The Effect of Foreign Direct Investment on Total Factor Productivity in Selected ASEAN+3 Countries: New Evidence Using A Panel ARDL Study

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The Effect of Foreign Direct Investment on Total Factor Productivity in Selected ASEAN+3 Countries: New Evidence Using A Panel ARDL Study

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Abstract

This study investigates the effects of FDI and other macroeconomic variables on Total Factor Productivity (TFP) in selected ASEAN+3 countries from 1981 till 2016. Total Factor Productivity (TFP) for each ASEAN+3 country was constructed using the Malmquist productivity index method. Then, a panel ARDL framework (dynamic heterogeneous panel), namely Pooled Mean Group (PMG), Mean Group (MG), and Dynamic Fixed Effect (DFE) are employed in examining the effects of FDI and other controlling variables on TFP. The new findings show that FDI has a significant and positive impact on TFP in the long run and the short run in ASEAN+3 countries. Besides, the results also reveal that in the long run, other variables such as the average number of years of schooling and the ratio of high-skilled to low-skilled labor also have a significant and positive effect on TFP. However, economic openness, government expenditure on R&D, and interaction between countries and FDI have a negative and significant impact on TFP. These findings implied that the recipient countries must ensure their political stability and offer various incentives to attract more investors. Furthermore, the influx of foreign investors, especially large ones and lower costs, should be encouraged by each country as FDI inflows can boost their TFP growth.

Keywords: ASEAN, Foreign Direct Investment, Total Factor Productivity, Panel ARDL

JEL Classification Code: F10, O1, O3, O47, O50

1. Introduction

According to the Malaysia Productivity Corporation (MPC) in 2016, increasing the contribution of Total Factor Productivity (TFP) to economic growth can help boost the standard of living. Higher growth in TFP can bring many benefits, such as better quality goods and services, lower cost, higher consumer satisfaction, and sustainable economic development. Therefore, an increase in TFP can be realized from human capital contribution, capital structure, demand intensity, technological advances, and economic restructuring. Countries with strong economic growth rates can provide a better quality of life and a higher standard of living for their citizens. Figure 1 shows the contribution of production factors to economic growth in selected ASEAN+3 countries over the period 2010–2017, according to the Asian Productivity Organization (2019) Databook, TFP played a significant role in driving rapid economic growth over the past few decades. China recorded an average annual TFP growth rate of 2.3%.

Japan recorded an annual average TFP growth of 0.9%, while the average annual TFP growth rate in South Korea stood at 0.8%. The yearly average TFP growth rate in most selected ASEAN+3 countries stood between 0.1% and 2.3%. Based on Figure 1, it can be learned that capital growth is the dominant factor in economic growth in most selected

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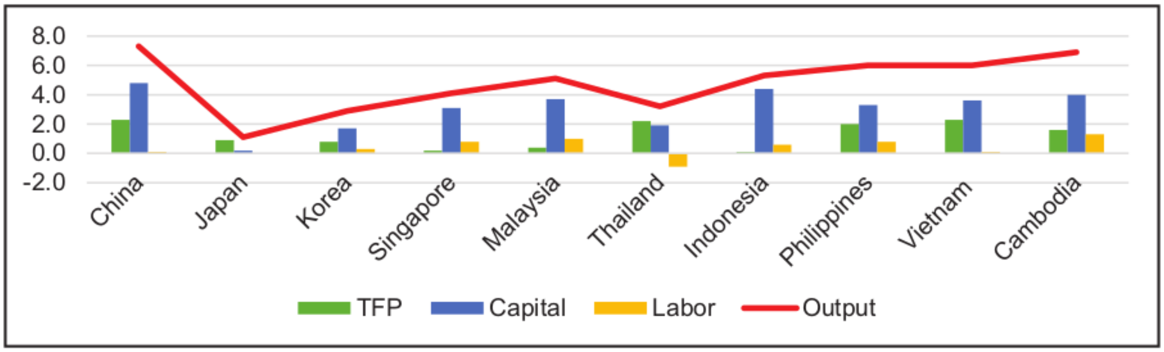

Figure 1: The Production Factors in Selected ASEAN+3 Countries, 2010–2017 (%)

Source: Asian Productivity Organization, 2019.

