that skills upgrading is the key (Jordaan, 2018).

Competent foreign labour has a positive and significant impact on productivity, reflecting interdependence between foreign expertise and domestic production. This finding supported technology diffusion hypothesis, suggesting that competent foreign labour facilitated knowledge transfer and better management (Vasic et al., 2023). Foreign labour has a comparatively low coefficient despite being statistically significant, suggesting that its contribution is highly supportive rather than transformative. This affirmed that productivity growth in manufacturing sector is highly driven by competency, rather than quantity. On the other hand, capital showed a negative long-term impact, suggesting that potential capital accumulation is insignificant without corresponding productivity gains. Similar findings were recorded in studies that focused on capital misallocation within developing manufacturing sectors (Hsieh & Klenow, 2009). Through the perspective of Vision 2030, these findings strongly validated policies aimed to:

- Expand high competency employment,
- Reduce dependency on incompetent labour,
- Strengthen technical and vocational education (TVET),
- Encourage selective utilisation of competent foreign labour for knowledge transfer.

Construction Industry: Labour Dependence and Structural Inefficiency

The construction sector constantly relied on intermediate inputs to significantly enhance productivity. However, both competent and incompetent labour, domestic and foreign workers are either having a highly negative impact or failed to significantly improve productivity in the long run. These results indicated continuous ineffectiveness in labour deployment and project execution. The negative impact of incompetent domestic labour supported preliminary findings where the practise of labour-intensive construction discouraged productivity growth. What is more concerning, the negative impact of foreign labour suggested that high dependence on low-cost foreign workers might be the barriers for mechanisation and innovation (Nor et al., 2023; Hamza et al., 2019). Segmented labour market theory provided a useful explanation here, as foreign workers are frequently confined to secondary labour markets, characterised by low salaries, lack of training, with minimal productivity incentives (Nor et al., 2023; Sahudin & Nor 2025; Doeringer & Piore, 1971).

Capital investment and salary both exerted positive effects, suggesting that productivity gains tend to stem from technological adoption and salary-based motivation rather than labour expansion. From the Vision 2030 standpoint, these findings reinforce the needs to:

- Gradually reduce the reliance of foreign labour in construction,
- Promote industrialised building systems (IBS),
- Improve skill certification and productivity-induced incentives.

Accommodation and Food Service Activities: Low Value-Added Labour Structure

In accommodation and food service activities, intermediate inputs positively influenced productivity, but all labour categories such as competent and incompetent, domestic and foreign labour possessed negative and statistically significant impacts. This indicated labour saturation and severe mismatched of skills in the sector. The negative impacts of incompetent labour suggested the underutilisation of human capital, consistent with findings that service industries in developing economies frequently failed to match skills with job requirements (OECD, 2019). This reflected the dominance of routine, less value-added tasks that did not reward skill accumulation. Capital and salary, however, positively impacted productivity, indicating that improving service quality and incentives are more effective drivers of productivity rather than enhancing the workforce. These findings are in line with SPV 2030 that put the focus on transforming low-productivity service sectors through:

- Digitalisation,
- Service innovation,
- Higher wage–productivity linkage.

Cross-Sectoral Implications and Alignment with Vision 2030

The FMOLS results provided significant experimental support for Vision 2030's productivity-led growth strategy. Three key insights emerged from this finding include productivity gains, contributions of competent domestic labour, and foreign labour productivity. Productivity gains in Malaysia are highly driven by technology, competency, and inputs, rather than labour quantity, thus validating policies that emphasised reducing the dependence on incompetent labour. Secondly, competent local labour contributed positively only in the industries that are capable of absorbing skills, particularly manufacturing. This highlighted the importance of

industrial upgrading alongside human capital investment. Third, foreign labour is productivity enhancing only when it is skilled and complementary, supporting selective and regulated foreign labour policies under SPV 2030. Taken together, these findings suggest that Malaysia's long-run productivity agenda should focus on structural transformation, skill deepening, and labour market reform, consistent with the objectives of becoming a high-income, inclusive, and sustainable economy by 2030.

