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DETERMINANTS OF LABOR PRODUCTIVITY IN ASEAN-6 COUNTRIES : USING DYNAMIC PANEL SYS-GMM

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Abstract

Labor productivity is an important issue to be discussed in the economic development of each country including in ASEAN-6, the differences in labor productivity levels among ASEAN-6 countries need to be researched further, therefore the purpose of this study is to determine the effect of human development index, labor force participation rate, foreign direct investment, and exports on labor productivity in ASEAN-6 countries, and also see the long-term and short-term effects. The data used consists of time series data from 2005 to 2022 and cross-sectional data from ASEAN-6 countries, using the dynamic panel SYS-GMM method. The results show that the human development index and foreign direct investment have a significant positive effect on labor productivity in ASEAN-6 countries, while the labor force participation rate and exports have a negative effect on labor productivity in these countries. In the long run, the human development index, labor force participation rate, foreign direct investment, and exports have a 7 times greater influence on labor productivity than in the short run, indicating a multiplier effect. Then the most dominant variable affecting labor productivity is the human development index.

Keywords: Labor Productivity, Human Development Index, Labor Force Participation Rate, Foreign Direct Investment, Export, SYS-GMM

JEL Classification: E24, J24, C33

1. Introduction

Labor productivity is closely related not only to the quality of life and human resources but also to a country's capacity and competitiveness. In the ASEAN region, particularly the ASEAN-6

countries, which consist of Brunei Darussalam, Philippines, Indonesia, Malaysia, Singapore, and Thailand, there is a disparity in productivity levels. This phenomenon is interesting to study, considering that these countries are in the same region but exhibit diverse productivity levels. Differences in labor productivity levels need to be further investigated by examining the factors that can influence productivity improvement in these six countries.

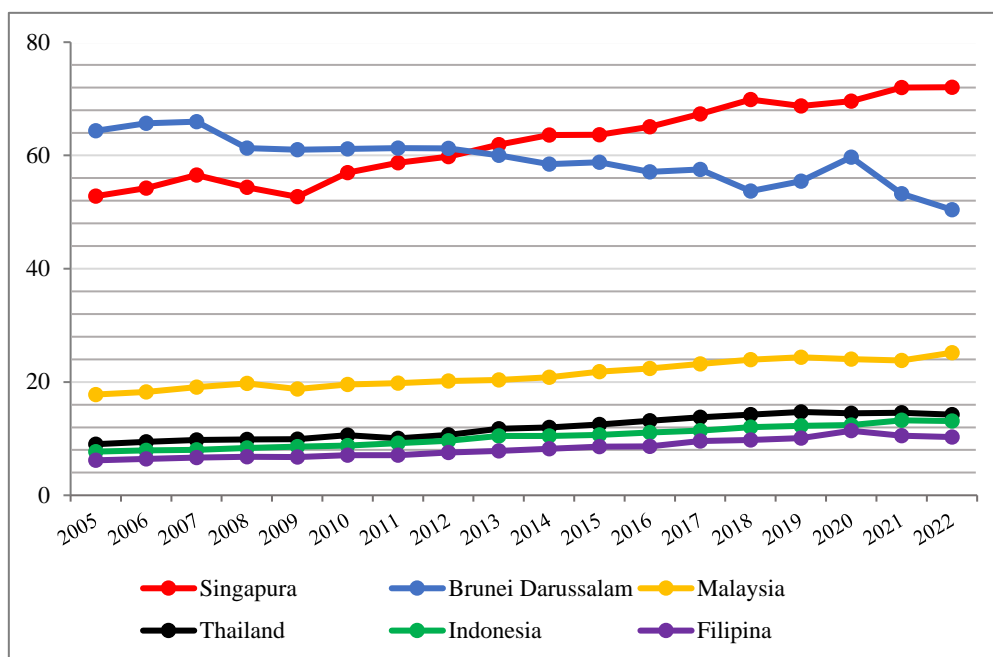


Figure 1. Labor productivity of ASEAN-6 countries (USD)

