APPLIED GENERAL EQUILIBRIUM ANALYSIS OF EAST ASIAN GROWTH[1]

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SUMMARY

This paper examined how several changes in the East Asian region had an impact on these economies and their industrial structures before and after the currency crisis by using an applied general equilibrium model.

First, to study whether export-led industrialization can singly lead to growth, the paper made an explicit account of the mechanism in which industrialization makes way for a service economy. In the process, it was shown that it is increasingly important for NIES to get along with the predominance of the service sector. Second, as robust export expansion may be considered as the primary factor behind their recovery since 1999, the effect of currency depreciation on the real economy was estimated in the countries and its impact on the recovery process was evaluated. Finally, given a prevailing view that the V-shaped recovery has put an end to the crisis, this paper examined the effect of investment which has fallen significantly after the crisis on their potential economic growth.

INTRODUCTION

One characteristic that sets East Asian economic growth apart from others is that high growth was sustained for more than 30 years. In particular, fast growth was observed in NIES and ASEAN countries. Latin America experienced rapid growth in the 1970s, but its growth has decelerated considerably in the 1980s. There is hardly a region that experienced sustained high growth like East Asia.

However, the currency crisis descended on Thailand in the summer of 1997. This triggered similar crises later in Korea, Indonesia, and so on. Economies previously admired for high growth exposed a number of vulnerabilities, thus registering a sudden change with substantial negative growth in 1998.

Entering 1999, the economies affected by the currency crisis have rapidly recovered. However, the question remains as to whether they will be able to continue high growth as in the pre-crisis years. This paper used an applied general equilibrium model and examined how several changes in the conditions surrounding growth in the East Asian region have made an impact on these economies and their industrial structures before and after the currency crisis.

An applied general equilibrium model has an advantage in analyzing intra-market or inter-market transactions of economic units such as utility maximizing households and profit maximizing firms. Macro-econometric models are effectively used for economic forecasts and analyzing the effect of economic measures on macroeconomic variables such as output and employment, given the observed relationships between variables in the past and the assumption of stable economic structure. On the other hand, applied general equilibrium models can quantitatively evaluate the effect of a change in economic policies on industrial structure, allocation of resources and income distribution, as it affects relative prices and leads to corresponding changes in the behavior of economic units. This is a characteristic not found in macro-econometric models. This technique may

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well find a wide range of uses, including an analysis of not only the economy-wide effect of trade liberalization through a change in tariff regime but also the effect of economic structural reform designed to remedy the regulation-induced distortions.

An applied general equilibrium model was used in this paper because structural change in the economy is deeply involved in growth in this region and thus one cannot discuss the prospect of the Asian economy without this consideration.[2] The model used here has the industrial sector disaggregated into specific categories, providing a major advantage for studying growth when structural change is underway. To the extent that it is a comparative static model, it can only capture a shift in equilibrium levels of variables. However, assuming that structural change is taking place constantly in Asia, equilibrium levels of economic variables keep shifting, and this model may be used as an analytical tool.

This paper consists of the following sections. Chapter 1 deals with industrialization policies. East Asian countries aimed at industrialization led by exports. In the process of growth, they successfully transformed themselves from an agricultural or natural resource-producing region to an industrial product-producing region. However, the share of the manufacturing sector and the export-output ratio have already reached high levels, and Japan and NIES have large increasing service sectors. Thus a question arises as to whether export-led industrialization can singly lead to growth. The study made an explicit account of the mechanism in which industrialization makes way for a service economy, and examined how increased consumption resulting from an expanding economy affects industries and individual economies.

Chapter 2 deals with the effect of an extraordinary depreciation in the exchange rate in the aftermath of the Asian currency crisis. Despite a significant economic downturn immediately after the crisis, the East Asian economy has registered a sharp V-shaped recovery since 1999, which was well beyond expectations. One of the major factors behind it seems to be a robust growth in exports. Capital outflows after the crisis caused exchange rate depreciation, which adversely affected the financial sector with soaring non-performing assets, but contributed to the real economy with an increase in exports. In this section, the effect of exchange rate depreciation on individual economies and the extent of impact on their economic recovery were examined.

Chapter 3 considers the effect of a change in investment activities after the crisis. A rapid pace of capital accumulation provided underpinnings for high economic growth in East Asia. However, after the crisis, investment declined sharply, and there was a turnaround in international capital movements from net inflow to outflow. While a prevailing view is that the V-shaped recovery has put an end to the crisis, one may note a clear difference in the pattern of growth before and after the crisis. The current state may simply be considered as an upturn in economic activity in reaction to the major economic downturn and, in particular, an upturn in foreign demand. This section examined how potential growth rate would have been affected by the assumption that investment activities did not recover.

CHAPTER 1 GROWTH BASED ON EXPORT-LED INDUSTRIALIZATION

1. INDUSTRIALIZATION POLICIES IN ASIA

Probably no one will argue against the point that it was successful industrialization policies that enabled East Asian economies to take off to the fast growth path. Though initially they were agricultural or resource producers, except Hong Kong and Singapore, East Asian countries started to adopt policies for industrialization in the 1950s and 60s. Industrialization proceeded by undergoing several stages. This sequence may be roughly summarized as follows.

The first step toward industrialization for most developing countries is import substitution. Its purpose is to: first, reduce current account deficits by promoting domestic production of imported industrial goods; and second, absorb a vast pool of domestic

2 Ito et al.(2000) discussed that the structural change has a profound relevance in Asian economic growth.

labor surplus. East Asia achieved a measure of economic growth with domestic production induced by the policy of import substitution. Because of their small-sized economy, however, their growth soon faced an impasse. The downside of import substitution was that steep tariffs and quantitative import restrictions protect domestic industries by making them immune from international competition, which leads to a high-cost economic structure and sluggish improvement in industrial productivity. Furthermore, in the absence of domestic agglomeration of intermediate and capital goods industries, as industrialization proceeded further, more intermediate materials and capital goods, such as equipment and machinery, had to be imported. Thus this policy did not produce initially expected results in slashing current account deficits. NIES and ASEAN countries recognized these limitations at the early stage and made a major policy shift toward industrialization through promoting exports. This resulted in sustained high economic growth in later years.