Panel Group for Fully Modified OLS and DOLS

The estimation results of the panel group for FMOLS and DOLS models are presented in table 4 and table 5. Moreover, the coefficients estimated from these two models can be used as long-term elasticities. It is obvious to note that the coefficients estimated from the two models FMOLS and DOLS models are very close and have the same signs. Indeed, from the results presented in table 4 and table 5, it is found that the coefficients obtained from the regression are statistically significant at 10% and 1% significance for Capital, Intermediate Input and Unskilled Local Labour.

Table 4: Panel Group Fully Modified OLS Result

Variable	Intermediate Input	Skilled Local Labour	Unskilled Local Labour	Skilled Foreign Labour	Unskilled Foreign Labour	Capital	Salary
Coefficient	0.9694*** (0.0000)	0.0635 (0.3130)	-0.0970 (0.0000)	-0.0052 (0.7196)	0.0261 (0.1612)	0.0727 (0.0057)	0.0050 (0.8950)

Notes: ***, ** And * Imply Significance Level At 1%, 5% And 10% Respectively.
Source: Author's Computation Based On Eviews9 (2024)

Table 4: Panel Group Dynamic OLS Result

Variable	Intermediate Input	Skilled Local Labour	Unskilled Local Labour	Skilled Foreign Labour	Unskilled Foreign Labour	Capital	Salary
Coefficient	0.9652*** (0.0000)	0.0511 (0.4946)	-0.0979 (0.0000)	-0.0085 (0.7760)	0.0221 (0.1226)	0.0697 (0.0665)	0.0111 (0.8642)

Notes: ***, ** And * Imply Significance Level At 1%, 5% And 10% Respectively.
Source: Author's Computation Based On Eviews9 (2024)

Intermediate Input as the Dominant Long-Run Productivity Driver

The results show that intermediate input has a strong, positive, and statistically significant effect on labour productivity, with a coefficient of 0.9694 ($p < 0.01$). This implies that a 1% increase in intermediate inputs leads to an approximately 0.97% increase in labour productivity in the long run. The magnitude of this coefficient close to unity suggests that productivity growth in Malaysia remains heavily input-driven. This finding is consistent with classical production theory and the Cobb–Douglas production framework, where output per worker depends strongly on material inputs and production processes (Solow, 1956; Barro & Sala-i-Martin, 2004). Similar findings were also observed in previous studies which constantly addressed the importance of intermediate inputs such as energy, raw materials, and operational inputs in enhancing productivity in Malaysian industries (Jordaan, 2018; Rahman et al., 2020).

Aligning with Vision 2030, this result indicated that even though Malaysia has attained productivity gains through the enhancement of input utilisation, such growth might be cost-driven rather than efficiency-driven. SPV 2030 emphasises the needs to shift from input-intensive growth towards innovation-, technology-, and competency-driven productivity, suggesting that dependence on intermediate inputs alone is not sustainable in the long run (EPU, 2019).

Skilled Local Labour and the Limited Aggregate Productivity Effect

Competent domestic labour has a positive coefficient (0.0635) but is statistically insignificant ($p = 0.3130$) in the overall panel. This suggested that, in general competent domestic labour did not exert a strong or consistent long-term impact on labour productivity throughout Malaysian industries. This finding did not indicate that competent labour is not important; rather, it reflected heterogeneity in skill absorption across sectors. As shown in the industry-level results, competent domestic labour contributed significantly to productivity in manufacturing but not in agriculture, construction, or low value-added services. These sectoral differences diluted the overall effect if aggregated. Corresponded to human capital theory (Becker, 1964), the impacts of productivity on labour competency relied heavily on the capability of the industries to utilise those skills. The insignificant impact of competent domestic labour at the panel level therefore pointed out underutilisation and skill mismatch, a rising issue that is frequently highlighted in Malaysia's labour market literature (World Bank, 2020; Yusoff & Ismail, 2021).

This result reinforced the argument on policy, where capacity building alone is inadequate without parallel industrial upgrading. It is aligned with SPV 2030 that clearly stressed the needs for aligning education, TVET, and training systems with industry demands to ensure that competent workers are productively employed.