ASEAN+3 countries except for Japan. TFP contributed most to economic growth in the country compared to capital and labor over the period 2010–2017. According to the Conference Board (2014), TFP's poor contribution was owing to a downturn in demand, which disrupted economic growth, and this was caused indirectly by the country's failure to produce innovative technologies.

Foreign direct investment (FDI) refers to transferring management resources beyond boundaries (Alvstam, 1993). FDI is often measured by international capital transfer. Besides, it is also measured by human resources and financial capital transfer. Most countries rely heavily on FDI to develop their local economies. FDI involves investments in capital, technology, and expertise usually made by multi-national companies or transnational companies. In the presence of FDI, the recipient country can get access to skilled human capital, physical capital, new technology, research and development (R&D), innovation, and skills. FDI is also essential to provide more job opportunities and also can improve the standard of living. Apart from that, multinational companies (MNCs) also play a crucial role in enhancing a standard of living through adequate minimum wages. MNCs usually invest in other countries for several reasons, such as natural resources, market expansion, and efficiency. These motives are in line with the OLI framework theory according to Wadhwa et al. (2011). Host countries will also provide many benefits to foreign investors such as cost advantages, better facilities, tax incentives, and monopoly power. This friendly policy to encourage FDI will indirectly boost economic growth.

However, the competition to attract FDI intensifies as many competitors emerge, especially from low-cost countries such as China, Vietnam, and Thailand. In Malaysia, the strategic location gives a head start to attract more foreign investors, leading to the country's industries' success. FDI does not only improve technology and knowledge, but it can also provide more job opportunities. Besides, FDI can bring skilled human capital and better physical capital, and thus output can be enhanced. Most countries also rely heavily on FDI to develop their economies. Investors' confidence in the global economy has increased, and this bodes well for developing countries to attract more FDI.

FDI inflows can increase productivity and thus lead to a higher economic growth. However, it has been found that most ASEAN countries such as Malaysia, Thailand, Philippines, and Cambodia show lower FDI inflows compared to China, Singapore, Indonesia, South Korea, and Vietnam, which are ranked 2, 5 and 18, and 20, respectively among Asian countries (UNCTAD, 2019). FDI growth mostly stems from higher investment in Singapore, Indonesia, Vietnam, and Thailand. China is the second-largest economy, and it has attracted foreign investment of US$139 billion with an increase of 4%. However, foreign direct investment inflows into some countries such as Malaysia and the Philippines have decreased. Political and economic instability results in investors being less interested in investing in the countries. This is because they do not want to take the risk of loss. Other than that, trade restrictions can also play an essential role in reducing FDI. Singapore was the subregion's largest FDI recipient with inflows of US$78 billion in 2018, and FDI inflows in Indonesia grew by 7% to US$22 billion. Among the ASEAN countries, Singapore accounted for 50% of the total FDI. China and Japan contributed substantially to FDI in Singapore.

Given this background, this paper contributes to the existing literature, and it can shed light on policymakers to formulate an appropriate FDI policy. Policy to encourage more FDI is required if the productivity in recipient economies has improved in response to FDI's inflow. This study also improves previous studies in terms of the effect of FDI on TFP growth in the following ways. First, this study improves earlier studies in terms of the impact of FDI on TFP growth. Previous researchers did not much explore the topic. It can also improve the existing policies to attract more foreign investors by providing various incentives. The policies that can be used to expand FDI in ASEAN + 3 countries are to ensure political and economic stability, trade size, reduce the barriers to FDI inflows, create an environment that can attract FDI inflows, and eventually encourage foreign investment to become established in ASEAN + 3 countries. Therefore, further studies need to be performed to analyze the effects of FDI on TFP growth using different dimensions. Second, this study could also help policymakers to boost TFP growth by increasing the contribution of FDI. The reason is that the increase in the FDI can improve productivity in a country based on technologies and knowledge spill-over. Therefore, this study is the first to examine the effect of FDI on TFP growth using the Panel ARDL approach.