Making a turnaround to an export-oriented economy, East Asian countries sought sources of demand in overseas markets, which were far larger than their domestic markets, and were able to increase production to the maximum extent that they could expand their supply capacities. Many countries employed not only industrial policy but also trade, foreign exchange, and financial policy to boost exports, while setting in place import substitution policy. High tariffs and quantity restrictions on intermediate goods therefore became a drag in promoting exports. In an effort to keep up with international competition, governments took such preferential measures for the export sector as lower tariffs on intermediate goods and the allocation of import quota for those exporters with good export records. While the export sector received favorable treatment, the industries aiming at the domestic market were left in the cold, thereby giving a strong momentum to a shift to an export-dependent industrial structure. Since the mid-1980s, Korea and Taiwan saw an increasingly tough export environment, due to appreciation in their currencies, wage hikes, growing protectionism in the industrial countries and developing countries gaining on them. In the area of trade, individual economies in the region reduced tariffs and pushed forward import liberalization. And liberalization in the capital market moved forward step by step, accelerating the overall trend for liberalization.

As industrialization proceeded smoothly primarily in the light industries, and the economies gained strength, some countries tried to develop the heavy and chemical industries. One purpose was to add, as an extension of import substitution policy, intermediate and capital goods to the list of domestic products, which had been hitherto dominated by consumer goods. The other purpose, motivated by export promotion policy, was to shift exports to more value-added heavy and chemical industries. The heavy and chemical industries, however, are capital intensive, and thus require huge amounts of investment. Given meager capital resources in the private sector, the public sector had no choice but to play a significant role in the developing countries, whether it directly undertakes or indirectly assists the private sector. This is the reason that not all the developing countries could take this route, and some of those who dared had to backtrack in the midway, unable to shoulder the heavy financial burden.

2. TRANSFORMATION OF INDUSTRIAL STRUCTURE

As a result of industrialization policy, East Asian countries enjoyed high economic growth over a long period of time and underwent a drastic change in the industrial structure, the focus of which shifted from agriculture and natural resources to manufacturing. According to neoclassical growth theory, a structural change has only a temporary effect of shifting the level of output, but is not a factor for changing growth rate over a long time. In East Asia, however, structural change itself continued to take place one after another, bringing about a sustained increase in the level of production, thus helping to achieve a robust economic growth.

Table 1 shows the growth rate of total value added per employment by industry. An interesting point here is the bold-faced figures for Korea, Taiwan and the Philippines in the second half of 1980s and for Indonesia, Malaysia and Thailand in the first half of 1990s. The growth rate in the industries as a whole surpassed

the comparable rate in each individual industry. In the absence of a change in industrial structure, it would be impossible for the overall growth rate to exceed individual growth rates in the primary, secondary and tertiary industry, since the former is a weighted average of the latter. However, this is not necessarily the case if the employment pattern has changed. What actually happened in East Asia was that labor force migrated from the primary industry, where labor productivity was low, to the secondary and tertiary industries, where productivity was high, thereby boosting the growth rate of economy-wide productivity[3].

The figures in Table 1 reveal that even when la-

Table 1 Growth of Value Added Per Employment (annual, in Real Terms)

(%)

Japan	1970〜75	1975〜80	1980〜85	1985〜90	1990〜95
Agriculture	8.3	0.2	4.7	3.3	1.7
Industry	3.2	3.5	2.5	4.4	0.5
Manufacturing	4.0	5.0	3.6	4.1	1.5
Service	2.8	2.6	1.8	1.9	0.7
All Industries	4.0	3.2	2.4	3.1	0.8

Indonesia	1970〜75	1975〜80	1980〜85	1985〜90	1990〜95
Agriculture		10.4	−0.1	−0.9	**5.4**
Industry		−0.7	1.1	3.8	**2.1**
Manufacturing		9.7	8.2	4.9	**3.7**
Service		6.4	2.6	4.9	**2.9**
All Industries		9.4	1.7	3.0	**6.2**

Korea	1970〜75	1975〜80	1980〜85	1985〜90	1990〜95
Agriculture	2.7	0.5	11.0	**3.1**	6.8
Industry	3.1	5.6	6.9	**5.7**	6.6
Manufacturing	6.1	7.1	7.3	**5.8**	8.7
Service	4.4	0.2	1.5	**4.8**	2.5
All Industries	4.0	4.0	6.2	**5.9**	4.9

Malaysia	1970〜75	1975〜80	1980〜85	1985〜90	1990〜95
Agriculture			3.8	4.3	**4.5**
Industry			2.4	3.2	**4.9**
Manufacturing			3.1	3.9	**6.9**
Service			−1.0	1.1	**5.3**
All Industries			1.7	3.3	**5.8**

Singapore	1970〜75	1975〜80	1980〜85	1985〜91	1991〜95
Agriculture	6.5	7.1	8.1	1.8	4.5
Industry	3.2	2.0	2.4	4.1	9.9
Manufacturing	1.6	3.5	1.5	5.6	10.1
Service	4.4	3.2	3.6	4.6	4.1
All Industries	4.2	2.9	3.2	4.4	6.0