Unskilled Local Labour and Long-Run Productivity Suppression

A negative and highly significant impact on labour productivity can be observed in incompetent domestic labour, with a coefficient of -0.0970 ($p < 0.01$). This suggested that 1% increase in incompetent local labour reduced labour productivity by approximately 0.10% in the long run. This result supported diminishing returns theory where the expansion of incompetent labour without corresponding enhancement in capital or technology could lead to the reduction in marginal productivity. It also seconded the argument of Lewis dual-sector model where excess labour in low-productivity sectors suppresses overall productivity growth (Lewis, 1954). Similar findings were recorded in previous studies from Malaysia and other middle-income countries, suggesting that high reliance on incompetent labour could lead to stagnant productivity and limited technological progression (Alemayehu et al., 2024; OECD, 2019). This result provided justifications for policies aligned with Vision 2023 that aims to:

- Reduce dependence on incompetent labour,
- Encourage automation and mechanisation,
- Motivate training and upskilling of the existing workforce.

The findings directly supported the objective of SPV 2030's to shift towards quality employment and higher labour productivity.

Skilled Foreign Labour: No Aggregate Productivity Gain

Competent foreign labour has a negative coefficient (-0.0052) and insignificant contribution ($p = 0.7196$) on productivity gains, suggesting that competent foreign workers did not have a significant long-term impact on labour productivity at the aggregated level. Despite having positive contribution in specific sectors such as manufacturing, the impact of competent foreign labour is insufficient to affect overall productivity. This was due to the concentration of competent foreign workers in limited industries or firms, resulting in less economy-wide spillover impacts. The benefits of productivity on competent foreign labour relied heavily on their absorptive capacity and knowledge diffusion, as described by technology transfer theory (Vasic et al., 2023). The insignificant panel results suggested that foreign expertise in Malaysia is not leverage enough to motivate productivity enhancement. This finding supported a selective and strategic foreign labour policy in Vision 2030, where competent foreign workers are employed specifically for knowledge transfer, innovation, and capacity building rather than as long-term substitutes for local talent.

Unskilled Foreign Labour and Weak Productivity Contribution

Unskilled foreign labour displayed a positive but statistically insignificant coefficient (0.0261 , $p = 0.1612$) demonstrating that incompetent foreign workers did not have a significant impact on productivity in the long run at the aggregated level. This result reflected the dual nature of incompetent foreign labour in Malaysia where foreign workers helped alleviating labour shortages in labour-intensive sectors, but contrastingly reduced investment in automation and skill upgrading with their presence. As a result, the net long-term impact on productivity can be statistically negligible. Aligned with segmented labour market theory, foreign workers are frequently concentrated in secondary labour markets with lower salaries, inadequate training, and low productivity growth (Doeringer & Piore, 1971). With regards to Vision 2030, this finding fortifies the needs to:

- Gradually remove low-skilled foreign labour from the market,
- Establish levy system that is productivity-related,
- Promote labour-saving technologies to be adopted by firms.

Capital Accumulation and Productivity Enhancement

Capital possessed a positive and statistically significant impact on labour productivity, with a coefficient of 0.0727 ($p < 0.01$) which indicated that capital intensity remains as a fundamental driver of long-term productivity growth in Malaysia. This finding matched with the Solow growth model, that focused on capital accumulation as a main determinant of output per worker in the long run (Solow, 1956), supporting experimental evidence indicating that investment in machinery, equipment, and infrastructure enhances labour efficiency (Hsieh & Klenow, 2009). A comparatively small magnitude of coefficient suggested that capital is not able to contribute large productivity gains in the absence of skills and technology development. This finding is in line with Vision 2030, which emphasises smart investment, digitalisation, and formation of innovation-driven capital rather than insignificant expansion of physical capital.