The structure of this article has divided into five sections. The second section discusses the previous studies, and the third section has highlighted the methodology and model specifications. Section four discusses the main findings, and the final section concludes.

2. Literature Review

Foreign direct investment (FDI) can increase the host country's productivity with advanced management techniques and technology from foreign firms that can benefit local companies. Multinational companies often use the most advanced and up-to-date technology, and technology transfer ensues. However, based on studies in developing countries, Van Pottlesberghe and Lichtenberg (2001) found that technology transfer through FDI is only possible if they invest in research and development (R&D) activities. However, this is rare because foreign firms invest abroad to exploit technological advantages rather than to disseminate their technology. Thus, FDI inflow into a country will lead to technological overflows. Technology and knowledge transfer from one country to another pave the way for the country to adopt more advanced technology, leading to growth in TFP.

According to a study conducted by Kruger (2001), globalization has led to changes in productivity from the 1960s to the 1990s. This shows that FDI is one of the leading factors in technology transfer in most developing countries. Sadik and Bolbol (2001) argued that FDI inflows can stimulate TFP through knowledge and technology transfer. Besides, Zulridah and Rahmah (2007) also found that TFP growth is higher in industries that involve more foreign direct investment than industries that involve domestic investment. According to Liu (2008), FDI and trade can be seen as the major channels of technological overflow. The transfer of technical knowledge through economic activities is different and indirectly improves technological progress. Multinational companies introduce new technology to the local market. FDI inflows can stimulate innovation through learning by analyzing multinationals' roles and output to local companies through R&D projects. This enables local companies to carry out their innovation activities more effectively. Thus, this is also evident from the findings of a study conducted by Elsadig (2008) that higher FDI contributes positively to TFP growth.

Contrary to the findings of a study conducted by Rahmah and Idris (2009), several types of industries showed negative contributions of capital input to their output growth. This is likely due to very high capital expenditure beyond foreign direct investment in these industries. This study's findings also show that capital-oriented and technologically advanced industries are less efficient and achieve lower TFP growth. This illustrates inefficiency in capital use associated with the use of less efficient technologies. It is also possible that there is a mismatch between the technology used and their labor skills.

Suyanto et al. (2009) found FDI inflows on productivity overflow in the pharmaceutical and chemical sub-sectors in Indonesia from 1988 to 2000 have led to an overflow of productivity in Indonesia. Besides, the increasing competition will also result in a large spike in local firms benefiting from the overflow of R&D growth compared to firms that do not perform R&D. The results also show that overflow from FDI is positively and significantly related to technological change, but FDI overflow to technical efficiency is not significant. This shows that technological change is a key factor in increasing Indonesia's productivity for pharmaceutical and chemical firms.

Technology transfer from multinational companies to local firms also occurs through human capital mobility or labor market turnover where trained managers and skilled workers who have worked for Multinational Companies (MNCs) will be transferred to local firms or set up their own companies. Thus, FDI is positively related to local firms' innovation in China through R&D industries. This suggested that technology surplus from FDI is generated through foreign companies' R&D activities and not through their production activities (Liu, 2008). Therefore, the results of a study by Wang (2010) show that FDI has a powerful effect on TFP growth. However, it is in contrast to the study conducted by Tanna (2009), who showed that FDI inflows negatively impact the short run but have a positive long-term impact on TFP. Elsadig (2010) also found that FDI contributed negatively to TFP per labor unit during the period 1987–1996. Besides, Nguyen (2020) stated that the attraction of FDI inflow to Vietnam will maintain a high economic growth rate.

