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Foreign Direct Investment and Economic Growth: A Comparative Study among East Asian Countries*

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Abstract In the past two decades, there was a major shift in the degree of foreign direct investment (FDI) in East Asian countries. FDI as a tool for technology transfer can contribute to economic growth but this would depend on the economic environment of the host economy. This study examines the effect of FDI on the economic growth of 15 East Asian countries. For the analytical purpose, the countries are classified by their economic conditions, i.e. levels of human capital, investment on infrastructure, and trade openness. The panel cointegration analysis with endogenous growth model is used to observe the effect. The analysis is based on time series data from 1990-2009. The results show that FDI does not necessarily enhance economic growth. FDI had a positive effect on the economic growth only in the countries that have the appropriate economic conditions. East Asian countries including Thailand need to invest more on fundamental infrastructure and human capital, and increase their degree of trade openness in order to gain more from FDI.

Keywords: foreign direct investment, economic growth, East Asia countries, endogenous growth model

JEL Classification: C33, F21, F43

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Introduction

Over the past two decades, foreign direct investment (FDI) has become increasingly important in developing countries. In theory, there are several ways FDI can facilitate an economic growth. By applying the Solow-type standard neoclassical growth models, Brems (1970) suggested that FDI increases the capital stock and thus growth in a host economy by financing capital formation. In neoclassical growth models with diminishing returns to capital, FDI has only a short-run growth effect as countries move towards a new steady state. Accordingly, the impact of FDI on growth is identical to that of domestic investment. Endogenous growth models, on the other hand, often assume FDI is more productive than domestic investment. The logic is that FDI encourages the incorporation of new technologies in the production function of the host economy (Borensztein *et al.,* 1998). In this view, FDI-related technological spillovers offset the effects of diminishing returns to capital and keep the economy on a long-term growth path. Endogenous growth models also imply that FDI can promote long-run growth by augmenting the existing stock of knowledge in the host economy through manpower training and skills acquisition. Alternative management practices and organizational arrangements introduced by FDI also enhance national growth (see de Mello, 1997).

Wei and Liu (2006), Bende-Nabende *et al.* (2001), and Borensztein *et al.* (1998) revealed that there are empirical evidences that FDI can stimulate economic growth through technology transfer and spillover effect. Bashir (1999) showed a positive but not statistically significant relationship between FDI and economic growth. Carkovic and Levine (2005) however found no effect of FDI on economic growth. The reason might be that FDI is less than or simply replaces domestic savings and investment. FDI may target primarily the host economy's domestic rather than export market. FDI may not improve the comparative advantages of the host economy if the country merely aims at utilizing the cheap local labor and raw materials.

According to Kose *et al.* (2006), capital flows could directly increase GDP growth and reduce consumption volatility in the host economy. However, the growth and stability benefits of financial globalization are also realized through a broad set of positive factors in the host economy such as a well developed financial market, efficient institutions, better governance, and macroeconomic discipline. This set of benefits is called "collateral benefits". It is observed that before the Asian economic crisis in 1997 the correlation between FDI/GDP and GDP growth were

negative in some countries, but almost all turned positive after 2000. This suggests that there were changes in the initial threshold conditions after the crisis that enabled most countries to generate more benefits from FDI.

This study thus examines the impact of FDI on host country's growth as well as the effects of some threshold conditions in 15 East Asian economies. The sample economies are classified into three groups namely: (1) high income group, i.e. Hong Kong, Japan, South Korea, Singapore, and Taiwan, (2) middle income group, i.e. China, India, Indonesia, Malaysia, Philippines, and Thailand, and (3) low income group, i.e. Cambodia, Lao, Myanmar, and Vietnam. The study compares the impact of FDI among these three groups with different threshold conditions in terms of levels of education, investment on infrastructure and trade openness. It is postulated that the impact of FDI on growth varies among the groups. A panel cointegration technique with two different models, i.e. pooled regression model and fixed effect model are applied. The analytical concept is based on the endogenous growth model. The next section presents the overview of FDI flow and economic growth in East and South East Asian countries during 1990-2009. It is followed by the sections on conceptual framework, methodology, results and conclusion.