Sources: International Labor Organization, 2024

Growth in labor productivity can be caused by increased efficiency in the use of labor without the addition of other inputs. Increasing labor productivity is a strategic target, because increasing productivity will depend on the ability of human resources that use it. Based on Figure 1 ASEAN-6 labor productivity shows a fluctuating growth rate. Singapore's productivity shows a positive growth trend, Singapore occupies the top position with an average labor productivity of USD 62.21 and a growth rate of 36%, the magnitude of Singapore's labor productivity reflects the quality of education that produces a highly capable workforce and investment in infrastructure and sophisticated technology. Brunei Darussalam's average productivity ranked second at USD 59.24 but showed a negative growth trend of -22%, as an oil and natural gas producing country Brunei relies on the energy sector to increase labor productivity. Malaysia showed a total growth of 41.48% with an average productivity of USD 21.28 which reflects that Malaysia is still in the developmental stage of advancing its labor productivity, Thailand has an average labor productivity of USD 11.92 with a growth rate of 58%, while Indonesia's labor productivity recorded the highest total growth in ASEAN-6 of 70% but with a relatively low average of USD 10.29 then the Philippines experienced a significant increase in productivity of 66% but only has an average productivity value of USD 8.29 the lowest among ASEAN-6 countries.

Economic development is a component of the human development model, where productivity is one of the four key paradigms for achieving human development goals. The Human development index, as a measure of human resource quality, plays a role in enhancing productivity. An increase in the Human Development Index indicates good labor productivity (Fadillah et al. 2021). Koyuncu et al. (2016), explain the labor force participation rate can affect labor productivity, the LFPR reflects the number of workers available to produce goods or services relative to the working-age population, and the workforce plays an important role in efforts to increase productivity. Foreign investment has become a key policy in developing countries, when foreign companies aim to increase efficiency, the direct foreign investment received by a country

leads to a greater productivity increase. This is because the methods transferred by these companies directly and indirectly impact labor productivity in the host country (Hassan *et al.* 2023). According to Schwarzer (2017), exports can lead to increased productivity. Domestic companies engaged in exports with relatively low competitiveness experience higher productivity growth, highlighting an important competitive pathway for improving productivity.

Previous researchers have discussed labor productivity, however many factors still require further investigation. Therefore, this study distinguishes by examining different variables, research years, and countries. From the previous explanation, labor productivity in ASEAN-6 countries (Singapore, Brunei Darussalam, Malaysia, Thailand, Indonesia, and the Philippines) becomes the main focus of this study and serves as the dependent variable. Then the independent variables used are the human development index, labor force participation rate, foreign direct investment, and export.

2. Theoretical and empirical literature

Sukirno (2016), defines productivity as the output produced by a worker. Increased productivity means workers can produce more goods in the same period of time or a certain level of output in a shorter period of time, productivity increases are caused by several factors such as technology, efficient management, and education and training. Labor productivity is the total output (measured by GDP) produced per unit of labor (measured by the number of hours worked) in a given period of time. An increase in labor productivity is an increase in the efficiency of using labor without adding other inputs, or an increase in efficiency where each worker makes better use of other inputs such as physical capital, human resources, and intermediate inputs. If the mix of activities in an economy or industry shifts from less productive activities to more productive activities then the expected labor productivity will increase even if no activities become more productive, in the presence of constantly different activities, the best measure of labor input that can be used in the productivity equation is the total number of hours worked by all workers per year (ILO, 2023).

According to Todaro and Smith (2011), the human development index is an index that measures a country's socio-economic development achievements by combining indicators in education, health, and standard of living. One of the main benefits of the HDI is that it demonstrates that a country can perform much better even with a low-income level, and conversely, a high-income level does not always correlate with high human development achievements. Based on research conducted by Fadillah *et al.* (2021), using panel data regression analysis, the results showed that the human development index influences labor productivity, with a positive regression coefficient indicating that an increase in HDI can lead to higher labor productivity. However, these findings are contrary to the study by Astutik and Aisyah (2023), which found that the human development index does not impact labor productivity growth. Borjas (2016), explains that the labor force participation rate represents the majority of the economically active working-age population in a region, the higher the labor force participation rate, the more labor supply available for the production of goods and services in the economy. Research conducted by Abonazel and Shalaby (2021), using panel data shows that the labor force participation rate has a significant negative effect on labor productivity, the main cause of this negative relationship is that new workers may not have practical skills and they take a long time to become fully productive.