Anwar and Nguyen (2014) found in the manufacturing sector of Vietnam from 2000 to 2005 and that overflow from FDI has a strong relationship with TFP growth. Besides, FDI inflows will transfer knowledge and technology to the host country and also indirectly caused local workers to invest in education. Emphasis on increasing the ability and capacity to compete in business should be given attention in the global market. The industry should emphasize enhancing the ability to compete with foreign investors in the local market and increase exports. Malaysian entrepreneurs should be more receptive to new knowledge and increase their skills and creativity in an enterprise. In the long run, businesses should maintain the industry's competitiveness through continuous innovation and innovation in the delivery system. They should also strive to produce new products and services with high value-added. Hence, productivity growth increases. Therefore, the industry also needs to emphasize increasing productivity, efficiency, and innovation capabilities in the face of global challenges. On the other hand, research and development can contribute to increasing TFP in China's manufacturing sector (Lee & Xuan, 2019).

A study by Fernandes and Paunov (2012) examined the impact of substantial foreign direct investment (FDI) inflows in producer service sectors on the total factor productivity (TFP) of Chilean manufacturing firms. Their findings also suggested that service FDI fosters innovation activities in manufacturing. The results of the study conducted by Amann and Virmani (2015) also found that FDI can boost productivity in 18 developing countries during the period 1990–2010. However, a greater impact can be seen when the developed countries invest in the developing countries, and this can indirectly lead to higher R&D. Kim et al. (2015) found that TFP positively affected by FDI inflows in the less developed countries (southern countries). The foreign investment from developed countries (northern countries) are stronger than those in less developed countries. According to Liu et al. (2016), increasing foreign investors can lead to technology transfer and indirectly enhance TFP in China's electronics industry. In a contrary study by Herzer and Donaubauer (2017), FDI has a negative long-term impact on TFP. Thus, FDI and TFP show the long-term causality tests. Besides, they are also found in the short run, TFP will affect FDI, and TFP has a positive impact on FDI in the long term. This leads to higher TFP depending on a particular group of countries. This is because the value of the coefficient between TFP and FDI is negative in countries that have problems related to financial development, human capital, and trade.

The study among FDI and TFP was also supported by the findings of Kannen et al. (2017) in developing countries. The results showed that FDI positively and significantly affected TFP. However, this effect is only for the North-South countries, but FDI for the South-South countries is not significant and negative for TFP growth. It can be concluded that FDI is also one factor contributing to TFP based on previous research. This is because of FDI inflows into a country that cause technological and knowledge transfer. Li and Tanna (2019) investigated the contribution of inward FDI on TFP using a GMM estimator in 51 developing countries and found that FDI has a strong impact on the TFP growth after accounting for its roles in institutions and human capital.

Based on the review of previous literature, no studies focused on ASEAN+3 countries. Therefore, this study is essential to determine whether FDI can positively impact TFP growth in selected ASEAN+3 countries. Besides, this study also fills the lack of previous literature such as Rahmah and Idris (2009) and Suyanto et al. (2009), as well as Fernandes and Paunov (2012), who focused on the contribution of FDI to TFP in specific sectors. This study proposes a panel ARDL approach in analyzing the effects of FDI on TFP growth in selected ASEAN+3 countries. Most previous studies used ordinary least squares (OLS), a Generalized Method of Moments, fixed and random effects. The advantage of using the ARDL approach is that we can directly examine the impact of FDI on TFP in the short and long run.

3. Research Methods and Materials

This study applied a panel dynamic approach to examine the effect of FDI on TFP from 1981 to 2016 in selected ASEAN+3 countries (Indonesia, Thailand, Malaysia, Philippines, Vietnam, Cambodia, Singapore, Japan, China, and South Korea). The dependent variable is TFP, while the independent variable is FDI, schooling average years, skilled workers, trade openness, R&D expenditure, and the interaction between FDI and country dummy. Despite this study's focus on FDI, this study still considers other variables that may contribute to TFP.