Overview

In the past two decades, there has been a major shift in the size and composition of the cross-border financial flows to developing countries, especially East Asian countries. According to the data from World Economic Outlook, IMF and World Investment Report, UNCTAD, FDI and foreign portfolio flows to developing countries started growing rapidly in 1980s and slowed down after 1990. This reflects the increased financial volatility and financial crises such as the one that occurred in East Asia in 1997. FDI is the most important source of funds among the various types of investment flows. During 1990-2000, inward FDI in East Asia significantly increased. The volume of FDI inflows to the sample countries were 160 billion USD, compared to only 15 billion USD in 1991, which was more than a ten-fold increase in ten years. During the financial crisis in 1997, the value of inward FDI to the selected countries dropped only 2%. When the economies recovered in 1998, the value grew 6%. China, Hong Kong and Singapore were the major FDI recipients.

In 2008, FDI inflow to East Asia was around 187 billion USD. China became the third largest FDI recipient country in the world in 2008. In India, the leading transnational corporations (TNCs) in many manufacturing and service industries hastened their market entry and expansion

in recent years. As a result, FDI flows to the country in 2008 surged, continuing the trend of the previous two years.

According to UNCTAD's World Investment Report 2009-2011, during 2008 and 2009 the FDI inflows to the Republic of Korea boomed. FDIs also rose in Hong Kong but declined sharply in Singapore and Taiwan. The latter two economies were affected severely by the global financial crisis. Among middle and low income countries, FDI inflows to Malaysia and Thailand decreased by 4% and 10%, respectively. In contrast, Indonesia and particularly Vietnam became more attractive for FDI inflows in labor intensive industries.

According to World Economic Outlook 2010, the economic growth rates of high income countries had been increasing since 1990. The average growth rate was around 5-8%, except Japan. However, the Asian financial crisis turned GDP growth rates negative in 1998. With recovery, the growth rate bounced back to 5% during 2001-2005. In 2007, it became negative again in high income countries because of the world economic recession that caused a sharp fall in external demand and thus exports. Among the middle income countries, China had the highest growth rate at an average of 10%. During the Asian financial crisis in 1997, GDP growth declined and became negative for most Asian economies except China; China's growth rate was around 7% while Indonesia and Thailand had below -10%. During 2001-2005, most economies recovered and their growth rates increased. However, in 2007 the growth rates became negative in Thailand and Malaysia. Among low income countries, except Vietnam, the Asian financial crisis did not affect their GDP growth because of their weak links to the export markets

Model

According to Levin and Raut (1997) and Zhang (2003), FDI can be applied into growth model in two ways depending on different assumptions. FDI can be postulated to cause growth directly or indirectly through the spillover effects. First, we assume that FDI would directly cause growth, then the capital stock in Solow production function is assumed to consist of two components, i.e. domestic and foreign owned capital stock $K_t = K_{dt} + K_{ft}$. Here Equation 1 is obtained:

$$Y_{it} = A_{it} L^{b1}_{it} K^{b2}_{dit} K^{b3}_{fit} \quad (1)$$

where Y is denoted as output, K_{dit} and K_{fit} as the domestic and foreign owned capital stocks, L_{it} as labor, A_{it} as total factor productivity, which explains the output growth that is not accounted by the growth in factors of production specified. The subscript i = 1,…, N indicates sample country i to N.

Subscript t = 1,…,T represents time period t, starting from 1 to T. After taking logarithm to Equation 1, the production function is as follows:

$$\ln(Y_{it}) = A_{it} + b_1 \ln(L_{it}) + b_2 \ln(K_{dit}) + b_3 \ln(K_{fit}) \quad (2)$$

