FDI and Economic Growth in Asian countries

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[Summary]

Foreign Direct Investment (FDI) has been commonly regarded as indispensable element in the economic growth of developing countries. However, in many papers, the role of FDI in economic growth has been reexamined and recently it seems to have changed from "important and indispensable" into "something that cannot be performed as long as the fundamental conditions are not fulfilled in the proper order". In this paper, we examine empirical analyses such as the Granger causality test concerning the role that FDI has played for each economy using SNA macro data.

Our result is that FDI neither necessarily contributes to economic growth nor to TFP in each country, but it rather seems to be led by growth of investment or the economic growth which has already taken place in Asia.

For both cases where SNA data by country and pooled data of all countries are used, the null hypothesis that FDI does not cause the economic growth is not rejected for the most cases, which means that FDI does not prompt economic growth, on the contrary, economic growth leads the FDI growth in reality.

1. Introduction

As is generally known, the rates of economic growth in Asian countries are considerably high although almost all economies have suffered an extreme slowdown due to the financial crisis in 1997-1998. This is sometimes regarded as the result of high investment, favorable circumstances for exports and also the result of technology transfer and an increase in employment through FDI.

In Japan, there is the tendency to consider international capital transfer such as FDI to be something that is the result of wages and other production cost considerations, and there is also a tendency to conclude that it results in the hollowing-out or restructuring of Japanese industry. In this paper, we discuss and analyze empirically how and what effects FDI exerts on economic growth in Asian countries.

According to the OECD (2001) (OECD International Forum on International

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Investment 2001), FDI is not a specific remedy but a catalyst which deeply depends on the level of infrastructure. Although FDI still has a large influence on economic growth and especially on exports, its direct effects have become the subject of reconsideration recently.

The amount of FDI depends on the country and varies largely, and while it is less than 5% in one country, it exceeds 20% of domestic investment in the other, and the relationship of FDI to a specific country is also quite different. But, in general, the more open and competitive the domestic market is, the more effective FDI becomes. However, presuming the condition of openness for developing countries is itself based on the assumption that the nation has already started to take off. Concerning these countries, it is doubtful that we can separate FDI from investment which has autonomously commenced when discussing this.

As we show later, there are various types of empirical studies. One typical example is to investigate the direct effect or causality of FDI by using multi-national panel data. An nother typical type of study is related with endogenous growth theory, in which FDI contributes to human capital and exerts an indirect effects on economic development.

If FDI is assumed to contribute to economic growth through spillover effects such as technology transfer and other indirect factors, then changes in TFP should be regarded as an important factor. In this paper, we also examined how FDI contributes to TFP.

2. Characteristics of Existing Studies and Framework of Analysis

2.1 Simple Significance Test

Ram and Zhang (2002) tested the significance of the explanatory variables through a t-test of the parameters of a linear model, and not through a causality test. They state that FDI prompts economic growth in general by (a) increasing domestic investment or savings, (b) transferring technology from developed countries, (c) promoting competitive conditions of the domestic market, (d) increasing the export and foreign reserves, and (e) implementing an external economy in the nation.

The model starts from the production function.

$$y=f(L, K, FDI)$$

$$gy=b_0+b_1gL+b_2gK+b_3gFDI+u$$

Data are used from the years 1990-1997 including 140 countries (effective 85 countries). g denotes the average rate of change in each variable and satisfies the following relation.

$$X_t = X_0 \exp(gt)$$

However, because capital stock data are not available in many countries, in this paper the parameters of marginal product of investment by using I/Y in place of the elasticity of K.

$$K \approx \alpha\left(\frac{I}{Y}\right)$$

Adding to this basic model, a lot of detailed variations which use "level of education", ratio of FDI to GDP, and rate of FDI change are examined. However, because most data are converted into dollar basis once, "distortion" caused by the exchange rate in addition to the domestic factor cannot be excluded.

The estimation method is simple OLS, and neither the fixed effect nor random effect related to the constant term are taken into account. However, as the data variance for each country is normalized, heteroscedasticity of the error term can be ignored. Though FDI dose not seem to be necessary significant regarding the t-value of the parameter b_3, the authors argue that FDI has a positive effect on economic growth in general, and another hypothesis concerning the complementary effect between the level of education and FDI is rejected.

2.2 Application of Granger Causality

Lutz (2004) analyzes the Granger causality between FDI, exports and economic growth in the Moroccan economy. The Null hypothesis assuming FDI does not Granger-cause economic growth was strongly rejected. The test was carried out by using real GDP growth rate and the ratio between nominal FDI and GDP. The paper also shows that the reverse assumption that economic growth does not cause an increase in FDI is not rejected. This may be a typical conclusion under the analysis which uses macro time series data.

The model is a simple one as follows.

$$y_t = \beta_0 + \sum_{i=1}^{M} \beta_i y_{t-1} + \sum_{j=1}^{N} \beta_j x_{t-j} + \varepsilon_t$$

The unit root test for each variable was carried out by using an ADF test with trend data.

$$\Delta x_t = \rho_0 + \rho_1 x_{t-1} + \rho_2 \,\mathrm{Trend} + \sum_{i=1}^{n} \Delta x_{t-i} + \varepsilon_t$$

Here, if $\rho_1 < 0$ and is significant, the null hypothesis that each variable is non-stationary is

rejected.

Choe (2003) examined the effect of FDI and domestic investment on economic growth by using pooled panel data, in which 80 countries were involved, including OECD countries. The results are quite the opposite of the above.

The model is as follows, the estimation method is GLS, and the sample range is 1971-1995.

$$(y_{it}-y_{it-1})=\sum_{j=1}^{p}\beta_j(y_{it-j}-y_{it-j-1})+\sum_{j=1}^{p}\delta_j(x_{it-j}-x_{it-j-1})+(\nu_{it}-\nu_{it-1})$$

$$t=p+2,\ \ldots,\ T$$

The Null hypothesis to be examined here is $\delta_1=\delta_2=\ldots\delta_p=0$.

The χ^2 test for the significance of causality is carried out by taking the difference of the squared sum of the residuals between with and without constraint.

According to the estimated results, Granger causality was detected to be weak either for FDI on economic growth or reversely for economic growth on FDI. However, as for developed countries like OECD and cases excluding several countries, the effect on economic growth of FDI is not significant. In this paper, the author stresses that FDI does not Granger cause economic growth, on the contrary, economic growth itself prompts and leads to FDI.