3.1. TFP Measurement Method

The Malmquist productivity index (MPI) method is used in this study to obtain TFP values based on PIM-DEA software introduced by Emrouznejad and Thanassoulis (2015). This method can also generate value changes in technological change (TC) and technical efficiency (TEC). Data output and input are needed to construct the TFP value. According to Fare et al. (1994), the formula for obtaining a more accurate Malmquist productivity index is output-oriented which can increase output by using the same input. Thus, the following equation can be written as:

$$m_o(y_s, x_s, y_t, x_t) = [m_0^s(y_s, x_s, y_t, x_t) \times m_0^t(y_s, x_s, y_t, x_t)]^{\frac{1}{2}} \quad (1)$$

However, Fare et al. (1994) developed the equation of change in the MPI as:

$$m_o(y_s, x_s, y_t, x_t) = \left[\frac{d_0^s(y_t x_t)}{d_0^s(y_s x_s)} \times \frac{d_0^t(y_t x_t)}{d_0^t(y_s x_s)}\right]^{\frac{1}{2}} \quad (2)$$

In equation (2), m_o represents the TEC index, x is input, and y is output. Besides, $d_0^s(y_t x_t)$ represents the difference between period t and technology at time s or the productivity of the production point (y_t, x_t) and the production point (y_s, x_s). If m_o greater than one, it indicates positive changes in TFP for both periods, whereas if m_o is less than one, it represents negative changes in TFP compared to the previous period.

$$m_o(y_s, x_s, y_t, x_t) = \underbrace{\frac{d_0^t(y_t, x_t)}{d_0^s(y_s, x_s)}}_{\text{(TC)}}\underbrace{\left[\frac{d_0^s(y_t, x_t)}{d_0^t(y_t, x_t)} \times \frac{d_0^s(y_s, x_s)}{d_0^t(y_s, x_s)}\right]^{1/2}}_{\text{(TEC)}} \quad (3)$$

In equation (3), changes in the Malmquist TFP index comprise two components which are TEC and TC. The value outside the bracket is a measure of the efficiency change of the output-oriented technique between period s and period t, while the geometric mean of the bracket shows the ratios that dominate technological change between the two time periods, namely X_s and X_t. Therefore, the TEC can be expressed as follows:

$$\frac{d_0^t(y_t, x_t)}{d_0^s(y_s, x_s)} \quad (4)$$

Technological change inefficiency refers to the use of presence capital, labor, and other inputs that can bring out more output. To get the value of technology change (TC) is as follows:

$$\left[\frac{d_0^s(y_t, x_t)}{d_0^t(y_t, x_t)} \times \frac{d_0^s(y_s, x_s)}{d_0^t(y_s, x_s)}\right]^{1/2} \quad (5)$$

Technological change (innovation) reflects the frontier change. Squires and Reid (2004) stated that TC refers to the new technologies development that can enhance the production process. Due to production innovation, firms can produce more efficient products, so that the production cost can be reduced and output will increase.

In theory, the Malmquist index for TFP change (TFPC) based on the interpretation of Cabanda (2001) is a result of TEC and TC that can be expressed as:

$$\text{TFPC} = \text{TEC} \times \text{TC} \quad (6)$$

The MPI index can be expressed as:

$$m_0(y_t, x_t, y_s, x_s) = \text{TEC} \times \text{TC} \quad (7)$$

Malmquist TFP is an index that indicates changes in technical efficiency (TEC), technological change (TC), and TFP (Raphael, 2013). The TEC and TC indexes are components of TFP. The TFPC value (m_o) is lower than 1 when there is a decrease in TEC and TC. If the value is higher than 1, it suggests an increase in TEC and TC. TFP measures an increase or a decrease in productivity over time. TFP will increase as a country adopts new inventions or better processing methods. It is called technological change. TFP can also increase as the country adopts existing technologies and inputs more efficiently. For example, using the same amount of capital, labor, and technology inputs, the country will generate more output. In this situation, the country will experience increasing technical efficiency.

3.2. Panel Data Analysis

A panel data analysis based on POLS, fixed effect, and random effect allows for heterogeneity in the long-run relationship between the dependent and independent variables (Pesaran & Smith, 1995; Pesaran et al., 1999). The panel static assumption that coefficients are homogeneous is also irrelevant in the real world as countries differ in terms of economic growth, human capital, geography, technology, etc. Therefore, this estimation analysis will use a panel dynamic method approach. The approach is chosen to achieve the objective of this study (to analyze the impact of FDI on TFP). This method combines time series and cross-section data with time series (t) larger than cross-section (N) or $T > N$. The estimators used in analyzing our data are Pooled Mean Group (PMG) and Mean Group (MG). Before the estimation, a Hausman test will be conducted to determine which estimator is better, either PMG or MG.