Philippines	1970〜75	1975〜80	1980〜85	1985〜90	1990〜95
Agriculture	−2.0	1.9	−2.9	**2.5**	−0.7
Industry	7.4	2.2	−5.3	**1.1**	−1.3
Manufacturing	4.8	1.8	−3.9	**2.4**	−1.2
Service	4.1	0.6	−4.5	**1.8**	−0.4
All Industries	2.7	2.0	−4.6	**2.6**	−0.5

Taiwan	1970〜75	1975〜80	1980〜85	1985〜90	1990〜95
Agriculture	1.0	8.5	1.3	**5.8**	2.7
Industry	2.9	5.6	4.5	**5.3**	4.6
Manufacturing	1.5	6.9	4.5	**5.7**	6.5
Service	5.4	3.8	3.2	**6.5**	4.2
All Industries	4.9	6.9	4.1	**6.8**	4.8

Thailand	1970〜75	1975〜80	1980〜85	1985〜90	1990〜95
Agriculture	8.1	−3.8	2.5	0.8	**6.9**
Industry	−6.0	6.7	0.3	7.2	**2.1**
Manufacturing	−6.7	8.2	−0.1	8.0	**3.8**
Service	0.2	3.8	−0.8	6.2	**1.9**
All Industries	6.7	1.1	2.6	6.5	**7.4**

Sources: *World Development Indicators, World Bank; Yearbook of Labor Statistics*, ILO; *Taiwan Statistical Data Book,* Council for Economic Planning and Development, Taiwan.

3 Let total value added per worker be Y, its rate of change y, the share of workers in the particular industry relative to total labor force S, and its change Δ S. Further, let figures, 0, 1, 2 and 3 denote respectively the total economy, the primary, secondary and tertiary industry. Then,

$y_0 = \{(S_1*Y_1/Y_0)*y_1 + (S_2*Y_2/Y_0)*y_2 + (S_3*Y_3/Y_0)*y_3\}$ ..... (Labor productivity effect)

$+ \{\Delta S_1*(Y_1/Y_0) + \Delta S_2*(Y_2/Y_0) + \Delta S_3*(Y_3/Y_0)\}$ ..... (Structural change effect)

$+ \{(\Delta S1*Y_1/Y_0)*y1 + (\Delta S_2*Y_2/Y_0)*y_2 + (\Delta S_3*Y_3/Y_0)*y_3\}$ ..... (Residual)

where $Y_0 = S_1*Y_1+S_2*Y_2+S_3*Y_3$ and $\Delta S_1 + \Delta S_2 + \Delta S_3 = 0$

When changes in share and labor productivity are small in each industry, the residual of the above equation may be ignored. Then, a change in the economy-wide labor productivity is the sum of increases in labor productivity in the respective industries and the effect of structural change. Structural change contributed 0.8% to annual growth in Korea, 0.7% in Taiwan and 0.8% in Philippines during 1985-90; 3.0% in Indonesia, 0.7% in Malaysia and 4.6% in Thailand during 1990-95.

bor productivity did not improve in individual industries, structural change (or more advanced industrial structure) could lead to growth in the overall labor productivity. In Asia, structural change was one of the factors behind high growth. Needless to say, a factor on the demand side that made structural change possible in the respective East Asian economies was the expansion of exports. Had there been a constraint in demand growth, a larger production capacity would have simply ended up in increased inventories. It is because they turned to overseas for sources of demand that they achieved rapid growth without being hampered by the limited domestic purchasing power. In order to attain high growth, the governments had only to address ways to expand production capacities. Simply by concentrating the resources in the export-related industries, they could transform themselves into industrial economies. The export-GDP ratio was traditionally high in Hong Kong and Singapore because they were transit trade ports, but this ratio soared in Korea from 14.1 % in 1970 to 40.2 % in 1987, and in Taiwan from 30.3 % in 1970 to 52.4 % in 1985, indicating their rapidly increasing dependence on exports up to the 1980s. Entering the 1980s, ASEAN countries continued to register steep increases in their export-GDP ratios. From 1980 through 1985 it rose from 57.5 % to 95.4 % in Malaysia, from 24.1 % to 41.7 % in Thailand, and from 23.6 % to 36.4 % in the Philippines, though it declined in Indonesia, a largely resource exporting country, during this period. Export structure also changed, with primary products giving way to industrial products as the mainstay of exports. The share of industrial products in exports, which was around 20 % in 1980, increased to over 70 % in 1995 in Malaysia and Thailand, and to 40 - 50 % in Indonesia and the Philippines.

3. MODEL SIMULATION

(1) Introduction

ASEAN countries experienced sustained economic growth driven by progress in industrialization up to the eve of the crisis. Although industrialization also proceeded in Japan and NIES during the high growth period, the share of the manufacturing sector has declined in Japan since the first oil crisis, and in Korea, Taiwan and other NIES since the second half of 1980s. In Japan, despite consistent growth in per capita GDP, the share of manufacturing in GDP reached a peak of 36.0 % in 1970 before the first oil crisis and thereafter gradually declined to 24.3 % in 1996. Likewise in Korea, the share of manufacturing fell from 32.1 % in 1988 to 25.9 % in 1996, and in Taiwan from 39.4 % in 1986 to 27.9 % in 1996. In Singapore and Hong Kong, the similar share also took a downturn from a peak in mid-1980s.

Industrialization that proceeded in individual countries and regions was considered to be the driving force behind growth in East Asia. However, after a certain point in time, it appears that income was rising even if industrialization was taking a step backward. This raises a question as to whether economic growth driven by industrialization is sustainable.