Nair-Reichert and Weinhold (2001) introduced the Mixed Fixed and Random Effect Model to analyze the relationship between FDI and economic growth, and also the relation between economic growth and the level of education, and openness of the domestic market, in which they use the macro data for 24 developing countries for over 25 years from 1971.

The basic model is same as for Choe's study, but is greatly enhanced. The fixed effect is considered to treat the variance of the error term properly and new explanatory variables are added.

$$y_{it}=\alpha_i+\gamma_i y_{it-1}+\beta_{1i}x^{o}_{1it-1}+\beta_2 x_{2it-1}+\varepsilon_{it}$$

$$\text{where,}\quad \beta_{1i}=\bar{\beta}_1+\eta_i$$

Here, x^{o}_{1it-1} is the orthogonal factor, which is independent from other explanatory variables such as openness of the market. This model includes both the fixed effect related to the constant term α_1 and random effect for the parameter β_1, and is sometimes called the Mixed Fixed and Random Effect Model (MFR Model) (see Weinhold (1996)).

Similar to conventional studies, this paper also reports that FDI causes economic growth in most cases, however, due to incompatibly with the explanations, the estimated

results are not very decisive in reality when compared to the fact that domestic investment definitely causes economic growth. They argue that FDI is effective and works properly if the external conditions such as level of education and openness of the market are adequate.

2.3 TFP, FDI and Economic Growth

Bende-Nabende et al. (2001) analyzes the role FDI plays in economic growth in five ASEAN countries. In this paper, we mainly aim to analyze the inducing effect of FDI in the ASEAN Preferential Trade Agreement (APTA) area. Beside this, we implement a clear analysis of the relationship of economic growth and FDI. In conclusion, FDI is assumed to contribute to economic growth through various types of spillover. In particular, the effect of human factors and technology are stressed.

In the model, the main variables such as FDI, HC (Human Capital, i.e., secondary education ratio), labor force (LF), degree of trade dependences (IT), LD (Learning by Doing, ratio of value added to GDP in manufacturing industries) are regressed by FDI/GDP.

These main variables are treated as a simultaneous system, and estimated by country by using 3SLS. The sample period is 1970-1996, which are stable years before the financial crisis in 1997.

$$gY=\alpha_0+\alpha_1 FDI+\alpha_2 HC+\alpha_3 LF+\alpha_4 TT+\alpha_5 IT+\alpha_6 LD+\varepsilon$$

Each variable is normalized and denoted in terms of ratio or growth rate. The variables on the right hand side are added to another equation, so they appear in simultaneous equations. Each variable is tested with the Walt test to be added or deleted in the equation.

The contribution of FDI to economic growth is not widely found, and decisive results are not necessarily obtained. Moreover, the elasticity of FDI to growth is also extremely low. A significant estimation cannot be done in Singapore and Thailand. The direct effect of HC on economic growth is not significantly estimated.

Whereas openness of the market, that is, the ratio of exports and imports to GDP, $(E+M)$/GDP, is counted as the most important variable to determine FDI in general. For Indonesia, the Philippines and Singapore, the results are not necessarily valid because the parameter has a significant negative value.

Next, we show a study regarding UK as the recipient country of FDI. Driffield et al. (2002) analyzes how to cause the spillover effect of FDI for a British industry by

using the UK Census of Production data (70 industries for years 1983-1992). A basic framework of the model is used to estimate the growth rate of output (Q) of the enterprise, and to define the effectiveness of FDI as a TFP other than capital and labor. TFP growth is regarded as a spillover effect here.

$$\ln Q_{it}=a+\beta_1 \ln (L_{it})+\beta_2(K_{it})+\sum_{k=1}^{M}\alpha_k X_{it}+u_{it}$$

where, $u_{it}=\alpha_i+\bar{\omega}_t+\theta_{it}$.

The estimation method is GMM, allowing for fixed and random effect in error terms. Here, X_i is an exerting factor on spillover such as FDI. In this model, there are four categories of FDI ; (1) foreign affiliated enterprises that sell parts and materials to British enterprises, which are called "forward intensity type", (2) foreign affiliated enterprises that procure parts and materials from British enterprises, which are called "backward intensity type". In addition to this classification, trading partners are also divided into two categories for each type, that is, inter trade type which conduct trading with different industries and intra trade type which conduct trading within same industry.

They conclude that the spillover effect is larger for backward intensity type, but for forward intensity type in which foreign affiliated enterprises are functioning as suppliers, the spillover effect is not realized.

This paper stresses that FDI may cause growth of output through the spillover effect, but not through direct channels.

Fan and Dickie (2000) examined the causality of FDI on economic growth and TFP for five ASEAN countries after the financial crisis in 1997 using the conventional framework of TFP.

TFP is defined as follows :

$$TFP=gy-\varepsilon_K gK-\varepsilon_L gL$$

Here, g denotes the growth rate.

ε_K, ε_L are the elasticity of capital stock and labor respectively.

The authors use the translog function to evaluate ε_K, ε_L as follows.

$$\ln Y=\alpha \ln K+\beta \ln L+1/2\beta_{KK}(\ln K)^2+1/2\beta_{LL}(\ln L)^2+\beta_{KL}\ln K \ln L$$

However, as second order terms are not significant : $\beta_{KK}=\beta_{LL}=\beta_{KL}=0$, then the equations used in reality are altered to a rather simple formulation.

$$\ln y_t-\ln y_{t-1}=\alpha(\ln K_t-\ln K_{t-1})+\beta(\ln L_t-\ln L_{t-1})+\sum_{j=1}^{4}d_j Dummy_{country j}$$

The contribution of FDI to economic growth is assumed to be in a range between 4.4% (Indonesia) to 20.9% (Singapore), judging from the ratio of FDI to capital stock.

However, there is a problem with this estimation. The influence of FDI is necessarily positive if capital stock contributes to growth, because the effect of FDI is counted as a fixed part of the total effect of capital stock.

Next, we show an example from Chamarbagwara (2000) which analyzes the contribution of FDI on economic growth according to the level of TFP. This paper involves 7 countries ; one group consists of higher income countries such as Hong Kong, Korea and Singapore, the other group consists of lower income countries such as Indonesia, Malaysia, the Philippines and India. In this model, domestic investment and FDI are separately treated and set in the production function.