PMG and MG can show the long-run and short-run effects of each variable. According to Pesaran et al. (1999), these estimators are more consistent in generating long-term coefficients regardless of whether our variables are integrated of a different order, $I(0)$ or $I(1)$. These analyses are used to reduce bias, provide more accurate results, reduce multicollinearity, and produce a more precise estimation of coefficients. Using this estimation, intersection, coefficient slope, and standard deviation error can differentiate the entire group. Assume that ARDL (p, q_1, ... q_k) can be written as follows:

$$\Delta \text{TFP}_{it} = \varnothing_i \text{TFP}_{i,t-1} + \beta_i' x_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta \text{TFP}_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}' \Delta x_{i,t-j} + \mu_i + u_{it} \quad (8)$$

$i = 1,2, \ldots N$, while $t = 1, 2, \ldots T$

In this study, TFP is treated as a dependent variable while X_i is our independent variable, μ_i is fixed effect state, $\varnothing_i$ is the coefficient of level form lags dependent variable, β_i is the vector coefficient, λ_i is the coefficients of the lagged of first-difference dependent variable and δ_{ij} is a $k \times 1$ vector coefficient for the first difference of the explanatory variable and each explanatory variable's lag. The central assumption is that the ARDL model is normally distributed (independently distributed) over i and t with a mean value of 0 and the standard deviation is $\delta > 0$. It is further assumed that the error correction terms (ECT) $\varnothing_i < 0$ for i, this means that there is a long-term relationship between TFP and x. The relationship model can be written as follows:

$$\text{TFP}_{it} = \theta_i' x_{it} + \eta_{it} \quad (9)$$

$i = 1, 2, \ldots N$, and $t = 1, 2, \ldots T$

where $\theta_i' x_{it} = -\frac{\beta_t}{\varnothing_i}$ is a $k \times 1$ vector for the long-term coefficients and stationarity with the non-zero mean probability that includes a fixed effect. Equation (10) can be written as follows:

$$\Delta \text{TFP}_{it} = \varnothing_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta \text{TFP}_{i,t-j} + \sum_{j=0}^{q-1} \text{TFP}_{ij}' \Delta x_{i,t-j} + \mu_i + u_{it} \quad (10)$$

η_{it-1} is an error variable generated from the long-term equation, $\varnothing_i$ is ECT to describe the speed of adjustment. If $\varnothing_i = 0$, thus suggests that there is no long-term effect among our independent variable and the dependent variable. Therefore, the parameters must be significant and negatively correlated with the central assumption that the variable returns to its long-term equilibrium. The number of lags for the ARDL model is determined by using either the Akaike information criterion (AIC) or Schwartz Bayesian criterion (SBC) before the model is estimated using the least-squares regression technique. However, the number of lags selected by AIC is higher than that is selected by SBC.

$$\begin{aligned} \Delta \text{TFP}_{i,t} = {} & \beta_0 + \varnothing_i \text{TFP}_{i,t-1} + \beta_1' \ln \text{FDI}_{i,t} + \beta_2' \ln \text{FDI}_{i,t} * \text{DC}_{i,t} \\ & + \beta_3' \text{YOS}_{i,t} + \beta_4' \text{HS}_{i,t} + \beta_5' TO_{i,t} + \beta_6' \text{R\&D}_{i,t} \\ & + \sum_{j=1}^{p-1} \lambda_{ij} \Delta \text{TFP}_{i,t-1} + \sum_{j=0}^{q-1} \delta_{1ij}' \Delta \ln \text{FDI}_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{2ij}' \Delta \ln \text{FDI}_{i,t-1} \times DC_{i,t-j} \\ & + \sum_{j=0}^{q-1} \delta_{3ij}' \Delta \text{YOS}_{i,t-1} + \sum_{j=0}^{q-1} \delta_{4ij}' \Delta \text{HS}_{i,t-1} \\ & + \sum_{j=0}^{q-1} \delta_{5ij}' \Delta \text{TO}_{i,t-1i,t-1} + \sum_{j=0}^{q-1} \delta_{6ij}' \Delta \text{R\&D}_{i,t-1} + \varepsilon_{1ij} \end{aligned} \quad (11)$$