Jhingan (2016), explains that foreign direct investment brings the latest science, technology, and management to developing countries which in turn encourages local companies to invest more in supporting industries or cooperate with foreign companies. In a study conducted by Ahmed and Kialashaki (2021), using panel data regression analysis techniques, the results show that there is a positive and significant effect of foreign direct investment on labor. The foreign direct investment obtained by a country for increasing productivity will be stronger when foreign companies aim to increase efficiency because the technology and methods transferred by these companies have an impact on labor productivity in the recipient country directly. Empirical evidence emphasizes that only a small proportion of firms sell abroad, exporting firms are more efficient than other exporting firms, in addition, export-oriented firms are more technology intensive and more productive than non-exporting firms (Petković *et al.* 2023). Research

conducted by Dalgıç et al. (2021), using panel data regression shows significant positive results between exports and labor productivity, exporting companies have higher productivity levels than companies that have never exported. Ciarli et al. (2023), using the VAR method that estimates cause and effect found that export growth has no direct impact on firm productivity growth.

3. Data and methodology

This research is a type of quantitative descriptive research, which systematically describes the actual data and sees the influence between the variables used in the study. The independent variables in this study are human development index, labor force participation rate, foreign direct investment, and exports. The dependent variable is the labor productivity of 6 ASEAN countries (Singapore, Brunei Darussalam, Malaysia, Thailand, Indonesia, and the Philippines) which are the six countries with the highest level of labor productivity in ASEAN during the 2005 to 2022 time period. This study uses secondary data with a dynamic panel method that is a combination of cross section and time series. The cross section data includes 6 ASEAN countries and the time series data has a time span of 18 years (2005-2022). The data in this study comes from the International Labor Organization (ILO), United Nations Development Program (UNDP), and the World Bank.

The analysis in this study uses the generalized method of moments (GMM) method. GMM is the best estimation method for panel data that involves a lagged dependent variable, which is autocorrelated due to the presence of lags in the dependent variable, causing a dynamic relationship between the data. The lag in the dependent variable means that the model depends not only on the current time period but also on the previous time period. The GMM method is often used in dynamic panel data analysis to identify the short-run and long-run effects of independent variables on dependent variables (Hall, 2009). The model equation of the generalized method of moment (GMM) used in the study is as follows:

$$LN_LP_{it} = \alpha + \delta LN_LP_{it-1} + \beta_1 LN_HDI_{it} + \beta_2 LN_LFPR_{it} + \beta_3 LN_FDI_{it} + \beta_4 LN_EX_{it} + \varepsilon_{it}$$

Table 1. Research variable

Variable	Notation	Scale
Labor Productivity	LN_LP	Dolar
Human Development Index	LN_HDI	Ratio
Labor Force Participant Rate	LN_LFPR	Percent
Foreign Direct Investment	LN_FDI	Billion Dolars
Export	LN_EX	Billion Dolars

4. Results and discussion

4.1. Unit root test

Table 2. Panel unit root tests - output summary

Unit Root Test : IPS			
Variable	Level	First Difference	Decision
LN_LP	2.1517	-5.1202***	I(1)
	0.9843	0.0000	
LN_HDI	-1.5363***	-3.6978***	I(1)
	0.0622	0.0001	
LN_LFPR	0.3934	-4.5779***	I(1)
	0.6530	0.0000	
LN_HDI	-2.3453***	-5.5187***	I(1)
	0.0095	0.0000	
LN_EX	1.0679	-4.2795***	I(1)
	0.8572	0.0000	

Notes: ***, **, * significance at the 1%, 5%, and 10% levels.

Source: Output Stata 18 (processed data)

Unit root test is one of the methods in time series analysis used to test whether a variable is stationary or non-stationary. Stationary variables are variables that have constant mean and variance over time, while non-stationary variables can experience significant fluctuations or changes over time (Baltagi, 2005).