The model is as follows :

$$\ln\left(\frac{y}{L}\right)_{it}=\sum_{i=1}^{2}\gamma_i d_i+\alpha_i\sum_{i=1}^{2}d_i\ln\left(\frac{KD}{L}\right)_{it}+\beta_i\sum_{i=1}^{2}d_i\ln\left(\frac{KF}{L}\right)_{it}$$

Here, d_i denotes the area group dummy, 1 the higher income group, 2 the lower income group. The constant term denotes TFP. TFP is estimated to be 0.51 for group 1 and 0.32 for group 2. This means the higher the income level is, the greater TFP the country shows and the spillover effect differs according to the level of income.

How different is the role of capital on economic growth in the first group and the second group ? The following test is carried out :

$$H_0:\alpha_1-\alpha_2=0 \text{ and } \beta_1-\beta_2=0, \text{ and test statistics are } t_\alpha=\frac{(\hat{\alpha}1-\hat{\alpha}2)}{SE(\hat{\alpha}1-\hat{\alpha}2)}$$

The paper concludes that the parameters are significantly different and if TFP is high, the contribution of FDI on economic growth is also expected to be high. From these analyses, they stress the importance or necessity of infrastructures to provide a high standard of education and the transfer of technology.

3. Outline of Economic Growth and FDI in Asia

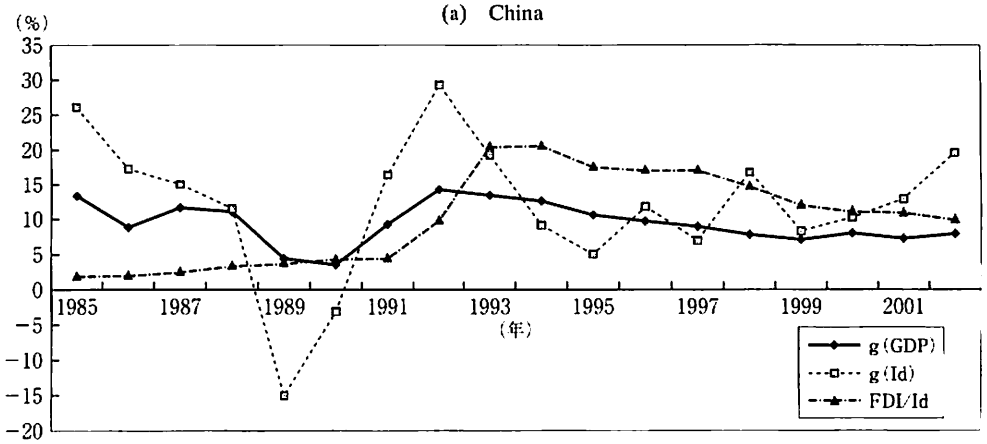
First, we review the circumstances of FDI, the ratio of FDI to domestic investment and its changing rate in advance to evaluate the role of FDI in Asian countries.

China has continued to grow by almost 10% annually since the decline in 1990. This is mainly due to the rapid growth of investment and exports, and changes in FDI follow the preceding changes in domestic investment after a delay of one year.

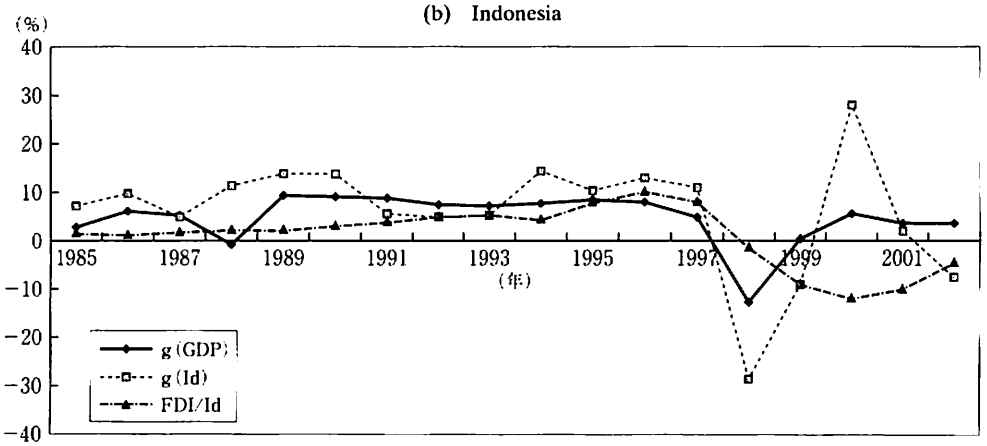
Recently, the ratio of domestic FDI has decreased to about 10%. However, it remained at a high level of 15% after the 1990's on average. Recently, investment from Japan and South Korea has increased rapidly, while direct investment from the United

Figure 3.1 Economic Growth and Change in Investment (Some countries are omitted)