With the use of growth accounting, sustained high growth over a long period in East Asia may be broken down into three factors: rapid accumulation of capital stock; abundant labor force; and technical progress (an increase in total factor productivity (TFP)). There are divergent views on the question of whether growth in TFP made a significant contribution.[4] However, broad consensus exists over the contribution of an increase in capital stock and labor force to growth.[5]

Capital stock increased in response to robust investment demand mainly from the export-oriented industry, supported by growing domestic savings and capital inflows from overseas. Saving ratios in East Asian countries are very high, and they are characterized by a large share of public sector savings and substantial savings in the corporate sector rather than in the household sector. The corporate sector holds larger export profits and spends them for their investments. Further, the manufacturing sector could expand production by absorbing labor from agriculture, the sector where there is surplus labor.

As long as there is labor surplus, the goods-pro-

4 The World Bank (1993) argues that an increase in total factor productivity contributed significantly to East Asian growth, whereas Krugman (1994) presents a negative view on its contribution.

5 Economic Planning Agency (1999)

ducing sector and the service sector may expand production simultaneously. Once labor shortage appears, however, competition for obtaining labor raises wages further. If the rate of wage increase exceeds the growth rate, the labor share in National Income will increase, raising household income and thereby sharply boosting demand for services. At the same time, wage hikes also tend to degrade the international competitiveness of the labor-intensive manufacturing sector, which, in turn, will put a brake on export growth. Frequent explanation for increased share of the service sector in the economy is that since the consumption of services is highly income elastic, income growth raises their relative share in the economy.[6] As the composition of consumption demand, where spending on the service sector accounts for a predominant share, differs substantially from that of export demand, where goods have a dominant share, a rise of the labor share will dramatically expand the service industries. In Taiwan and Korea, the real wages in the manufacturing sector rose by an annual rate of 10 % or more during the second half of the 1980s, and an attendant sharp increase in the labor share bolstered consumption. Japan had already witnessed a rapid growth of labor in the first half of the 1970s, resulting in a growing share of its service sector in total output. Booming consumption apparently led to a shift in industrial structure (toward the dominance of the service sector in the economy).

In an attempt to examine this stylized explanation, a simulation using an applied general equilibrium model finds the effect of an increase in total consumption expenditure (household consumption + government consumption) on the economy and industries. The following simulations see the effect of one percentage point increase in the consumption ratio (the percentage share of total consumption in GDP) in the four countries—Korea, Taiwan, Malaysia and Thailand.

(2) Simulation

Since the structure of the ORANI-G Model used in this paper has already been described in Horridge et al. (1998), only a brief explanation is given below to the extent that there is relevance to the simulation.[7] The database of the GTAP Model, a global model, was converted to be used for the ORANI-G Model, single region model. The simulations here group industries into 17 categories as shown in Table 2. Simulation was carried out for the individual regions respectively.

The model has equations in linear form, with the variables expressed in terms of the rate of change. Thus the rate of change of demand for nominal household consumption *(w3tot)* is expressed in the model as the sum of the rate of change of nominal GDP *(w0dgpexp)* and a variable that denotes a shift in the share of household spending *(f3tot)* in nominal GDP:

$$w3tot = w0gdpexp + f3tot \qquad (2\text{-}1)$$

Assuming that *f3tot = 0*, then *w3tot = w0dgpexp*, thus the growth rates of nominal household consumption and nominal GDP coincide, and the consumption ratio (the average propensity to consume) remains unchanged[8]. An exogenous shock to *f3tot* may change the consumption ratio. It is assumed that the rate of

6 Ito et al. (2000).

7 JBIC has employed the GTAP (Global Trade Analysis Project) Model since 1997. The GTAP Model is an applied general equilibrium model developed with the aim of analyzing the effect of global trade on individual countries across the world. It is based on an international input-output table comprising 45 countries/regions and 50 industries (Database Version 4). For further details, see Hertel (1997). The ORANI-G Model used here was developed jointly by the Australian government, Monash University, La Trobe University and Australia National University under the Impact Project. The original ORANI Model, which became the basis for the GTAP Model, was an applied general equilibrium model and divided the Australian economy into 56 regions and 112 industries. It has been used to evaluate the effect of a change in taxation, reduction in tariffs, relaxation of the regulations, and environmental regulations. The ORANI-G Model generalized this model by eliminating intra-country regional divisions of the ORANI Model to focus on the specific conditions of individual countries. Though there is a major difference between the GTAP Model and ORANI-G Model in that the former is a global model while the latter is a single-region model, they use the common software and share basically a similar structure, with a few exceptions such as a more simplified consumption function used by the latter.

8 Strictly speaking, since the growth rates of the government and household spending coincide in terms of quantity rather than value, the consumption ratio, which is the sum of spending in both the government and household sectors, is influenced by a change in their relative price. The analysis here abstracted from this effect.

Table 2 Industrial categories in model simulations

Aggregation	Code	Industry/Commodity
Agriculture	AGR	Agriculture, Forestry, Fishing
Mining	MNG	Coal, Petroleum, Gas, Other mining
Processed Food	PFD	Food, Beverages, Tabacco
Textile	TXL	Textile, Wearing apparel
Petroleum	P_C	Petroleum, coal products
Chemical	CRP	Chemical, rubber, plastic products
Metal	MTL	Ferrous metals
Motor Vehicle	MVH	Motor vehicles and parts
Other Transport Equipment	TRN	Other transport equipment
Electric Machinery	ELE	Electronic equipment
Other Manufacturing	OME	Other machinery and equipment
Other Manufacturing	OMF	Products of Leather, Wood, Paper, Mineral, etc.
Electricity	EGW	Electricity, Gas distribution, Water
Construction	CNS	Construction
Trade & Transport	T_T	Trade, Transport
Private Service	OSP	Financial, business, recreational service
Public Service	OSG	Public administration, education, health

change of real government spending *(x5 (c,s))* is equivalent to that of real consumption expenditure *(x3tot)*:

$$x5(c,s) = x3tot \quad (2\text{-}2)$$

The value of *f3tot* that raises the consumption ratio by 1 percentage point becomes:

$$f3tot = 1\% \times (\text{Nominal GDP/Total nominal consumption}) \quad (2\text{-}3)$$

Accordingly, the value of *f3tot* that increases the consumption ratio by 1 percentage point was calculated for each region, using the database: 1.55 % in Korea, 1.43 % in Taiwan, 1.79 % in Malaysia and 1.56 % in Thailand.