Alternatively, if we specify that FDI affects growth through the spillover effects, the total factor productivity variable A has to be endogenized as a function of FDI. An example can be found in Zhang (2003) who applied the endogenous growth model to formulate the impact of FDI on the output growth through enhancing the total factor productivity. In this aspect, the model can be presented as follows:

$$Y_{it} = A_{it} L^{b1}_{it} K^{b2}_{it} \quad (3)$$

$$A_{it} = B^{*} FDI^{b3}_{it} \quad (4)$$

where Y_{it} is denoted as country's output, L_{it} as the labor, K_{it} as capital stocks, A_{it} as the total factor productivity, B as a constant term, and FDI as foreign direct investment. The subscript i = 1,…, N stands for country i to country N, and subscript t = 1,…, T represents time period t, starting from 1 to T. After substituting technologies (A) into the production function and taking logarithm, the production function became:

$$\ln(Y_{it}) = b_{0i} + b_1 \ln(L_{it}) + b_2 \ln(K_{it}) + b_3 \ln(FDI_{it}) + u_{it} \quad (5)$$

Use K_{dit} as a proxy of K_{it} and use K_{fit} as a proxy of FDI_{it}, we then obtain the model for estimation, which turns out to be the same as Equation 2.

In this study, we apply FDI to the growth function based on the assumption that FDI can stimulate economic growth through the technology transfer and spillover effect (Wei and Liu, 2006; Bende-Nabende *et al.,* 2001). Moreover, according to Kose *et al.* (2006), the growth benefits also depend on initial threshold conditions such as financial market development, institutional development, better governance, and macroeconomic discipline. Levin and Raut (1997) and Roy and Berg (2006) concluded that levels of human capital and infrastructure can increase technology of production. Their studies showed that countries with a high degree of trade openness tend to have a greater ability to absorb technology that comes with FDI. Therefore, in this study, we postulate that the level of human capital (HK), the level of infrastructure (IF), and international trade policy (TRADE) would have an impact on technological capability or total factor productivity.

We use the public expenditure on education as a proxy for the level of human capital (HK) which reflects the institutional development in host economies. Public investment is used as a proxy

for the level of infrastructure (IF). Trade openness is used for the degree of international trade (TRADE). Public investment and trade openness reflect host economies' macroeconomic discipline. The production and technology function in this study are shown in Equation 6 and 7, respectively.

$$Y_{it} = A_{it} L^{b1}_{it} K^{b2}_{it} \quad (6)$$

$$A_{it} = B_i * FDI^{b3}_{it} HK^{b4}_{it} IF^{b5}_{it} TRADE^{b6}_{it} \quad (7)$$

Substitute the technology function into the production function and then take logarithm, the function became:

$$\ln(Y_{it}) = b_{0i} + b_1 \ln(L_{it}) + b_2 \ln(K_{it}) + b_3 \ln(FDI_{it}) + b_4 \ln(HK_{it}) + b_5 \ln(IF_{it}) + b_6 \ln(TRADE_{it}) + u_{it} \quad (8)$$

In addition, we also investigate how the interaction between FDI and each initial condition variable could affect growth. For example, if the interaction term between FDI and the level of human capital is positive and statistically significant, it will indicate that the countries that have high level of human capital would receive higher benefits from FDI in encouraging the economic growth. Here we specify that the levels of human capital, investment on infrastructure, and international trade have an interaction with FDI in promoting the economic growth. The interaction terms between FDI and these variables ($\ln(HK_{it})*\ln(FDI_{it})$, $\ln(IF_{it})*\ln(FDI_{it})$, and $\ln(TRADE_{it})*\ln(FDI_{it})$ are then added in Equation 8. An inflation rate variable (Inf) which may have an effect on growth and a dummy variable (D97) used to capture the impact of financial crisis in 1997 are added in the equation. We thus obtain the final form for the estimation with Equation 9.

$$\ln(Y_t) = b_{0i} + b_1 \ln(L_{it}) + b_2 \ln(K_{it}) + b_3 \ln(FDI_{it}) + b_4 \ln(HK_{it}) + b_5 \ln(IF_{it}) + b_6 \ln(TRADE_{it}) + b_7 Inf_{it} + b_8 D97_{it} + b_9 \ln(HK_{it})*\ln(FDI_{it}) + b_{10} \ln(IF_{it})*\ln(FDI_{it}) + b_{11} \ln(TRADE_{it})*\ln(FDI_{it}) + u_{it} \quad (9)$$

where Y is denoted as country's GDP (million USD), L as labor (thousand person), K as domestic investment (million USD), FDI as foreign direct investment (million USD), HK as public expenditure on education (million USD), IF as public investment in infrastructure (million USD), TRADE as trade openness (%), and D97 as dummy variable for financial crisis which is equal to 1 for the crisis period (1997-1998), otherwise it is equal to zero. Subscript i stands for country i in each group where i = 1,…,5 for high income group, i = 1,…, 6 for middle income group, and i = 1,…, 4 in low income group. Subscript t = 1990,…, 2009 represents time period from 1990 to 2009.