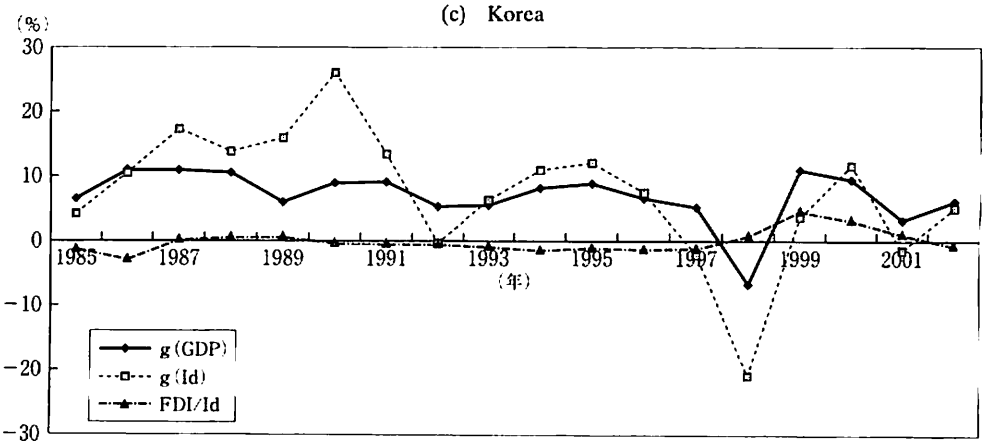
(a) China



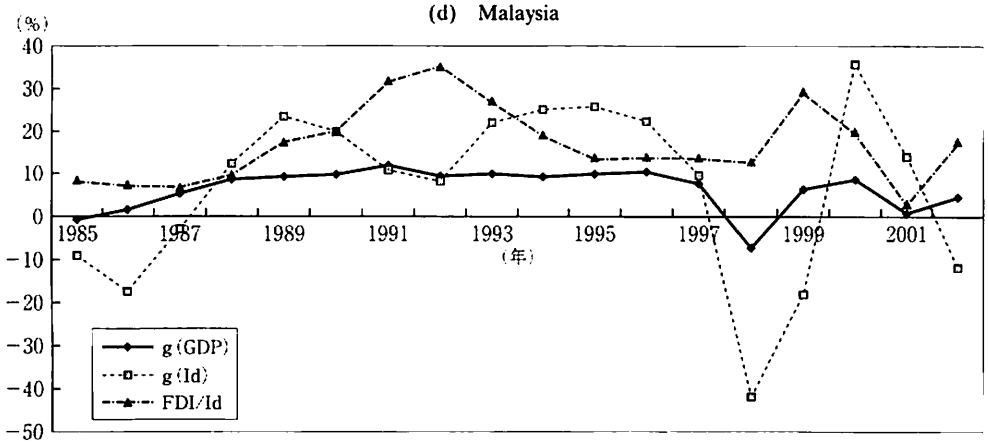
(b) Indonesia



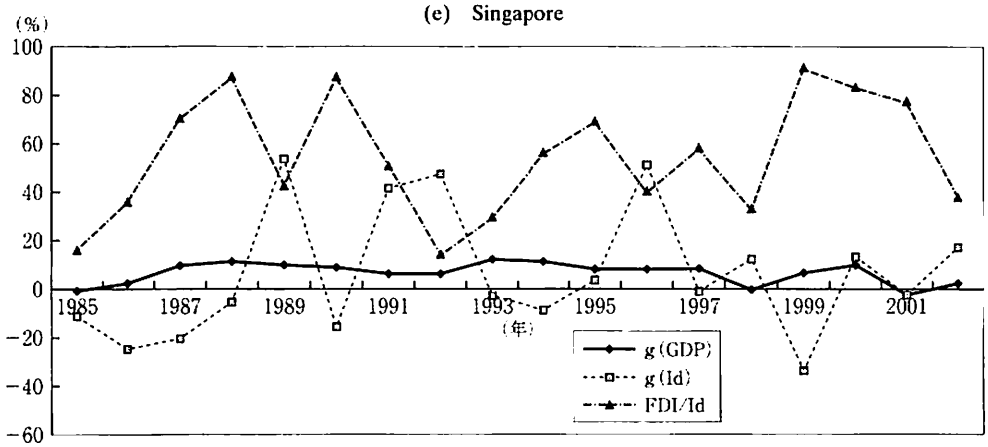
(c) Korea



(d) Malaysia



(e) Singapore



(f) Thailand

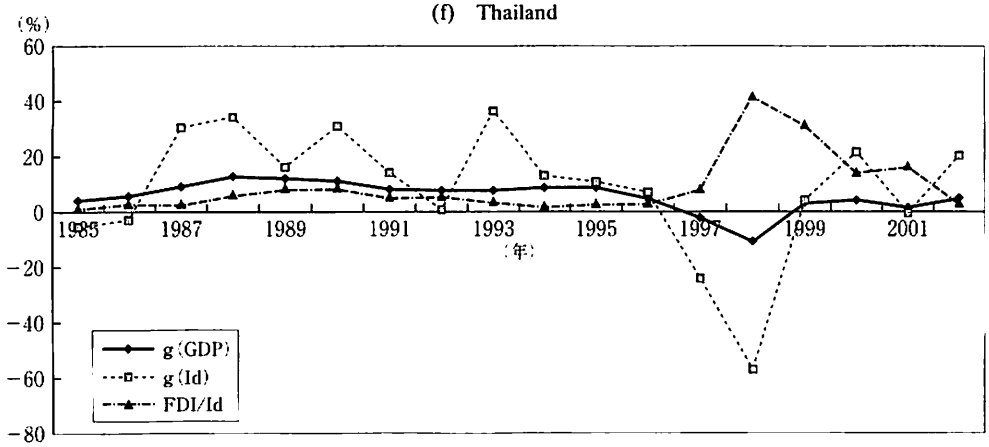


Fig. 3.1 GDP Growth and Change in Investment

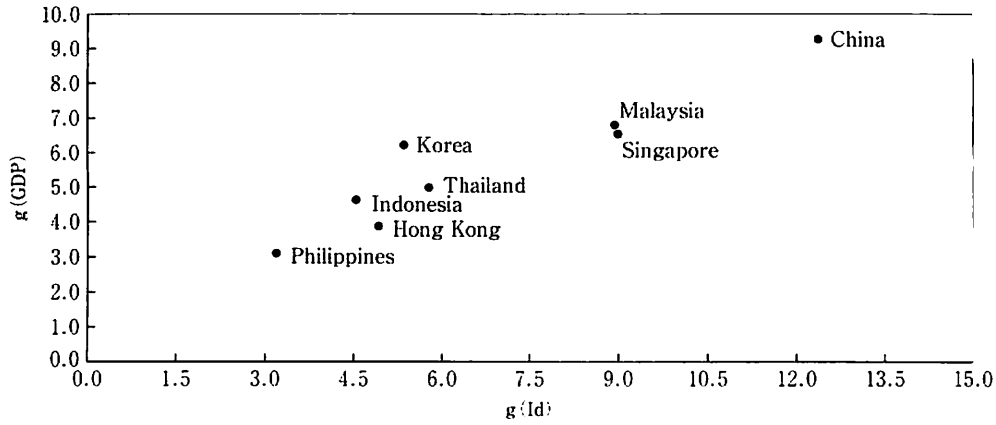
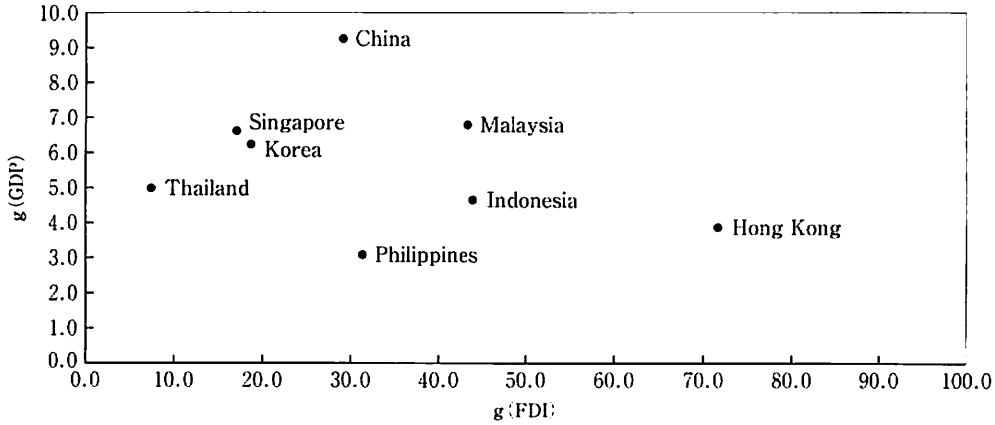


Fig. 3.2 GDP Growth and Change in FDI



States and Taiwan has decreased a little.