To solve the model, it is necessary to divide the variables into endogenous and exogenous variables. In this simulation, the model was closed by assuming that induced investment increases capital stock and leads to increased production, incorporating capital accumulation effect. The current account balance will vary endogenously, allowing international capital movements. The country's total labor input is fixed, which makes wages an endogenous variable. Import prices are assumed unchanged.

The process in which a given exogenous impact will spread through the macroeconomy is as follows (see Table 3). First, the average propensity to consume increases, which raises both household and government consumption by 2.1 to 2.4 %. An increase in consumption leads to more production, hence higher demand for factors of production. While labor input is fixed exogenously and thus unchanged, capital input rises by 0.6 to 0.9 %. Wages also rise by 0.9 to 2.0 %, and the rental price of capital by 0.2 to 1.0 %. So do the prices of domestic products. Since the prices of foreign products are fixed exogenously, increased prices of domestic products affect trade, reducing exports by 0.5 to 2.5 %, and increasing imports by 0.8 to 1.7 %. In a closed economy, a rise in the consumption ratio (lower saving ratio) will be directly translated into a decline in the investment ratio (since S = I). However, because the current account balance changes endogenously, there will be capital inflows from overseas and the increase of consumption ratio does not necessarily cause a decline of investment ratio. Eventually, investment will rise by 0.6 to 0.9 %, thus leading to increased capital input. The effect will be a 0.4 to 0.7 % increase in real GDP.

Table 3 Macroeconomic effects by increase of consumption ratio

(%)

	Korea	Taiwan	Malaysia	Thailand
(Change of quantity)				
GDP	0.4	0.4	0.4	0.7
Household consumption	2.2	2.1	2.3	2.4
Capital formation	0.8	0.9	0.6	0.8
Government consumption	2.2	2.1	2.3	2.4
Export	−2.5	−1.8	−0.5	−0.9
Import	1.4	1.0	0.8	1.7
(Change of price)				
GDP	1.5	0.9	0.4	0.5
Household consumption	1.3	0.7	0.2	0.3
Capital formation	0.9	0.5	0.2	0.2
Government consumption	1.5	1.0	0.3	0.7
Export	1.0	0.7	0.2	0.4
Import	0.0	0.0	0.0	0.0
Change of current account/GDP	−1.0	−1.0	−1.0	−1.0
Labor input	0.0	0.0	0.0	0.0
Capital input	0.9	0.9	0.6	0.8
Wage	2.0	1.3	0.9	1.3
Rental price	0.9	0.5	0.2	0.2

Note: Results of model simulation. The effect of one percentage point increase in the ratio of consumption expenditure to GDP.

Since an exogenous shock of one percentage point increase was given to the propensity to consume for all the countries examined, its impact spreads through each macroeconomy in the same process but in somewhat different degrees, depending on individual countries.

In Korea and Taiwan from the second half of the 1980s through the pre-crisis year, the saving ratio and the investment ratio did not move in a parallel fashion. In Korea, whereas the saving ratio reached a peak of 39.7 % in 1988, and then falling to 33.7 % in 1996, the investment ratio in the same period soared from 31.3 % to 38.4 %. Similarly in Taiwan, although the saving rate hit 37.9 % in 1987, then plunging to 26.6 % in 1996, the investment ratio rose from 20.6 % to 23.2 % (after reaching a record 26.2 % in 1993). The disparity between the saving rate and the investment ratio during this period was financed by capital inflows from overseas. In analyzing East Asian economies during this period, the assumption of endogenous current account balance, or the existence of capital movements, is consistent with actual developments and is therefore justified.

Our attention should focus not only on macroeconomic development but also on a shift in industrial structure. As described above, since there was an exogenous increase in the propensity to consume in the simulation, this resulted in increased consumption spending. In the model used here, the elasticity parameter of household consumption expenditure is set less than 1 for agricultural products and foods, but larger than 1 for industrial goods and services. This has resulted in disparate rates of growth in consumption among different products. However, in most products the resulting increases were generally 2 to 3 %. Also, the elasticity parameters for imports and exports with respect to the relative price of domestic and foreign goods are set for each industry in the model. Therefore, any change in domestic prices will affect import and export volume. According to the

Table 4 Effects to industrial output by increase of consumption ratio

(%)

	Agriculture	Mining	Manufacturing	Electricity	Construction	Services
Korea	0.2	−0.7	−0.7	0.3	0.8	1.1
Taiwan	0.0	−0.6	−1.0	0.3	0.9	1.1
Malaysia	0.0	0.0	−0.1	0.6	0.6	0.9
Thailand	0.0	0.0	0.2	0.9	0.8	1.1

Note: Results of model simulation. The effect of one percentage point increase in the ratio of consumption expenditure to GDP. Changes in production were tabulated by regrouping the industries into six categories. The service sector includes commerce and transportation (T_T), services in the private sector (OSP), and public service (OSG). The manufacturing sector includes Processed food (PFD), Textile (TXL), Petroleum (P_C), Chemical (CRP), Metal (MTL), Motor vehicle (MVH), Other transport equipment (TRN), Electric machinery (ELE), Other machinery (OME) and Other manufacturing (OMF).

simulation, since upward pressure on domestic prices occurred by an increase in consumption demand, exports fell and imports rose. However, the structure of goods and services differs from one demand category of to another. Whereas services make up a larger portion of consumption demand, industrial and agricultural products comprise most of the traded goods. As a result, it was shown that when consumption and imports increase, and exports decline, output in the service sector will rise, but the manufacturing will fall, and the share of the service sector in the economy will increase.