Methods and Data

Panel cointegration analysis is used for observing the relationship among time series variables. This method can avoid the problem of spurious regression which may occur when using ordinary regression with non-stationary variables. The analysis comprises three steps. Firstly, doing the panel unit root test (Dickey and Fuller, 1979) to check whether the variables are stationary or non-stationary. If the variables are stationary, we can use panel regression to estimate the equation. Secondly, if the variables are non-stationary, the cointegration test will be used for testing whether the variables have a long-term relationship or not. In this study, we use cointegration test based on a single-equation Engle-Granger two-step procedure. Finally, if all variables are cointegrated or have a long-term relationship, a long-run equation can then be estimated using pooled regression model and fixed effect model. The estimation procedure is shown in Appendix Figure 1.

The scope of this study is limited to 15 economies in East Asian. The verification of the threshold effects in each economy is based on some parameters, i.e. GDP per capita, level of education expenditure, government investment, and trade openness. The analysis thus covers three income groups: (1) high income group that comprises Hong Kong, Japan, South Korea, Singapore and Taiwan, (2) middle income group that comprises China, India, Indonesia, Malaysia, Philippines and Thailand, and (3) low income group that comprises Cambodia, Lao, Myanmar and Vietnam.

The secondary data of 1990-2009 obtained from IMF and UNCTAD are used to base the analysis. Appendix Table 1 shows a summary of descriptive statistics of initial economic conditions for each group. The amount of public expenditure on education in high and middle income countries was around three percent of GDP. These were twice the value compared to that of low income countries. The level of public investment in high income countries was the highest followed by the middle income countries. The level of public investment in low income countries was two times less than that in high and middle income countries. The level of trade openness in high income countries was also the highest. The high income group seems to have the best threshold conditions in contrast to the low income group. Although the middle income group had the same level of public expenditure on education compared to high income group, the other two conditions were not better.

The main hypothesis is that FDI is an important factor affecting economic development through technology transfer and productivity increase. Therefore, a positive and statistically significant coefficient value of FDI (b_3) can be expected. The same can be expected on the

coefficient b_9 to b_{11}. If it is the case, it would imply that other economic factors can also support FDI in stimulating the economic growth. According to growth theory, the coefficient value of L (b_1) and K (b_2) should be positive and statistically significant. The coefficients of other variables, except inflation and dummy variable, should also be positive and significant.

Results

The main purpose is to estimate the effects of FDI on economic growth, and to investigate whether the countries with different initial economic conditions would obtain different effects of FDI on growth. We examine this through the observation of the interaction terms between FDI and variables of levels of human capital, investment on infrastructure, and international trade.

Firstly, we use ADF panel unit root test to check whether the variables used in this study are stationary or not. The null hypothesis of the test is that the variable is non-stationary. Considering ADF-Fisher Chi-square in Appendix Table 2, most variables, except inflation rate, are non-stationary at the level form but stationary at first difference form. Although the variables were non-stationary at level form, these variables had a long-run relationship when linear combination among these variables (the residual of the equation) was stationary. The cointegration test is then conducted to confirm a long-run relationship among FDI and some macroeconomic variables. We use panel cointegration test based on single-equation Engle-Granger two-step procedure to test whether there is a long-run relationship between FDI and other variables. The null hypothesis is that all variables in the equation are not cointegrated. Appendix Table 3 shows that FDI and macroeconomic variables were cointegrated. In other words, there was a long-run relationship among FDI and other macroeconomic factors. The growth equation can then be estimated using pool regression and panel fixed effect model. In pool regression, the intercept term of the equation is equal for all countries. The fixed effect model captures the differences among countries indicated by the constant terms. Therefore, in fixed effect model, there are differences in the intercept term of each country.