Salary and the Absence of an Efficiency Wage Effect

Salary has a positive but statistically insignificant coefficient (0.0050, $p = 0.8950$), suggesting that wage increment did not contribute to a higher labour productivity in the long-term at the aggregated level. This finding showed that Malaysia is lacking a strong salary system as higher salaries did not necessarily motivate workers to enhance their productivity. It might be driven by organisational factors, labour market regulations, or living cost adjustments rather than performance-based incentives. This finding supported other studies that focused on the relationship between poor wages and productivity in Malaysia (World Bank, 2020). Aligning with the context of Vision 2030, it highlighted the significance of:

- Strengthening salary systems to be more productivity-driven,
- Expanding performance-based remuneration,
- Enhancing the foundation of labour market.

Overall Implications and Alignment with Vision 2030

The overall FMOLS results collectively supported the key principles of Malaysia's Shared Prosperity Vision 2030. The findings suggested that:

1. Productivity growth continued to be input- and capital-driven, rather than skill-driven.
2. Domestic incompetent labour significantly restrained productivity in the long run.
3. Competent labour and foreign labour contributed significantly under specific sectoral and structural conditions.
4. Salary increment alone is inadequate to enhance productivity without institutional reformation.

These results implied that achieving SPV 2030's goal of becoming a high-income, productivity-driven country demands deep organisational reformations which include reorganising labour market, upgrading industrial, shifting away from incompetent, labour-intensive growth models.

Discussion and Theoretical Implications

Discussion of Key Empirical Findings

This study examined the long-term relationship between labour productivity and labour composition in Malaysia by differentiating the competent and incompetent labour along with domestic and foreign workers using the Fully Modified Ordinary Least Squares (FMOLS) estimator. The utilisation of FMOLS ensures that the estimated coefficients captured the long-term balanced relationships whilst correcting endogeneity and serial correlation in cointegrated panels (Phillips & Hansen, 1990; Pedroni, 2001).

The overall and industry-specific findings constantly indicated that labour productivity in Malaysia is not motivated labour expansion, but rather by input utilisation, capital accumulation, and sectoral capacity to absorb skills. Intermediate inputs emerged as the most robust determinant of productivity throughout industries, whilst incompetent labour specifically domestic incompetent labour exerted a statistically significant and negative impact in the long run. Competent labour contributed positively only in selected sectors, most notably

manufacturing, indicating strong sectoral heterogeneity. These results suggested that Malaysia's growth track depended heavily on input-driven and labour-intensive approaches, which are highly related to different productivity gains. This pattern raised concerns that Malaysia might be approaching its productivity ceiling under the existing labour structure (World Bank, 2020; OECD, 2019).

Implications for Classical Production Theory

In the context of classical production theory, the results provided significant experimental support for the law of diminishing marginal returns to labour, specifically for incompetent labour. Incompetent domestic labour has negative long-term impacts on productivity, suggesting that enhancement of labour inputs without corresponding enhancements in capital, technology, or organisational efficiency could decrease output per worker (Solow, 1956; Barro & Sala-i-Martin, 2004). Positive impacts that have been constantly found in intermediate inputs reflected a production structure that depended heavily on material and operational inputs. The result is consistent with the Cobb–Douglas production framework, where productivity gains emerged from enhanced collective inputs rather than labour quantity alone. When productivity growth is dominated by cumulative factors rather than efficiency growth, the same patterns were also observed in other developing and middle-income countries (Lee & Park, 2024).

In addition, agriculture and construction sectors had demonstrated the negative productivity impacts, supporting the Lewis' (1954) dual-sector model that suggested excess labour in conservative sectors discouraged productivity growth. The findings indicated that some segments of Malaysia's economy continuously exhibiting the characteristics of excess labour and low marginal productivity.

Implications for Human Capital Theory

Human capital theory recognised that competent labour enhanced productivity by enhancing efficiency, innovation, and technology adoption (Becker, 1964). The findings of this study partially assist this theoretical premise. Competent local labour significantly enhanced productivity in manufacturing, a sector characterised by higher level of technology and greater scopes for skill utilisation. However, the lack of a significant aggregate productivity impact of competent labour suggested that human capital cannot be automatically translated into productivity gains. Preferably, productivity returns to skills are dependent on sectoral structure and technological readiness. This finding complemented other experimental studies that pointed out skill mismatched, and underemployment could weaken the impact of education and training on productivity in Malaysia (Yusoff & Ismail, 2021; Rahmah et al., 2016).