The extent of a shift in industrial structure differed from one country to another. There was no significant difference in the growth of service sector output: 1.1 % in Korea, Taiwan and Thailand, and 0.9 % in Malaysia. The output in the manufacturing sector, however, fell by 0.7 % and 1.0 % in Korea and Taiwan respectively, but a decline was 0.1 % in Malaysia, and in Thailand it rose by 0.2 %. Thus the expansion of the service sector corresponding to a change in propensity to consume proceeded more rapidly in NIES.

Why did the manufacturing output decline more in NIES than in ASEAN countries? The first and foremost factor that may be considered is different degrees of price changes. ASEAN countries turn to imports, whose prices do not change, for a large share of their intermediate goods. Thus increased prices of domestic factors of production are largely offset by this factor, leading to a smaller increase in the price of products (in particular traded goods) and thus a smaller decline in exports. Further, another route may be considered: the resulting more substantial structural change among NIES increased the prices of factors of production in these countries. Second, there is a difference in the degree of depth in production structure. ASEAN countries have a larger share of assembly-and-processing-type manufacturing, with a smaller share of domestic products being used as intermediate inputs. This means a smaller production inducing effect in ASEAN countries. When final demand decreases, there is a relatively small decline in production. Third, the service sector has already expanded its share to a certain extent in NIES, and even if it grows at the same rate as elsewhere, the effect on other industries is larger because of its large share in the economy.

(3) Is growth based on export-led industrialization sustainable?

If there were no constraints on factor inputs, industrialization responding to growing export demand could leads to economic expansion. However, there do exist constraints in factor inputs (in particular labor input). Since workers are still moving from agriculture to the manufacturing sector, ASEAN economies are not considered short of labor. NIES, on the other hand, have already got themselves out of the state of labor surplus, and thus the manufacturing sector alone cannot enjoy growth without a change in productivity in industries. They cannot solely focus

Table 5 Contributions of economic growth in Korea and Taiwan

(%)

		Before the second half of the 1980's				After the second half of the 1980's			
		Real Growth	Labor	Capital	TFP	Real Growth	Labor	Capital	TFP
Korea	Total	9.3	1.9	2.7	4.8	7.5	1.8	3.4	2.3
	Agriculture	4.7	−2.5	1.7	5.5	0.8	−3.2	2.7	1.3
	Industry	11.9	3.5	3.2	5.1	8.3	1.2	3.5	3.6
	Manufacturing	13.4	4.1	3.4	5.9	7.7	0.0	3.7	4.0
	Services	8.6	3.5	3.0	2.1	8.1	3.9	3.6	0.5
Taiwan	Total	7.5	2.0	2.2	3.3	7.3	1.1	2.7	3.5
	Agriculture	1.3	0.4	0.4	0.5	1.0	−2.5	1.1	2.3
	Industry	7.7	1.7	2.0	4.0	5.3	0.4	2.0	2.9
	Manufacturing	8.9	2.4	2.0	4.5	4.9	−0.6	2.3	3.1
	Services	8.1	3.0	2.6	2.5	9.3	2.8	3.3	3.2

Note: Estimated from *National Accounts Statistics*, UN; *Labor Statistics Yearbook*, ILO; *Taiwan Statistical Data Book*, Council for Economic Planning and Development. Figures before the second half of the 1980s indicate the average over 1980-88 in Korea and 1980-86 in Taiwan. Figures after the second half of the 1980s indicate the average over 1988-96 in Korea and 1986-96 in Taiwan. The underlying equation[9] is: $y(t) = \alpha k(t) + (1+\alpha)l(t) + tfp(t)$, where $\alpha = 0.3$

on export-led industrialization now, and must pay sufficient attention to developments in the non-manufacturing industries. To put it the other way round, the improvement in productivity is indispensable for NIES if they are to continue export-led industrialization,.

How have NIES dealt with this situation since the second half of the 1980s? Table 5 shows the breakdown of growth in Korea and Taiwan into contributions of capital, labor, and total factor productivity (TFP) before and after the time when industrialization reached its peak (1988 in Korea and 1986 in Taiwan). Note that this table simply uses the number of employees as labor input and does not take into account changes in the quality of workers and working hours. These factors are included in the TFP. In both Korea and Taiwan, output growth in the manufacturing sector significantly slowed down. In Korea, 4.1 % out of the 5.7 % decline in growth rate of the overall economy was attributable to a fall in contribution of labor input. In Taiwan, the comparable figure was 3.0 % out of 4.0 %.

If they cannot turn to labor input for economic growth, they have no choice but to rely on increases in capital input and TFP. Even if the propensity to consume rises, brisk investment demand may be financed by increased capital inflow. Investment activity was brisk in Korea and Taiwan, as attested by the increased contribution of capital input even after the second half of the 1980s. The pattern of international capital movement was that Korea had larger capital inflows and Taiwan observed smaller net capital outflows.

TFP still accounted for a majority of growth in the manufacturing sector, although its contribution decreased. In comparison with the overall industries, TFP in the manufacturing sector grew almost at the same rate in Taiwan. By contrast, in Korea the manufacturing sector far exceeded the overall industries in terms of TFP growth. In other words, productivity improved not only in the manufacturing sector but in the other sectors as well in Taiwan, while TPF grew mainly in the manufacturing sector in Korea and hardly did so in the service sector.

9 Capital stock was estimated in a simple procedure from fixed capital formation with the following equation. Capital stock at current period t is equal to current investment plus capital stock in the previous period minus depreciation; $k(t) = I(t) + (1-\delta)k(t-1)$. Capital stock is assumed to depreciate at $\delta = 0.1$.