Table 1 shows the estimated results of growth model for each income group using pool regression. FDI had positive relationship with the economic growth for high and middle income groups at 10% level of significance, but not statistically significant for low income group. The interaction terms between FDI and other variables in pool regression indicate that only trade openness would support FDI in promoting the economic growth for all income groups.

Table 1 Results of pool regression analysis

Coefficients	High income group	Middle income group	Low income group
C	5.716	3.715	3.841
	(8.170)	(4.479)	(6.008)
LOG(labor)	0.143	0.152	0.027
	(3.571)	(3.693)	(0.740)
LOG(domestic investment)	0.111	0.105	0.067
	(3.373)	(4.140)	(3.118)
LOG(FDI)	0.188	0.067	0.143
	(1.869)	(1.998)	(1.297)
LOG(public expenditure on education)	0.910	0.779	0.676
	(6.440)	(3.808)	(4.703)
LOG(government investment)	0.100	0.039	0.184
	(1.729)	(2.227)	(0.871)
LOG(trade openness)	0.186	0.225	0.345
	(2.523)	(2.584)	(4.634)
Inflation rate	-0.005	-0.002	-0.001
	(-1.904)	(-2.590)	(-1.869)
Dummy 97	-0.003	-0.009	-0.004
	(-2.446)	(-2.947)	(-2.176)
LOG(FDI)*LOG(public expenditure on education)	0.001	0.017	0.040
	(1.761)	(0.756)	(1.388)
LOG(FDI)*LOG(government investment)	0.018	0.024	0.016
	(1.848)	(1.158)	(0.409)
LOG(FDI)*LOG(trade openness)	0.027	0.021	0.047
	(2.222)	(2.354)	(3.568)
Number of observations	85	90	60
Adjusted R-squared	0.65	0.65	0.65
Durbin-Watson stat	2.33	1.73	1.90

Note: Dependent variable is LOG(GDP).

However, FDI did not seem to have an impact on the GDP growth of Japan and South Korea because they had very little FDI inflows. Therefore, in the next step of analysis, Japan and South Korea were removed from the high income group. Moreover, we assume equal values of coefficients for all countries in pooled regression and fixed effect model. Therefore, when estimating the equation, the sample countries should have had similar economic conditions. In this case, China and India are thus excluded from the middle income group in pool regression as well as Vietnam from low income group. The results of pooled regression and fixed effect model without Japan, South Korea, China, India, and Vietnam are shown in Table 2.

Table 2 Results of pool regression analysis without Japan, South Korea, China, India and Vietnam

Coefficients	High income group	Middle income group	Low income group
C	5.861	1.754	3.093
	(9.560)	(0.942)	(3.395)
LOG(labor)	0.145	0.211	0.004
	(3.047)	(4.024)	(0.120)
LOG(domestic investment)	0.112	0.117	0.045
	(3.583)	(3.823)	(1.861)
LOG(FDI)	0.128	0.248	0.232
	(2.131)	(2.039)	(1.400)
LOG(public expenditure on education)	0.580	1.180	0.284
	(2.853)	(2.893)	(1.777)
LOG(government investment)	0.143	0.174	0.617
	(1.911)	(2.696)	(1.254)
LOG(trade openness)	0.178	0.382	0.275
	(2.224)	(2.948)	(3.653)
inflation rate	-0.003	-0.002	0.000
	(-2.750)	(-1.769)	(-0.433)
dummy 97	-0.002	-0.007	-0.016
	(-2.050)	(-2.510)	(-2.619)
LOG(FDI)*LOG(public expenditure on education)	0.025	0.070	0.040
	(1.965)	(1.479)	(1.220)
LOG(FDI)*LOG(government investment)	0.008	0.035	0.059
	(2.333)	(1.160)	(1.148)
LOG(FDI)*LOG(trade openness)	0.009	0.030	0.035
	(2.462)	(2.021)	(1.688)
Number of observation	51	60	45
Adjusted R-squared	0.72	0.71	0.67
Durbin-Watson stat	1.70	1.69	2.03

Note: Dependent variable is LOG(GDP).