The main content of investment is in the electronic industry, and in recent years, a car related businesses. It should be noted that in recent years the amount of investment aimed at selling products in the Chinese domestic market is rapidly increasing, and export oriented foreign investment is decreasing.

Capital flow to China from Taiwan and several other countries is carried through third countries, making the international structure of capital flow uncertain, and harder to understand.

Moreover, it should be noted that Japanese companies may invest in China in cooperation with, for instance, a business in Taiwan. These triangular relationships can take place frequently. This, of course, exceeds the simple bilateral framework between two countries. Taiwan may be the site for research and development, whereas China

Fig. 3.3 GDP Growth and TFP

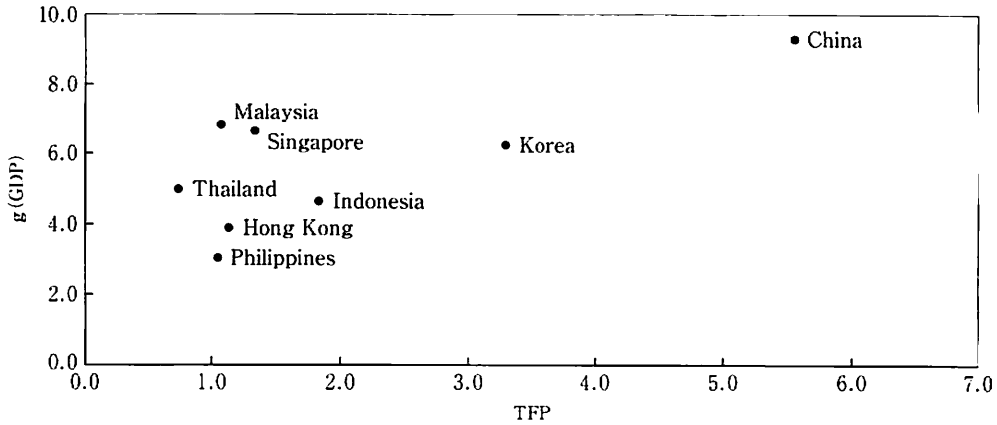
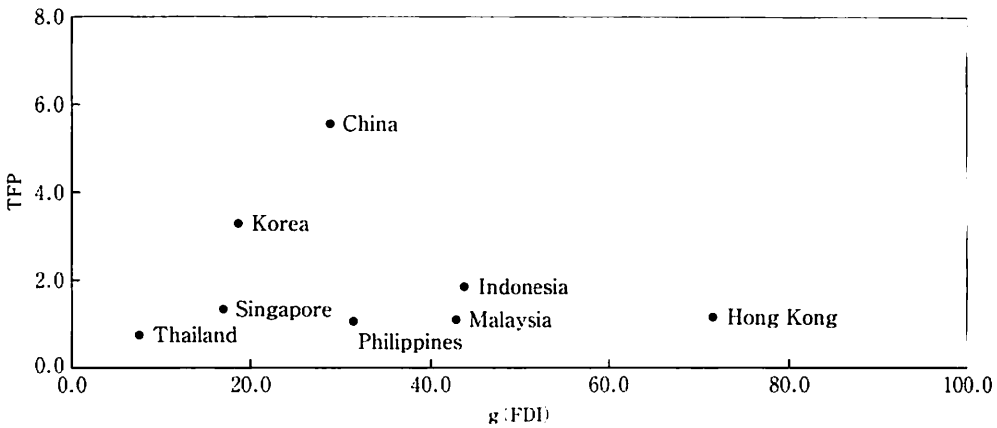


Fig. 3.4 TFP and Change in FDI



may be the site of a factory which utilizes the cheap labor costs. Thus, investment from abroad reflects a functional division and cooperation of several investing countries.

Korea received an IMF credit and emergency funding due to the financial crisis in 1997. That was a rare case among major nations. During 4 years under the control of IMF, Korea had a great capital inflow, but basically Korea was a net capital exporting country. The characteristic of this period is that Korea financed and compensate for the decline in domestic investment by capital inflows from abroad.

The investment in electronic equipment by China increased especially rapidly after 1998. The net inflow of FDI in Korea is not necessarily large compared to the GDP. However, a major portion of the investments were FDI from Japan, and it's major industry was electronic devices and mechanical parts until the early 90's.

Recently, Japan has shifted the main thrust of investment to China, and conversely,

capital inflow into Korea from Japan is decreasing. However, the Korean tendency to have considerable debt to imports can be partly deemed to be strengthened by Japanese FDI.

After the 1990's, Hong Kong had a positive flow of foreign capital. This trend has slowed down greatly in recent years. The capitals of the real estate industry, commerce, and financial operations, etc. account for 60% or more of the net inflow of foreign capital. This aspect is quite different from other countries. FDI in Hong Kong fluctuates over a wide range because it reflects the short-term capital flow among financial companies.

On the other hand, Singapore is peculiar among NIES countries. The ratio of FDI to domestic investment is extremely large compared to other countries. As the size of the economy is small, individual FDI varies and exerts a considerable effect on the fluctuation of data. Changes in FDI are synchronized reversely with the change in domestic investment and compensates for the lack of domestic capital.

The complementary position of FDI which covers a decrease in domestic investment is commonly observed in many countries such as Malaysia, the Philippines, and Thailand as well as Korea and Singapore. Indonesia shows slightly different aspects, and it has not yet recovered from the damage during the crisis of 1997, since there has been an outflow of capital for several years after the crisis.

Figure 3.2, 3.3 show that GDP and investment or TFP have a high correlation, but as for FDI, a decisive correlation has not been observed.

4. The Model

The effect of FDI on economic growth appears through capital accumulation. As many preceding researchers have pointed out, indirect effect or spillover effect such as the level of education and technology transfer are regarded to be substantial.

Here, we investigate the relation between economic growth and FDI under the assumption that economic growth can be attained through TFP.

(1) Definition of TFP

First, regarding TFP, we assume a linear homogeneous production function such as the Cobb Douglas production function.

$$y=(K, L),$$

TFP is defined as the residual growth rate attributed to each factor such as capital and

labor.

$$TFP=gy-\varepsilon_K gK-\varepsilon_L gL$$

Where g denotes the growth rate of each variable.