In this study, the unit root test was conducted with the Im, Pesaran and Shin W-stat approach. Table 2 shows the results of the unit root test, the t-statistic value at the first difference of each variable is significant where the p-value <0.05 which indicates that the variables are stationary after being differenced, meaning that changes in these variables have a more stable nature.

4.2. Model specification test

The best dynamic panel model is seen based on the Sargan test and the Arellano-Bond test. The Sargan test is used to assess the validity of instrumental variables in the GMM method, the instrumental variables are considered valid if they exceed the number of estimated parameters. The Arellano-Bond test, on the other hand tests the consistency of the estimates obtained from the SYS-GMM or FD-GMM. Consistent estimates mean that in the second-order first difference, there is no autocorrelation between the residuals and the endogenous variables.

4.2.1. Sargan test

The sargan test is a test for instrument variables in the GMM method. The instrument variable used is valid if the use of the instrument variable exceeds the number of estimated parameters (Arellano and Bond, 1991). Based on Table 3 below, it can be seen that the probability value of the sargan test in the SYS-GMM and FD-GMM models is > 0.05 so that H0 is accepted and H1 is rejected, which means that the overidentifying condition in the estimation of this model is valid.

Table 3. Sargan test result

Model	Statistical Value	P-value
FD-GMM	84.02764	0.2226
SYS-GMM	99.79881	0.2478

Source: Output Stata 18 (processed data)

4.2.2. Arellano-Bond test

Arellano-Bond test is a test to see the consistency of the estimates obtained. Consistent estimation means that in the 2nd order first difference there is no autocorrelation between the residuals and the endogenous variables (Blundell and Bond, 2023).

Table 4. Arellano-bond test result

Model	FD-GMM		SYS-GMM	
	Statistical Value	P-value	Statistical Value	P-value
Arellano-Bond test (m_1)	-2.1324	0.0330	-1.8684	0.0617
Arellano-Bond test (m_2)	-2.063	0.0391	-1.4037	0.1604

Source: Output Stata 18 (processed data)

Based on table 4, the statistical value of the 2nd order first difference (m_2) SYS-GMM is -1.4037 with a probability value of 0.1604 > 0.05, meaning that H0 is accepted and H1 is rejected, which means there is no autocorrelation in the 2nd order first difference error so that the resulting estimate is consistent. Meanwhile, the 2nd order first difference (m_2) FD-GMM has a probability value of 0.0391 < 0.05, which means H0 is rejected and H1 is accepted, meaning that there is autocorrelation.

4.3. Unbiasedness test

The unbiasedness test in generalized method of moments (GMM) refers to the assessment of whether the estimator resulting from the GMM model is biased or not. To find out that the analysis in this method is not biased, a comparison is made between the FEM test, SYSGMM test, and PLS test.

Table 5. Unbiasedness Test

Unbiasedness	FEM	0.5640689***
	SYS-GMM	0.85781278***
	PLS	0.95488542***

Source: Output Stata 18 (processed data)

Table 5 show the SYS-GMM estimation value of 0.85781278 is between the FEM test estimation result of 0.5640689 and the PLS test of 0.95488542 so that these results meet the unbiased requirements.

4.4. Estimation result

GMM is the best estimation method for panel data that involves a lagged dependent variable, namely the presence of autocorrelation due to the presence of lags in the dependent variable, causing the relationship between data to be dynamic. The lag in the dependent variable means that the model depends not only on the current time period but also on the previous time period. Based on table 4, the dynamic panel method model specification Arellano-bond test with the SYS-GMM approach has met the criteria for consistency and instrument validity, it can be concluded that SYS-GMM is the best model that can be used.

Table 6. SYS-GMM estimation result

Variables	Coefficient	Standar Error	z-stat	p-value
LN_LP _{t-1}	0.8578128	0.0306147	28.02	0.000
LN_HDI	0.9149037	0.2311911	3.96	0.000
LN_LFPR	-0.0932068	0.0997651	-0.93	0.350
LN_FDI	0.0170276	0.0053404	3.19	0.001
LN_EX	-0.0462729	0.0113512	-4.08	0.000
Constanta	1.872582	0.5519234	3.39	0.001

Source: Output Stata 18 (processed data)