After dropping Japan, South Korea, China, India and Vietnam, in the high income group (without Japan and South Korea), FDI had positive relationship with the economic growth at 5% level of significance. The factors (i.e. public expenditure on education, government investment, and trade openness) that may support FDI in promoting the economic growth had positive relationship with the economic growth at 5% level of significance. In the middle income group, although China and India were excluded, similar results were obtained. For the low income group, FDI did not have significant influence on economic growth. All interaction terms between FDI and other factors were not statistically significant.

Next step, we estimate our equation by using fixed effect model. In the fixed effect model, the differences among countries are indicated by the constant terms. Therefore, Japan and South Korea were still dropped while China, India and Vietnam were retained. The results of using fixed effect model are shown in Table 3. FDI had positive relationship with economic growth in the high and middle income groups but had no relationship in the low income group. In the high income group, the interaction terms between FDI and public expenditure on education, government investment, and trade openness were positive and statistically significant. In the middle income group, only interaction term with trade openness was significant. The interaction terms were not significant for all factors in low income group. This suggests that FDI would have a positive relationship with the economic growth in East Asian countries that have appropriate economic conditions. In low income countries, FDI alone cannot promote their economic growth. The insignificance of interaction term between FDI and trade openness indicates the insufficient levels of trade in low income countries which implies that low income countries cannot absorb the more benefit from FDI.

Table 3 Results of fixed effect model without Japan and South Korea

Coefficients	High income group	Middle income group	Low income group
C	5.688	3.237	5.412
	(10.312)	(7.230)	(11.096)
LOG(labor)	0.006	0.476	0.262
	(3.063)	(4.037)	(1.969)
LOG(domestic investment)	0.008	0.159	0.104
	(3.280)	(10.716)	(6.111)
LOG(FDI)	0.184	0.170	0.015
	(2.854)	(5.829)	(0.190)
LOG(public expenditure on education)	0.454	0.718	0.632
	(2.689)	(5.950)	(5.397)
LOG(government investment)	0.235	0.172	0.026
	(1.432)	(1.547)	(0.160)
LOG(trade openness)	0.231	0.543	0.132
	(2.599)	(11.524)	(2.145)
inflation rate	-0.005	-0.001	0.000
	(-4.289)	(-1.734)	(-0.880)
dummy 97	-0.012	-0.019	-0.016
	(-1.957)	(-1.917)	(-1.542)
LOG(FDI)*LOG(public expenditure on education)	0.046	0.012	0.007
	(2.170)	(0.841)	(0.264)

Table 3 (Continued)

Coefficients	High income group	Middle income group	Low income group
LOG(FDI)*LOG(government investment)	0.021	0.030	0.008
	(2.044)	(1.296)	(0.250)
LOG(FDI)*LOG(trade openness)	0.010	0.046	0.028
	(2.611)	(8.734)	(2.900)
Number of observation	85	90	60
Adjusted R-squared	0.98	0.98	0.97
Durbin-Watson stat	1.79	1.50	1.74

Note: Dependent variable is LOG(GDP).

In sum, the similar results from pooled regression and fixed effect model are obtained in the cases of high and middle income countries. High income economies had high level of economic conditions to absorb the benefit of FDI. In middle income countries, only the degree of trade openness was high enough. The low income countries did not have appropriate facilities from government investment and had low level of human capital. This limited the ability of countries to obtain more benefit from FDI. Table 1 and 3, when Vietnam is included, show a positive and significant coefficient of interaction term between FDI and trade openness while Table 2, Vietnam excluded, shows a non-significant interaction. This may imply that, in low income group, only Vietnam has enough degree of trade openness to absorb the benefits while Cambodia, Laos and Myanmar need to invest more on education and infrastructure and promote more trade in order to get a greater benefit from FDI.