Therefore, this study extended human capital theory by emphasising the significance of skill absorption capacity as skills enhanced productivity only when industries are capable of deploying them effectively through appropriate technology, organisation of work, and innovation systems.

Implications for the Solow Growth Model and Augmented Growth Theory

Within the Solow (1956) growth framework, long-term productivity growth is mainly accelerated by capital accumulation and technological progression, whilst labour quantity has limited explanatory capacity. The positive and statistically significant impact of capital in the

overall FMOLS results supported this prediction, confirming that capital intensity increased the output per worker. However, the comparatively small magnitude of the capital coefficient suggested distinguishing returns to capital accumulation in the lack technological advancement. The significant roles of intermediate inputs further implied that productivity growth has been highly input-based rather than innovation-driven, a characteristic generally observed in middle-income countries (Easterly & Levine, 2001). By incorporating labour heterogeneity, this study contributed to augmented Solow models that expanded the initial framework to include human capital and labour quality (Mankiw, Romer, & Weil, 1992). The findings showed the importance of labour quality, but only under specific sectoral conditions, focusing on the interactive role of capital, skills, and structural transformation in defining a long-term productivity.

Implications for Segmented Labour Market Theory

Segmented labour market theory offered a beneficial framework for interpreting the poor or negative productivity impacts of foreign labour observed in several industries. According to this theory, labour markets are separated into primary and secondary segments, where foreign workers frequently restricted to secondary markets characterised by low salaries, limited training, and poor career progression (Doeringer & Piore, 1971). The insignificant aggregate impact of competent foreign labour suggested limited knowledge diffusion and poor spillover impacts, reflected the findings of technology transfer from foreign workers relied on domestic absorptive capability Vasic et al., 2023). Similarly, the minimal contribution of incompetent foreign labour indicated that dependence on foreign workers might stabilise production in the short-term but did not enhance long-term productivity. Segmented labour market theory has been extended through the findings of this study, with the understanding that labour segmentation affected not only salaries and job security, but also long-term productivity performance. The industries might be in a low-productivity equilibria if they continuously relied on segmented, incompetent labour markets.

Theoretical Contribution of the Study

Theoretical contributions of this study can be concluded in three phases. Initially, this study provided robust long-term experimental evidence using FMOLS by distinguishing productivity impacts of competent and incompetent labour in the context of middle-income economy. Previously, some studies clearly differentiated local and foreign labour by skill levels in a long-term productivity framework. Secondly, the integration of classical production theory, human capital theory, growth theory, and segmented labour market theory into a unified analytical framework is another contribution of this study as the findings demonstrated that labour productivity is moulded by structural and institutional factors, not only by labour quantity or educational achievements. Finally, the results of this study experimentally supported the theoretical foundations of productivity-driven development approaches, strengthening the argument that sustainable growth demands structural transformation rather than continuous labour expansion.

Summary of Theoretical Implications

Overall, this study yielded four primary theoretical consequences:

1. Expansion of incompetent labour resulted in decreasing returns and discouraged productivity, supported classical production theory and the Lewis model.

2. Contribution of human capital to productivity can only be found when it is absorbed efficiently. This study further refined human capital theory in the context of sectoral heterogeneity.
3. Capital and intermediate inputs are persistently crucial, but their impact on productivity is constrained without innovation and efficiency gains, as proposed by growth theory.
4. Productivity spillovers are constrained by labour market segmentation, hence this study expanded segmented labour market theory to long-term productivity outcomes.

Through the findings, this study has expanded the understandings of theoretical perceptions of labour productivity dynamics in Malaysia, providing a solid basis for subsequent policy recommendations and implications.

Conclusion

This study is set out to examine the long-term relationship between labour productivity and labour composition in Malaysia through differentiation of the competent and incompetent labour, along with local and foreign labour. Through the adoption of Fully Modified Ordinary Least Squares (FMOLS) estimator, this study presented vigorous scientific data on how labour heterogeneity, capital gains, intermediate inputs, and salaries moulded labour productivity throughout selected industries in Malaysia at the aggregated level. This FMOLS approach permitted continuous long-term estimation by adjusting endogeneity and sequential correlation in cointegrated panel data to ensure reliability of the findings.