Table 6 shows the SYS-GMM estimation results, revealing that labor productivity in the previous period (t-1) has a positive and significant effect on current labor productivity (t). The positive influence is evident from a probability value of 0.000 < 0.05 and a coefficient of 0.8578128 for the previous period (t-1), meaning that a 1 percent increase in labor productivity in the previous period (t-1) will drive an increase in current labor productivity (t) by 0.8578128 percent. This finding aligns with the study by Asada (2020), which states that labor productivity exhibits sustained movement, with past experience and knowledge contributing to the improvement of current labor efficiency, thereby enhancing productivity. This finding is further supported by the research of Abdelgany and Saleh (2022), which highlights that labor productivity often demonstrates interrelated dynamics over time, with future productivity levels being heavily influenced by productivity achievements in the previous period. This occurs because productivity encompasses not only current outcomes but also the accumulation of skills, technological mastery, and knowledge gained, which impacts not only the present period but continues to influence productivity in subsequent periods.

The Human Development Index has a positive coefficient of 0.9149037 and a probability of 0.000 < 0.05, indicating that a 1 percent increase in the HDI will lead to a 0.9149037 percent increase in labor productivity. Feronica *et al.* (2024), also found similar results, showing that an increase in the Human Development Index significantly supports labor productivity growth.

Enhancements in human resource quality contribute to the competence and efficiency of the workforce, thereby improving productivity. This finding is also consistent with the research of Akinyele (2024), where human development improvements become a key instrument for engaging a productive workforce in the production process. However, these results are contrary to the study by Astutik and Aisyah (2023), which found that the Human Development Index has a negative and insignificant effect on labor productivity. This may occur because the increase in the Human Development Index has not been evenly distributed or does not directly impact the labor force groups, along with the influence of other factors.

The labor force participation rate has a negative and insignificant effect on labor productivity, with a coefficient value of -0.0932068 and a probability of 0.350 > 0.05. The negative coefficient indicates that a 1 percent increase in the labor force participation rate will decrease labor productivity by 0.0932068 percent. This negative relationship suggests that as more people join the labor force, worker productivity tends to decline. This may be due to the increase in the labor force not being accompanied by an improvement in the skills or expertise required by industries. The study by Abonazel and Shalaby (2021), supports this result, showing that the labor force participation rate has a negative effect on labor productivity. The main cause of this negative relationship is that new workers often lack practical skills and need more time to become fully productive. An increase in the labor force does not always lead to a positive impact on productivity, possibly due to issues such as skill mismatches or inefficient utilization of labor (Sarwar et al. 2021). In contrast to previous research Koyuncu et al. (2016), found that there is a significant positive relationship between labor force participation rate and labor productivity, when labor is more involved in the labor force their contribution to economic output and productivity will increase.

Foreign direct investment contributes positively and significantly to labor productivity in ASEAN-6 countries. FDI has a coefficient of 0.0170276, indicating that a 1 percent increase in foreign direct investment will raise labor productivity by 0.0170276 percent. Emako et al. (2022), explain that foreign direct investment plays a crucial role in boosting labor productivity in developing countries. FDI enhances labor productivity, particularly by improving productivity in the manufacturing and services sectors through structural changes that shift resources to more productive sectors and increase technology absorption and skills in the local workforce. Maharani and Woyanti (2023), found different results with previous studies where foreign investment has an insignificant positive effect on labor productivity, this insignificant positive result indicates that foreign investment does not directly result in an increase in labor productivity or its impact takes longer to materialize besides that if foreign direct investment is concentrated in sectors that are not intensive in the use of labor or technology its impact on aggregate productivity will be limited.

The export coefficient value of -0.0462729 indicates a negative effect, meaning that for every 1 percent increase in exports, labor productivity will decrease by 0.0462729 percent. The findings of Chowdhury et al. (2022), align with this study showing that exports have a significant negative effect on labor productivity. The negative impact may occur because companies are less productive and prefer to focus on the domestic market rather than face stiffer competition in international markets. Kacou et al. (2022), explain that barriers to exporting such as complex regulations or a lack of market information can make companies less productive and reluctant to engage in export activities. However Schwarzer (2017) found different results where exports have a positive effect and make a significant contribution to increasing labor productivity, if exports are dominated by commodity-based products or labor-intensive sectors with high added value then increasing exports can increase labor productivity.