Table 6 Contributions of added value growth in Korean manufacturing industries

(%)

	1980〜88				1988〜96			
	Total	Labor	Capital	TFP	Total	Labor	Capital	TFP
Total Manufacturing	11.5	3.8	3.0	4.7	10.4	−0.9	4.0	7.2
Food products	6.3	1.7	2.5	2.2	7.1	−0.9	3.0	5.0
Textile & Apparel	8.2	1.8	1.7	4.7	3.9	−3.8	2.0	5.8
Wood products	9.9	1.7	0.6	7.7	11.8	−0.1	5.9	6.0
Paper products	11.6	3.2	3.6	4.8	11.8	1.4	4.1	6.3
Chemical products	8.7	2.1	2.7	3.9	8.5	0.3	4.6	3.6
Petroleum & Coal	5.6	0.5	2.3	2.8	9.6	−1.0	6.3	4.2
Rubber, Plastic products	13.1	5.5	4.0	3.6	10.1	−4.5	4.8	9.8
Mineral products	7.6	2.0	2.4	3.2	10.9	0.1	4.0	6.7
Iron & steel, Other metal	10.5	2.4	2.6	5.5	8.5	−0.1	2.8	5.8
Metal products	17.5	6.3	3.8	7.4	13.0	1.7	4.2	7.1
Electric machinery	20.6	7.2	5.6	7.8	13.7	−0.8	4.7	9.7
Transport equipment	16.0	5.5	4.1	6.4	15.6	2.6	5.0	7.9
Other machinery	20.3	7.8	3.5	9.1	15.4	4.2	4.8	6.4

Note: Estimated from *Industrial Statistics Database*, UNIDO in the same manner as in Table 5.

The simulation above showed that, if we ignore improvement in TFP, an increase in consumption pushes up the wage level and prices in NIES more than in ASEAN countries because of difference in economic structure. The larger increase in prices there depresses exports, impeding GDP growth. However, to the extent TFP improves, prices will rise less, hence a smaller reduction in exports, contributing more to GDP growth. The share in value added of Korea's manufacturing sector in current prices has declined since 1988. On the other hand, in Table 5, which used figures in constant prices, shows a small increase in the share of the manufacturing sector, whose growth in terms of value added slightly surpassed that of the overall industry. The divergence of the nominal and real figures signifies a decline in prices of manufacturing relative to those of other sectors because of improved TFP in the manufacturing sector. One may easily understand that an increase in TFP is essential for achieving a robust export-led growth.

Since the manufacturing sector includes various industries, it is better to look into specific industries. Table 6 shows growth accounting corresponding to a breakdown of the Korean manufacturing sector by industry. The contribution of factors of production to growth in industry's value-added was calculated in the same manner as in Table 5.

It should be kept in mind that since the UNIDO's data cover only those firms with 5 or more employees, micro firms with 4 or fewer employees are excluded in Table 6, whereas the data used for Table 5 include them. Apart from those micro firms, contribution by labor input decreased in Korea, as was the case in Table 5, but the contribution of capital input as well as TFP increased. As a result, the growth rate of output in value added terms remained high. Thus when comparison is made of the figures for the total manufacturing sector in the two tables, we see that the disparities among firms widened, as large companies were more active in investments. By industry, we found that all the industries grew by increasing employment and investment before 1988, but after 1988 light industries such as textiles reduced employment, while the heavy industries such as general machinery and transportation equipment continued to hire more employment. Structural change was underway in the manufacturing sector, which was a mixture of the industries growing through capital substituting for other factors and those expanding by simply increasing both factor inputs.

Korea relied on the growth of the export-oriented manufacturing sector well after the arrival of post-

industrial period since the mid-1980s. Unable to increase labor input, the manufacturing sector tried to improve productivity through active capital investment and expansion of operation for the scale economy. Meanwhile, TFP in the non-manufacturing sector did not rise, giving rise to the high cost structure. In order to increase exports, the manufacturing sector had to further increase productivity and produce higher value-added products. However, this approach involved two risks. First, if a product of a certain industry is in short supply, that industry would enjoy benefits from scale expansion. On the other hand, once excess supply occurs, the market price will plummet and productivity growth will come to a halt. Second, growth relying on investment will inevitably lead to greater capital inflows from overseas when the ratio of domestic consumption to total income increases and the saving rate decreases. One of the factors that brought about the currency crisis was excessive dependence on short-term financing for investment under such circumstances.

CHAPTER 2 IMPACT OF CURRENCY DEPRECIATION

1. THE ASIAN CURRENCY CRISIS

A huge amount of capital continued to flow in the crisis countries in the pre-crisis period. Those economies had enjoyed a sustained high economic growth right up to the crisis, indicating an investment boom. Financial liberalization and globalization also progressed quickly during this period, inducing investment inflows from overseas and expanding current account deficits. Foreign investors could expect high returns on their investments due to strong economic growth, and were able to avoid exchange risk because of the government policy to fix the domestic currency to the US dollar. Reassured by good macroeconomic performance, and in particular, the sound fiscal position, the investors were not alarmed by the ballooning current account deficit.

A long period of investment boom and high economic growth, however, led to soaring wages and declining profitability of investment. In addition, since the real exchange rate appreciated under the policy of fixing nominal exchange rate, and due partly to depreciation of the yen since 1996, their competitive edge deteriorated, and export growth lost its steam. As for capital inflows, which initially comprised mainly direct investment, the share of short-term capital including bank loans rapidly increased in a couple of years preceding the crisis. Surplus investment funds moved into the real estate and construction sector and caused the asset bubble in Thailand, while in Korea the investment boom did not wind down and demand was financed by roll-over of the short-term loans, thus further fueling liquidity mismatch.