Conclusion

During the past two decades, there was a major shift in the degree of FDI in East Asian countries. FDI is recognized as a tool for technology transfer that leads to the economic growth of host countries. However, the effect of FDI on economic growth depends on the host country's economic conditions. This study investigated the effect of FDI on economic growth and compares these impacts among East Asian countries. The samples of 15 countries were divided into 3 groups, i.e. high income group (Hong Kong, Japan, South Korea, Singapore, and Taiwan), middle income group (China, India, Indonesia, Malaysia, the Philippines, and Thailand), and low income group (Cambodia, Laos, Myanmar, and Vietnam). The panel cointegration analysis was applied in the endogenous growth model in order to estimate the impacts of FDI.

The results show that FDI had a positive relationship with economic growth only in high and middle income countries which have the appropriate economic factors such as a well-educated work force, investment in infrastructure, and trade openness. The results coincide with Kose *et al.* (2006) who found that appropriate economic conditions play an important role in enabling FDI to stimulate economic growth. The high income countries which population have a high level of education, government investment, and trade openness would gain more benefit than the middle income countries which have high government investment and trade openness, but not enough education level. The results did not show a positive relationship between FDI and economic growth in low income group which had inappropriate facilities for investment and low degree of trade openness and investment on education. Therefore, the low income countries have poor ability to absorb the benefit of FDI as a channel for technology transfer from developed countries to host countries.

The results confirm the hypothesis that FDI can promote economic development in countries which have the appropriate factors such as a high level of human capital, infrastructure, financial development as well as a high degree of trade openness. High income economies thus have a greater advantage in this aspect to gain greater benefits from FDI than the lower income economies. The middle and low income countries need to invest more on education and infrastructure. The low income economies, in particular, Cambodia, Laos and Myanmar, also need to develop policies that promote greater trade openness.

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Appendices

Appendix Table 1 Summary of descriptive statistics

Variables	High income		Middle income		Low income	
	1990-1997	2000-2009	1990-1997	2000-2009	1990-1997	2000-2009
GDP growth (%)	6.0	4.4	7.1	6.3	6.6	8.7
GDP per capita (billion USD)	18.7	23.0	1.5	2.0	0.2	0.4
Ratio of FDI inflow to GDP (%)	3.2	7.5	2.6	2.4	4.3	3.5
Ratio of public expenditure on education to GDP (%)	3.6	4.0	2.8	3.2	1.3	1.6
Ratio of public investment to GDP (%)	14.1	14.5	11.0	11.5	8.6	6.3
Trade openness (%)	151.3	191.3	74.1	99.4	46.5	80.7

Appendix Table 2 Results of panel unit root test (null hypothesis: non-stationary)

Variables	Level form		1st different form	
	ADF-Fisher chi-square	Prob	ADF-Fisher chi-square	Prob
GDP (million USD)	13.93	0.99	76.07**	0.00
Labor (thousand person)	37.44	0.16	52.62**	0.01
Public expenditure on education (million USD)	12.93	1.00	42.02*	0.07
Government investment (million USD)	24.99	0.73	49.93**	0.01
Trade openness (%)	25.54	0.70	93.14**	0.00
Inflation (%)	58.88**	0.00		
Domestic investment (million USD)	22.93	0.82	63.86**	0.00
FDI (million USD)	29.49	0.49	90.82**	0.00
Public expenditure on education (FDI)	37.17	0.17	56.97**	0.00
Government investment (FDI)	43.47*	0.05	68.36**	0.00
Trade openness (FDI)	30.58	0.44	108.00**	0.00

Note: * and ** indicate 90% and 95% levels of significance, respectively.

Appendix Table 3 Results of panel cointegration test (null hypothesis: not cointegrated)

ADF unit root test of residual	Pool OLS	Fixed effect
Hong Kong, Japan, Korea, Singapore, Taiwan	28.85**	50.16**
China, india, Indonesia, Malaysia, Philippines, Thailand	25.24**	25.59**
Cambodia, Laos, Myanmar, Vietnam	27.19**	32.70**

Note: * and ** indicate 90% and 95% levels of significance, respectively.

Appendix Figure 1 Estimation procedure of panel cointegration analysis