Table 7. Short run – long run effect

Variable	Short-Run Effect	Long-Run Effect
LNIPM	0.9149037	6.434501
LNTPAK	-0.0932068	-0.6555219
LNIAL	0.0170276	0.119755
LNEK	-0.0462729	-0.3254366

Source: Output Stata 18 (processed data)

Dynamic panel data regression is a method that can be used to determine the short-run effects and long-run effects of endogenous variables. Based on Table 7, it can be seen that the long-term effects of the human development index, labor force participation rate, foreign direct investment, and exports are seven times larger than the short-term effects on labor productivity. This indicates the presence of a multiplier effect, where the impact is not immediately visible in the short term but becomes more apparent in the long term. The multiplier effect causes the relationships between variables to appear more pronounced in the long run, and any increase in a variable can trigger multiple effects that ultimately amplify its overall impact.

The short-term effect of the human development index is 0.9149037 while in the long run the effect is much higher at 6.434501. The positive coefficient value in the long run indicates that every 1 percent increase in the human development index will increase labor productivity by 6.434501 percent. The magnitude of the coefficient value indicates that both in the long run and short run, the human development index has the most significant impact on labor productivity growth. This increase explains that the components of the human development index including education, health, and living standards have a strong effect on labor productivity. The labor force participation rate in the long run has an effect of -0.6555219, meaning that every 1 percent increase in the labor force participation rate will decrease labor productivity by 0.6555219 percent. The negative effect indicates a structural mismatch in the labor market, where a larger increase in the number of workers is not always followed by an increase in productivity, especially if the labor entering the labor market is not accompanied by an increase in quality or does not have adequate skills and indicates a problem in labor absorption.

In the long run, the effect of foreign direct investment of 0.119755 is higher than in the short run, meaning that every 1 percent increase in foreign direct investment in the long run will increase labor productivity by 0.119755 percent. The positive increase shows that the benefits of foreign direct investment are not only limited to capital entering the economy, foreign direct investment can come from the transfer of knowledge, managerial skills, as well as the adoption of technological innovations brought by foreign companies and then adopted by the local workforce. Export has a long-run effect of -0.3254366, which is much higher than the short-run effect. The negative coefficient in the long-run indicates that every 1 percent increase in export will decrease labor productivity by 0.3254366 percent. The negative effect may occur due to unfavorable export structure in the long run or over-dependence on low value-added exports, when export demand increases sectors expand their production capacity rapidly without any significant increase in labor efficiency thus causing a decline in productivity.

5. Conclusion and recommendation

Based on the results of the research and analysis that has been carried out, it can be concluded that labor productivity in the previous period ($t-1$) has an effect on labor productivity in the current period (t), this positive influence has a learning effect in the production process, besides that the experience gained helps workers overcome various obstacles that may occur and provides long-term benefits in sustainable productivity improvement. The human development index as an indicator that measures important aspects of human development reflecting improvements in the quality of education, health, and overall welfare contributes positively to labor productivity.

An increase in the number of workers that is not accompanied by an increase in skills or expertise in accordance with industry needs will contribute less to output than a more experienced or skilled workforce, thus having no impact on productivity gains. Foreign capital flows assist in strengthening infrastructure, improving technology, and facilitating the transfer of knowledge and skills needed to support economic growth, thereby making the workforce more competent in performing highly skilled tasks and resulting in increased efficiency and productivity in various sectors of the economy. Although the volume of exports increases, labor productivity remains low due to a country's dependence on exporting primary goods that require intensive labor but are not supported by high technological innovation and tend to use inefficient traditional production methods.

The human development index, labor force participation rate, foreign direct investment, and exports have an impact on labor productivity in the long run 7 times greater than in the short

run, indicating a multiplier effect. The coefficient value of human development index in the long run and short run dominantly affects the increase of labor productivity in ASEAN-6 countries. Future researchers are expected to deepen the analysis by considering other variables that may affect labor productivity, expand the scope of the research area, extend the research period, or use other methods such as ARDL in order to provide a more comprehensive picture.

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