ε_K, ε_L are the elasticity of capital and labor respectively. From the constraints of linear homogeneity of the production function, the sum of elasticity is $\varepsilon_K+\varepsilon_L=1$, and each elasticity is equal to the relative share of labor and the capital.

(2) Granger Causality

The Causality test which is conventionally used is called the Granger causality test. It tests the explanatory power of additional exogenous variables. Here, several versions, that is, difference or logarithm, 1 st or 2 nd order difference were tested.

The Granger causality test is usually formulated as follows :

$$(y_{it}-y_{it-1})=\sum_{j=1}^{p}\beta_j(y_{it-j}-y_{it-j-1})+\sum_{j=1}^{p}\delta_j(x_{it-j}-x_{it-j-1})+(\nu_{it}-\nu_{it-1})$$

The null hypothesis that should be examined here is as follows :

$$H:\ \delta_1=\delta_2=\ldots\delta_p=0$$

If the joint hypothesis is rejected, causality from x to y cannot be rejected.

(3) Growth Accounting and Technological Progress

Considering TFP, we adopted the following formulation. Here, the growth rate of capital is defined as the ratio (Domestic investment+FDI)/K.

$$gy_t=\alpha+\beta_1\left(\frac{I_{Dt}}{K_t}\right)+\beta_2\left(\frac{I_{Ft}}{K_t}\right)\beta_3 gL_t+\beta_4 TFP_t+\varepsilon_t$$

We assume that TFP follows the AR process shown in the formulation of Favero (2001). The paper insists that technological changes are discontinuous, somehow fortuitous innovations that are assumed to take the AR process which is not decided endogenously but occasionally generated from random processes.

This kind of specification of TFP is like an explicit consideration of error terms. Conventionally shocks are absorbed in the error term and not specified explicitly. But in this model, we extract the major "error terms" caused by technology progress from the conventional error term. This requires estimation by a simultaneous equation system. The equation to be added to the growth accounting equation is as follows :

$$\ln(TFP_{t+1})=(1-\rho)\ln(TFP_{mean})+\rho\ln(\mathrm{TFP}_t)+\eta_t$$

where, $0<\rho<1$,

I_D denotes real domestic investment

I_F denotes real FDI(national currency base)

L denotes employment

TFP is defined above.

5. Estimated Results

(1) Granger Causality by Country

Table 5.1 shows the result of the Granger causality test. The null hypothesis is as follows :

Sample period is 1980-2002.

H_0 : GDP growth does not Granger cause FDI growth

H_0 : FDI growth does not Granger cause GDP growth

H_0 : TFP change does not Granger cause FDI growth

H_0 : FDI growth does not Granger cause TFP change

Table 5.1 Granger Causality

Country	GDP→FDI	FDI→GDP	TFP→FDI	FDI→TFP
China	3.99 [0.039]	0.208 [0.815]	2.736 [0.099]	0.143 [0.868]
Hong Kong	7.63 [0.005]	0.988 [0.394]	2.415 [0.121]	0.247 [0.784]
Indonesia	1.776 [0.201]	1.290 [0.302]	3.002 [0.095]	2.576 [0.125]
Korea	8.074 [0.004]	0.189 [0.829]	1.014 [0.386]	0.971 [0.401]
Malaysia	2.811 [0.089]	0.652 [0.534]	1.707 [0.215]	0.809 [0.464]
Philippines	0.222 [0.222]	0.994 [0.392]	0.347 [0.715]	1.489 [0.272]
Singapore	1.667 [0.219]	1.173 [0.335]	0.640 [0.541]	3.193 [0.069]
Thailand	5.951 [0.011]	1.480 [0.257]	6.260 [0.012]	5.201 [0.022]

Note : Upper line is Walt statistics (χ^2)
Lower line in [ ] is its P-value
Length of time lag is 2

The null hypothesis that economic growth does not cause FDI growth is rejected in many countries except the Philippines and Singapore. This allows the possibility that economic growth necessarily promotes FDI. On the contrary, the hypothesis that FDI

does not cause economic growth is not rejected for every country. From this, we conclude that economic growth is the main engine that prompts FDI, and the reverse cannot also be true.

Next, we examined the causality of TFP and FDI. The null hypothesis that TFP does not Granger cause FDI growth is rejected for China and Thailand, but not rejected for many other countries. Furthermore, the null hypothesis that FDI does not Granger cause TFP is not rejected except for Thailand.

As a consequence, TFP growth seems not to be caused by FDI directly, but is caused by an improvement in infrastructure. In addition, a well developed infrastructure tends to induce FDI by itself.

(2) Tests Using Pooled Data

When data are pooled, how do these results change ? We examined the causality test using data for 8 countries.

The estimation method used here is GLS with fixed effects. Table 5.3 shows the results.

The threshold level for the rejection of test statistics is 5.991. The null hypothesis that FDI growth does not Granger-cause economic growth is not rejected. In other words, it does not contradict the previous conclusion that economic growth causes FDI and FDI does not prompt economic growth explicitly.

(3) Direct Estimation of Growth Accounting with TFP

In the following section, we investigate the effect of FDI directly from the framework of growth accounting accompanied by innovations. Here, we cite the equations again

$$\begin{cases} gy_t=\alpha+\beta_1 gK_t+\beta_2 gL_t+\beta_3 TFP_t+\varepsilon_t \\ \quad =\alpha+\beta_{11}\left(\dfrac{I_{domt}}{K_t}\right)+\beta_{12}\left(\dfrac{FDI_t}{K_t}\right)+\beta_2 gL_t+\beta_3 TFP_t+\varepsilon_t \\ \ln\,(TFP_{t+1})=(1-\rho)\ln\,(TFP_{mean})+\rho\ln\,(TFP_t)+\eta_t \end{cases}$$

Where g denotes the rate of change.

One of the points we directed our attention to was the test if β_{12} is significant and if $\rho=1$, which denotes that technological progress is assumed to be under the random walk process, and if so, technological progress is independent from FDI.