The results revealed that labour productivity in Malaysia is primarily motivated by intermediate inputs and capital instead of labour expansion. Intermediate inputs continuously appeared as the most significant factor of productivity throughout industries, with the emphasise on the continuous reliance on material and operational inputs by the Malaysian industries. Simultaneously, capital gains have a positive contribution to productivity, albeit the impact is relatively modest, indicating decreased of returns to capital without technological and organisational enhancements. Conversely, labour is heterogenous, with a highly significant role in reducing productivity in many cases. Incompetent domestic local labour exerted a significant negative impact on labour productivity in the long run at the aggregated level, reflecting the decrease in marginal returns and labour congestion. This finding accentuated the constrains in labour-intensive growth strategies, suggesting that enhancement of incompetent employment did not result in sustainable productivity gains. Despite having a positive impact, competent local labour did not exert a significant economic productivity impact, due to skill mismatched and underutilisation throughout sectors. These outcomes suggested that skills buildup alone is insufficient in enhancing productivity without parallel industrial advancements.

The industry-specific findings further reinforced this conclusion. Competent labour has a positive and significant impact on productivity only in manufacturing sector, with higher technological and skill absorption capacities. Meanwhile, for agriculture, construction, and accommodation and food service activities, the competent and incompetent labour, domestic and foreign labour, were either failed to enhance productivity or having negative impacts, suggesting ineffective system, labour intensity, and poor skill utilisation. Foreign labour, specifically in laborious sectors, did not contribute significantly to the long-term productivity gains, seconding concerns that over-dependence on foreign labour might be the barrier of technological upgrading and efficiency improvements. Findings from this research

theoretically provided significant experimental support for classical production theory and the law of decreasing marginal returns to labour, specifically in incompetent labour. It also extended human capital theory by suggesting that productivity returns to skills relied on sectoral structure and technological readiness. Additionally, the positive role reflected by capital is persistent with the Solow growth framework, whilst the poor productivity overflow from foreign labour matched the segmented labour market theory. By integrating these theoretical perspectives, this study advanced the understanding of labour productivity dynamics in the context of a middle-income economy.

The findings of this study reflected significant policy implications as the results analytically validated the focus of Malaysia's Shared Prosperity Vision 2030 on productivity-driven growth, high-quality jobs, and reducing dependence on incompetent labour. It showed that achieving sustainable productivity growth requires a transition from labour intensive approaches towards structural transformation, skills and industry alignment, and growth-oriented investment. Therefore, policies should be formulated to focus more on strengthening technical and vocational education and trainings, promoting automation and digitalisation in labour-intensive sectors, encouraging productivity-related salary systems, and implementing a more selective foreign labour policy that prioritised knowledge transfer. In terms of limitations, as the analysis of this study focused only on selected industries and relied heavily on accessible aggregated data, it might not entirely capture the organisation-level productivity dynamics or informal sector activities. Further research should be conducted to expand this work by incorporating organisation-level or microdata, investigating dynamic adjustment processes, and exploring the role of institutional quality, digitalisation, and innovation in shaping labour productivity.

In conclusion, this study revealed that the long-term productivity growth of the Malaysian industries did not rely entirely on workforce expansion, but rather on the effective utilisation of labour within evolving models of production. Systematic reformation in labour markets, education systems, and industrial policies is needed to sustain productivity growth. This study contributed meaningfully to the academic literature by providing rigorous long-term experimental evidence that offered valuable insights for policymakers in achieving Malaysia's aspiration of becoming a high-income, inclusive, and productivity-driven economy by 2030.