Equation (11) is formed is based on the model introduced by Solow (1957). TFP refers to total factor productivity and is the dependent variable. The independent variables used in this study are foreign direct investment (FDI), the interaction between FDI and a country dummy (lnFDI * DC). The dummy variable refers to a group of developed countries, namely South Korea, Japan, and Singapore (dummy 2), and developing countries encompassing Malaysia, Indonesia, Thailand, Philippines, Vietnam, Cambodia, and China (dummy 1). YOS refers to the average number of years of schooling. In contrast, HS refers to the ratio of skilled workers, TO refers to trade openness (real exports + real imports / real GDP) while R&D measures the R&D expenditure, ε is the error correction term while i refers to countries and does not refer to years.

4. Results and Discussion

A Hausman test was conducted to determine whether PMG or MG and DFE or PMG are more appropriate in modeling the link between FDI and TFP. The Hausman test results to choose either PMG or MG show that MG is not significant, and thus, PMG is better than MG. The results of the Hausman test for PMG and DFE show that DFE is not significant. In other words, the probability value is insignificant. Therefore, the null hypothesis is rejected, suggesting that the PMG estimator is better. The results are based on the panel ARDL (1, 1, 2, 1, 1, 1). Table 1 shows the estimation of PMG, MG, and DFE in the long run estimation. FDI is found to have a significant and positive relationship with TFP in the selected ASEAN + 3 countries using PMG estimator.

These findings indicate that when FDI increases by 1%, it can lead to an increase of 1.22% in TFP. This suggests that FDI inflows can indirectly lead to technology transfer, improving human capital, and knowledge transfer. Thus, it can help boost TFP in those countries. Moreover, the findings are also in accordance with those of studies, such as Zulridah and Rahmah (2007), Liu et al. (2016), and Kannen et al. (2017). However, these findings are not in accordance with the results of the MG and DFE estimator. Other than that, PMG results show the average years of school also show a positive and significant effect on TFP. A 1-year increase in the average years of school will increase TFP by 0.89%. The results are in accordance with MG and DFE estimators.

The ratio of skilled workers (HS) can also have a significant and positive effect on TFP. An increase in 1 ratio of skilled workers will increase TFP by 18.43%. This shows that education can produce more capable and innovative workers who can think critically. As they are more skilled and of better quality, through human capital accumulation, they will become more efficient and productive. Thus, higher TFP ensues. The results of MG and DFE, on the other hand, show that skilled workers do not contribute to TFP.

The interaction variable's coefficient value, between lnFDI and countries (lnFDI*DC), is significantly negative for the PMG estimator. This indicates that TFP will decline by 0.71% in developed countries compared to developing countries. Investors are more interested in investing in countries with lower costs such as raw material costs, lower labor costs, strategic positions, and tax relief. The results of the MG and DFE estimator are not consistent. Therefore, trade openness significantly and negatively affects TFP in all these estimators. Based on the PMG result, a 1% of trade openness increase will decrease TFP by 3.39%. This suggests that more foreign workers migrate to countries that offer more benefits as the country becomes more open to trade. Other than that, there is an increase in imports and thus, this can indirectly affect TFP. The PMG estimator results show that R&D expenditure has a significant but negative effect on TFP in the long run. Besides, a 1% increase in R&D expenditure will cause TFP to drop by 0.06%. In the long run, this might be because the technology produced is outdated and does no longer fit the bill for production activities.