According to the Table 5.4 above, multicollinearity is detected between domestic

Table 5.2 Sample Results Using Pooled Data 1992-2002 (N=88)

Dependent Variable : ?GDPG-?GDPG(−1)
Method : Pooled EGLS (Cross-section weights)
Sample : 1992 2002
Included observations : 11
Cross-sections included : 8
Total pool (balanced) observations : 88
Linear estimation after one-step weighting matrix
Cross-section weights (PCSE) standard errors & covariance (d.f.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	−0.458301	0.43485	−1.053928	0.2953
?GDPG(−1)-?GDPG(−2)	−0.408322	0.115646	−3.530805	0.0007
?GDPG(−2)-?GDPG(−3)	−0.462024	0.116425	−3.968418	0.0002
?GDPG(−3)-?GDPG(−4)	−0.060881	0.116655	−0.521894	0.6033
?FDIG(−1)-?FDIG(−2)	0.001249	0.003098	0.40315	0.688
?FDIG(−2)-?FDIG(−3)	−0.00289	0.003711	−0.778736	0.4386
?FDIG(−3)-?FDIG(−4)	−0.000212	0.003157	−0.067215	0.9466
Fixed Effects (Cross)				
CH_—C	0.606758			
HK_—C	0.451043			
ML_—C	−0.651429			
PH_—C	0.838242			
SG_—C	−0.405245			
TH_—C	−0.58077			
KR_—C	0.1044			
IN_—C	−0.362998			

Weighted Statistics

R-squared	0.308496	Mean dependent var	−0.196476
Adjusted R-squared	0.187016	S. D. dependent var	5.519551
S. E. of regression	4.979308	Sum squared resid	1834.719
F-statistic	2.539472	Durbin-Watson stat	2.1926
Prob (F-statistic)	0.006067		

Table 5.3 Walt Statistic Using Panel Data

Period	Dependent variable	Walt statistic
1985-2002	$y_t - y_{t-1}$	2.06
	$\ln y_t - \ln y_{t-1}$	2.34
1985-1996	$y_t - y_{t-1}$	4.58
	$\ln y_t - \ln y_{t-1}$	1.34

(Note) $\chi^2_{0.05}$ (DF=2)

investment and FDI and the estimated parameters are slightly unstable. On the other hand, there is a high correlation between TFP and economic growth.

Test statistics for β_{12} are cited in the right hand side column. The null hypothesis is

Table 5.4 Direct Estimation of Growth Accounting

Country	I_D/K	I_F/K	$\dot{L}$	TFP	ρ	Walt
China	10.98 (1.03)	83.6 (3.79)	2.02 (3.93)	0.864 (40.7)	0.625 (3.28)	14.3 (0.00)
Hong Kong	4.93 (1.93)	0.451 (0.476)	0.823 (14.2)	0.915 (67.8)	0.421 (3.08)	6.23 (0.63)
Indonesia	−15.4 (−0.804)	93.9 (2.49)	0.825 (5.17)	1.06 (11.9)	0.206 (0.219)	6.20 (0.01)
Korea	19.0 (1.19)	51.7 (0.606)	0.868 (12.0)	0.896 (11.9)	0.665 (4.72)	0.368 (0.54)
Malaysia	19.1 (1.59)	53.1 (2.21)	1.59 (10.6)	0.663 (5.40)	0.205 (1.53)	4.87 (0.03)
Philippines	3.27 (1.67)	8.38 (0.89)	0.956 (74.9)	1.01 (191.7)	0.683 (4.72)	0.787 (0.37)
Singapore	76.8 (7.48)	6.43 (0.164)	0.905 (2.70)	0.704 (9.17)	0.665 (4.58)	0.027 (0.87)
Thailand	20.7 (14.0)	−88.9 (−2.50)	1.14 (5.19)	0.826 (7.36)	0.264 (3.12)	— —

Note : The figures in parenthesis are t-values except for the right-hand parenthesis, which denotes the P value of Walt statistics.

rejected for Indonesia and Malaysia, and it is accepted for other countries. As a whole, we can conclude that FDI does not contribute greatly to economic growth as a direct prompting element.

Moreover, the coefficient of TFP growth is estimated to be extremely stable, and hypothesis $\beta_3=0$ is completely rejected and ρ is clearly $\rho\neq 1$.

6. Conclusion

In this paper, we propose an empirical study of how FDI exerts an effective contribution to developing economies. In conclusion, FDI does not Granger-cause either economic growth or TFP. On the contrary, FDI seems to be induced or pulled by economic development which has already started to take off in Asian countries.

In many cases, the null hypothesis that FDI growth does not cause economic growth is not rejected when analyzing it from the both the case of pooled data and classified country data, and it is also true for the case when separating the effects of TFP explicitly. Stated concisely, economic growth causes FDI, but FDI does not prompt economic growth explicitly.

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Appendix

Tables of Basic Statistics

China	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	3.8	−3.3	3.0	2.3	0.1	1.0	4.2
1991	9.3	16.2	29.5	1.8	6.4	1.2	4.7
1992	14.2	29.1	165.5	1.4	11.2	2.7	9.6
1993	13.5	18.9	150.5	1.0	10.1	6.0	20.3
1994	12.6	8.8	10.4	1.1	8.2	5.9	20.6
1995	10.5	4.9	−10.5	1.2	6.4	4.7	17.6
1996	9.6	11.7	8.4	1.0	5.9	4.7	17.1
1997	8.8	6.9	7.9	1.1	4.8	4.7	17.2
1998	7.8	16.7	−1.0	0.9	3.7	4.3	14.6
1999	7.1	7.9	−11.1	1.0	3.3	3.6	12.0
2000	8.0	10.4	−2.0	0.8	4.1	3.2	10.7
2001	7.3	12.5	13.1	1.2	3.6	3.4	10.7
2002	8.0	19.4	11.3	1.3	4.2	3.5	10.0

Hong Kong	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	3.4	8.1	16.2	−1.1	2.7	2.1	8.6
1991	5.1	9.3	−70.7	1.2	2.7	0.6	2.3
1992	6.1	9.2	244.2	−0.2	4.7	1.9	7.3
1993	5.7	3.7	−26.5	2.4	2.3	1.3	5.2
1994	6.0	15.7	13.1	3.7	1.8	1.4	5.1
1995	3.9	10.7	6.5	0.7	1.1	1.5	4.9
1996	4.5	10.8	589.3	2.4	0.2	9.6	30.2
1997	4.2	12.7	−5.6	4.5	−1.6	8.7	25.3
1998	−5.0	−7.6	7.6	0.0	−7.1	9.9	29.5
1999	3.4	−17.5	64.3	−0.6	2.7	15.7	58.6
2000	10.2	11.0	162.4	2.7	6.8	37.4	138.6
2001	0.6	2.9	−61.6	1.9	−2.8	14.3	51.8
2002	2.3	−4.4	−5.3	−0.8	1.2	13.2	51.3