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References

- Alemayehu, W., Zewdu, G., & Adane, K. (2024). Structural Transformation in Ethiopia's Manufacturing Sector. *Tanzanian Economic Review*.
<https://doi.org/10.56279/ter.v13i2.133>.
- Baptist, S., & Hepburn, C. (2013). Intermediate inputs and economic productivity. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 371(1986).
- Barro, R. J., & Sala-i-Martin, X. (2004). *Economic Growth* (2nd ed.). MIT Press.
- Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis*. University of Chicago Press..
- Doeringer, P. B., & Piore, M. J. (1971). *Internal Labor Markets and Manpower Analysis*. Heath.
- Economic Planning Unit (EPU). (2019). *Shared Prosperity Vision 2030*. Prime Minister's Department, Malaysia.
- Hamza, M., Shahid, S., Hainin, M., & Nashwan, M. (2019). Construction labour productivity: review of factors identified. *International Journal of Construction Management*, 22, 413 - 425. <https://doi.org/10.1080/15623599.2019.1627503>.
- Hii, N. L., & Lau, E. (2025). Asymmetric effects of foreign worker employment on sectoral labor productivity: A Malaysian perspective. *Economies*, 13(5), 127.
- Jordaan, J. A. (2018). Foreign workers and productivity in an emerging economy: The case of Malaysia. *Review of Development Economics*, 22(1), 148-173.
- Kuznets, S. (1966). *Modern economic growth: Rate, structure, and spread*. Yale University Press.
- Lee, Y. H., & Park, J. (2024). Middle-income country trap and total factor productivity growth. *Pacific Economic Review*, 29(2), 214-229.
- Lewis, W. A. (1954). Economic development with unlimited supplies of labour. *The Manchester School*, 22(2), 139–191.
- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107(2), 407–437.
- Nor, S. M., Sahudin, Z., & Subramaniam, G. (2023). The Effects of Health, Labor and Capital towards Labor Productivity in Manufacturing Industries. *Information Management and Business Review*, 15(1), 121-130.
- Nor, S. M., Subramaniam, G., & Sahudin, Z. (2023). The effects of foreign labor on labor productivity in construction industries. *Information Management and Business Review*, 15(2), 116-127.
- Pedroni, P. (2001). Fully modified OLS for heterogeneous cointegrated panels. *Advances in Econometrics*, 15, 93–130.
- Phillips, P. C. B., & Hansen, B. E. (1990). Statistical inference in instrumental variables regression with I(1) processes. *Review of Economic Studies*, 57(1), 99–125.
- Rahmah, I., Ismail, R., & Lai, W. S. (2016). Skilled labour, capital and productivity growth in Malaysian manufacturing industries. *International Journal of Economics and Management*, 10(2), 287–304.
- Rahmah, M., et al. (2016). Skill and productivity in Malaysian industries. *Malaysian Journal of Economic Studies*, 53(1), 21–40.
- Rahman, M., et al. (2020). Labour productivity determinants in Malaysia: Industry-level evidence. *Asian Economic Journal*, 34(3), 245–268.
- Rajput, A. S., Sharma, L., & Shekhawat, P. S. (2022). Estimation of seasonal surplus labour in agriculture in different agro-climatic regions of Rajasthan. *Environment Conservation Journal*, 23(1&2), 55-64.

- Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5), S71–S102.
- Sahudin, Z., & Nor, S. M. The Impact on Labour Productivity in Malaysia Industries.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65–94.
- Tajuddin, S., Halim, M., Foziah, N., Zain, F., Abdullah, H., & Abidin, A. (2023). An empirical study in assessing the impact of foreign workers on labour productivity in the Malaysian manufacturing sector. *Asian Development Policy Review*.
<https://doi.org/10.55493/5008.v11i3.4905>.
- Todaro, M. P., & Smith, S. C. (2020). Economic development (13th ed.). *Pearson Education*.
- Vasic, M., Duica, M. C., Berber, N., Enukidze, N., Vasic, S., & Weis, L. (2023). Migrant workers and workforce integration: Challenges for managers in European companies. *Strategic Management-International Journal of Strategic Management and Decision Support Systems in Strategic Management*, 28(2).
- World Bank. (2020). Malaysia Productivity and Investment Climate Assessment.
- Yusoff, M. B., & Ismail, R. (2021). Human capital, technological adoption and labour productivity in Malaysian manufacturing. *Asian Economic Journal*,