Table 2 shows the results of PMG, MG, and DFE estimation in the short run. The results show that the error correction term (ECT) is negative and significant at 5% for all three estimators. These suggested that there is a

Table 1: Results of Long-Run Estimation for PMG, MG, and DFE

Variables	PMG		MG		DFE	
	Coefficient	*P*-value	Coefficient	*P*-value	Coefficient	*P*-value
lnFDI	1.223	0.030**	–0.216	0.603	0.161	0.861
lnFDI*DC	–0.707	0.023**	–0.251	0.099	–0.160	0.769
YOS	0.891	0.004**	3.093	0.000**	1.823	0.004**
HS	18.435	0.000**	28.117	0.137	8.534	0.327
TO	–3.386	0.000**	–6.744	0.284	–3.702	0.024**
R&D	–0.063	0.772	0.318	0.526	0.366	0.177
Hausman Test	5.20	0.5185			0.27	0.999

Note: **Indicates significance at 5%.

Table 2: Results of Short-Run Estimation for PMG, MG, and DFE

Variables	PMG		MG		DFE	
	Coefficient	*P*-value	Coefficient	*P*-value	Coefficient	*P*-value
ECT	–0.959	0.000**	–1.121	0.000**	–0.879	0.000**
Δ lnFDI	1.666	0.039**	0.948	0.241	–0.061	0.759
ΔlnFDI*DC	–1.623	0.300	–0.414	0.762	0.013	0.948
ΔYOS	–0.216	0.908	–2.611	0.498	2.077	0.381
ΔHS	–4.488	0.474	–22.829	0.058	–2.180	0.777
ΔTO	8.160	0.004**	8.719	0.066	1.296	0.565
ΔR&D	0.515	0.001**	0.360	0.394	0.071	0.738

Note: **Indicates significance at 5%.

long-run relationship (co-integration) between the explanatory variables and TFP. Besides, it also describes the speed of adjustment to achieve long-run equilibrium. The PMG estimator results show that FDI has a strong significant effect on TFP. A 1% rise in FDI can increase TFP by 1.6%. This might be due to technology transfer from one country to another. As a result, it can lead to TFP in the short run. Besides, investors will bring in new technologies and experts to countries that can improve their products' quality to be highly competitive in international markets.

In contrast, MG and DFE estimators' results show that FDI does not contribute to TFP. Trade openness also has a significant and positive effect on TFP. A 1% increase in trade openness leads to a rise of 8.16% in TFP. These findings are not consistent with the findings obtained from the MG and estimators. Only the results of PMG show that R&D expenditure is found to significantly and positively affect TFP in the short term. A 1% rise in R&D expenditure can cause TFP to rise by 0.52% in response to modern innovation that has been utilized in the short term.

5. Conclusion

This study investigates the effects of FDI inflows on TFP in selected ASEAN+3 countries (Malaysia, Singapore, Thailand, Indonesia, Philippines, Cambodia, Vietnam, China, South Korea, and Japan) from 1981 to 2016. The PMG, MG, and DFE estimators are employed, and the results of the Hausman test show that the PMG estimator is preferred over the MG and estimators. The results of PMG show that there are significant and positive long-run relationships between FDI inflows, education, skilled labor, and TFP in the selected ASEAN+3 countries. The interaction between FDI * DC and trade openness shows a significant but negative long-run relationship with TFP. The results of this study lend credence to the findings of previous studies that FDI can affect TFP. Therefore, countries need to attract more foreign investors to invest in those countries. The further estimation of PMG, MF, and DFE estimators reveals that the ECT is negative and significant. The results of PMG show that there are significant and positive short-run relationships between FDI inflows, trade openness, R&D, and TFP in the selected ASEAN+3 countries. In contrast, the MG and DFE estimators' results show that all variables do not contribute to TFP in the short run. Therefore, it can be concluded that FDI inflows can have a significant and positive effect on TFP in the selected ASEAN+3 countries in both the long run and short run.

Therefore, countries must offer various incentives and privileges to investors. This is because investors are usually more attracted to countries with lower labor rates, tax exemptions, strategic locations, and better infrastructure. Besides, political stability must also be maintained and enhanced to attract more foreign investors. This is because countries with unstable political conditions can affect investors' confidence and indirectly encourage them to move to other countries. Furthermore, multinational firms (MNCs) should be welcomed as they can improve the countries' technology and thus generate higher productivity for recipient countries.

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