Indonesia	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	9.0	13.7	54.1	3.0	5.7	0.8	3.1
1991	8.9	5.5	40.7	0.8	7.1	1.1	4.1
1992	7.2	4.3	21.3	2.9	3.4	1.2	4.7
1993	7.3	5.4	12.8	−1.9	6.0	1.3	5.1
1994	7.5	14.3	1.9	3.6	1.9	1.2	4.5
1995	8.2	10.1	99.4	−2.3	6.6	2.2	8.2
1996	7.8	12.5	39.3	4.7	1.1	2.9	10.1
1997	4.7	10.4	−9.7	1.8	0.6	2.5	8.3
1998	−13.0	−29.1	−113.3	2.7	−15.2	−0.4	−1.6
1999	0.3	−9.4	433.8	1.8	−0.9	−2.0	−9.2
2000	5.3	27.8	65.8	0.3	5.2	−3.2	−11.9
2001	3.3	1.6	−16.3	2.4	1.4	−2.6	−9.8
2002	3.6	−7.9	−58.5	3.3	1.0	−1.0	−4.4

Korea	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	9.0	25.9	−147.6	3.0	5.2	−0.1	−0.3
1991	9.2	13.3	8.7	3.1	5.2	−0.1	−0.3
1992	5.4	−0.7	39.3	1.9	2.3	−0.1	−0.4
1993	5.5	6.3	70.4	1.2	3.1	−0.2	−0.6
1994	8.2	10.7	111.0	3.2	4.1	−0.4	−1.1
1995	8.9	11.9	−3.0	2.9	4.5	−0.4	−1.0
1996	6.7	7.3	33.0	2.1	2.7	−0.5	−1.2
1997	5.0	−2.2	−23.1	1.7	1.5	−0.3	−1.0
1998	−6.7	−21.2	−158.0	−6.0	−2.7	0.2	0.7
1999	10.9	3.7	563.7	1.8	9.2	1.2	4.5
2000	9.3	11.4	−19.9	4.3	4.6	0.9	3.3
2001	3.1	−1.8	−71.2	2.0	0.2	0.3	1.0
2002	6.3	4.8	−160.2	2.8	3.0	−0.1	−0.6

Malaysia	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	9.6	19.3	37.5	4.6	2.0	5.4	19.8
1991	11.9	10.4	75.8	3.1	4.6	8.5	31.5
1992	8.9	7.6	18.6	3.0	2.5	9.2	34.7
1993	9.9	21.7	−5.2	4.2	2.0	8.0	27.0
1994	9.2	25.1	−12.6	2.8	1.8	6.4	18.9
1995	9.8	25.3	−8.5	4.1	0.8	5.3	13.8
1996	10.0	22.0	18.8	3.1	2.1	5.7	13.4
1997	7.3	9.1	9.6	5.0	−2.4	5.8	13.5
1998	−7.4	−42.5	−46.4	0.4	−6.9	3.4	12.6
1999	6.1	−18.4	88.0	2.8	6.7	6.0	29.0
2000	8.3	35.6	−8.4	5.4	3.4	5.1	19.6
2001	0.4	13.4	−85.0	2.3	−3.0	0.8	2.6
2002	4.2	−12.2	478.3	3.5	0.5	4.2	17.1

Philippines	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	3.0	16.4	−5.6	1.4	1.5	1.2	5.6
1991	−0.6	−14.8	−3.9	3.2	−3.7	1.2	6.4
1992	0.3	10.8	−63.4	3.4	−3.0	0.4	2.1
1993	2.1	0.4	406.2	2.9	−0.7	2.1	10.6
1994	4.4	6.4	17.9	2.7	1.7	2.4	11.7
1995	4.7	6.5	−10.5	2.5	2.1	2.1	9.9
1996	5.8	13.4	−2.5	2.0	3.8	1.9	8.5
1997	5.2	13.6	−13.3	0.6	4.3	1.6	6.5
1998	−0.6	−21.1	142.5	0.3	−1.0	3.8	19.9
1999	3.4	3.0	−28.9	1.3	2.0	2.6	13.7
2000	4.4	7.2	−26.4	2.1	2.3	1.9	9.4
2001	3.2	−1.5	−10.6	1.8	1.4	1.6	8.6
2002	4.6	1.5	8.9	1.5	2.9	1.7	9.2

Singapore	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	9.0	−16.4	73.4	9.7	1.7	14.0	87.9
1991	6.8	41.4	−18.5	1.9	2.9	10.7	50.6
1992	6.7	47.4	−58.6	1.8	2.3	4.2	14.2
1993	12.3	−3.1	104.5	1.1	7.7	7.6	30.0
1994	11.4	−8.8	71.1	3.4	5.2	11.6	56.3
1995	8.0	3.2	27.2	3.3	1.1	13.7	69.4
1996	8.1	50.7	−12.0	3.0	−2.0	11.2	40.6
1997	8.5	−2.0	39.8	4.4	−0.4	14.4	57.9
1998	−0.9	11.8	−36.7	1.4	−5.9	9.2	32.7
1999	6.4	−34.0	83.7	2.1	2.8	15.8	91.1
2000	9.4	12.5	2.8	4.4	4.6	14.9	83.3
2001	−2.4	−2.8	−9.3	2.9	−5.2	13.8	77.8
2002	2.2	16.8	−43.7	−0.6	2.5	7.6	37.5

Thailand	growth rate	change in I	change in FDI	change in L	TFP	FDI/GDP 比	FDI/I
1990	11.2	31.0	29.5	2.3	2.3	2.8	8.8
1991	8.6	13.9	−21.7	2.7	−0.5	2.0	6.0
1992	8.2	0.8	4.6	2.1	0.7	1.9	6.3
1993	8.1	36.6	−17.5	−2.4	3.2	1.5	3.8
1994	9.0	12.8	−27.7	−1.7	3.3	1.0	2.4
1995	9.2	10.5	41.0	2.2	1.4	1.3	3.1
1996	5.9	6.9	11.8	0.5	−0.3	1.3	3.2
1997	−1.4	−24.2	93.9	1.7	−5.9	2.6	8.3
1998	−10.5	−57.3	112.9	−4.5	−4.2	6.2	41.3
1999	4.4	4.0	−20.7	1.9	5.9	4.7	31.5
2000	4.6	21.2	−45.0	2.0	2.3	2.5	14.3
2001	1.9	−1.3	16.4	2.6	−0.9	2.8	16.9
2002	5.2	20.4	−77.0	2.6	2.3	0.6	3.2