It was under these circumstances that the currency crisis erupted in Thailand. What actually triggered the crisis was allegedly the selling offensive of the Thai baht by hedge funds in May 1997, after the asset bubble collapsed and bad loans had accumulated in the financial sector. The Thai monetary authority tried to resist these funds by buying the baht, only to find itself running out of foreign currency reserves. With their confidence in the fixed rate policy shaken, foreign investors also withdrew their short-term capital in panic, and the Thai government had no choice but to abandon the fixed exchange rate policy. In Korea, there was no real estate bubble, but corporate behavior put weight not on profitability but on gaining greater market share, and the financial system had been extremely inefficient. Korean banks had also borrowed short-term loans in foreign currencies from foreign financial institutions. Because of the increasing burden of non-performing loans, they found it hard to refinance the short-term capital that would fall concurrently due in December 1997, thus exposing the crisis to public attention. In Indonesia, the crisis worsened, fueled by political unrest. And the crisis also spread to Malaysia and the Philippines.

2. MODEL SIMULATION

(1) Framework of model simulation

The fixed exchange rate system allows foreign investors and firms to undertake investment and trade without concerns over the risk of exchange rate fluctuations. But it has its shortcomings. Adjustment of the real exchange rate takes an overly long time, overvaluing the currency, and thus weakening

competitiveness; and the authorities lose a free hand in conducting monetary policy. If the fixed-rate system is to be maintained upon eruption of capital outflow, the authorities have no alternative but to use the foreign currency reserves or raise interest rates. In the crisis countries, the authorities could not immediately devalue the exchange rate, because the companies and banks in the country, oblivious of exchange risk, relied on loans in dollars, and there is risk that they would turn into bad loans. After the crisis, however, a massive amount of foreign capital switched to outflows, consequently forcing them to leave the fixed exchange rate regime. As a result, their currencies lost much of their value. Having borrowed in dollars without hedging against exchange risks, increasing numbers of companies found their loans rapidly becoming delinquent as the currency depreciated, further deteriorating the situation. Further, the decline of exchange rates exerted a serious impact on trade and industrial structures in each country, through changes in export and import prices.

This paper examined the impact of changes of the exchange rate on the individual economies with an applied general equilibrium model. The GTAP Model cannot make this type of analysis because the nominal exchange rate is not defined in the model. With the ORANI-G Model, however, the nominal exchange rate is defined, enabling us to analyze changes in the exchange rate. That is the reason this paper has selected this modeling framework.

The exchange rates against the US dollar plunged sharply across the countries after the Asian crisis. The post-crisis rates were: nearly two-thirds of the pre-crisis level in Korea, Malaysia, Thailand and the Philippines, and one-third in Indonesia. In the simulation, the effect of a 33% exchange rate depreciation was examined with respect to Korea, Thailand and Malaysia-the three economies that suffered the similar plunge. In the Model, import prices in the foreign currency are exogenously fixed. Assuming that the exchange rates pass through by 100 %, import prices in the local currency increase by 33 %. The change in export prices in the foreign currency is the sum of changes in the price of domestic products and the change in the exchange rate 33 % depreciation.

In the model closure, it was decided not to include the effect of capital accumulation in which a change in investment flow will lead to an increase in production through a change in capital stock. In other words, this analysis focuses on a short-term impact by considering investment solely as a demand component, keeping unchanged total capital stock that determines supply capacity.[10] With regard to labor market, wages are assumed to be exogenous, and labor input endogenous.[11] In other words, we assume a situation where employment fluctuates under a given wage increase rate. This wage increase rate is assumed to be linked to the rate of increase in consumer price index, which is fixed at 10 % for the three countries on the basis of the rate of price increase in the 1997-1998 period.[12] The saving rate is fixed, while the current account is an endogenous variable, thereby allowing international capital movements to occur.

The simulation considers three scenarios. In the "Standard Case", the return on capital is determined endogenously, and standard figures from the database are used for the substitution elasticities of imports. But since the Asian crisis brought about a shortage in foreign exchange reserves, in addition to an increase in import prices, creating constraints on importing raw materials, simulation was made for the "Case of Import Constraint" where the elasticity of substitution between domestic goods and imported goods was set at double the Standard Case. Further, there may have been a sharp drop in return on investment due to the impact of the burst of the economic bubble and

10 The short-term impact in this section does not include stock accumulation effect, and this simulation is not a reproduction of a deflationary effect immediately following the crisis.

11 In this simulation, the exogenous shock is a change in the exchange rate. Therefore, if the wage level becomes endogenous, only the price level would change (real exchange rate fluctuation would be zero), and quantity variables would remain unchanged. This assumption is necessary in order to create a situation where the real exchange rate depreciation leads to changes in quantity varialbes. Also, there will be no impact on quantities if the domestic prices rise, so it would be more suitable to limit the simulation to the short-term rather than the long-term analysis that includes the capital accumulation effect.

12 An analysis on Indonesia was not conducted mainly because the currency depreciated against the US dollar by around 65%, but the rate of price increase exceeded 80% for the two year period of 1998-99, with no depreciation in the real exchange rate.

Table 7 Impact of Exchange Rate Depreciation on Asian Economies

(%)

	Standard case			Case of import constraint			Case of lower return on capital		
	Korea	Malaysia	Thailand	Korea	Malaysia	Thailand	Korea	Malaysia	Thailand
(Change of quantity)									
GDP	4.6	5.6	3.8	3.8	5.0	3.4	−1.4	1.0	−0.6
Household consumption	1.1	2.6	1.5	0.4	2.0	1.1	−5.0	−3.3	−4.6
Capital formation	−18.3	−4.1	−9.5	−29.7	−15.5	−17.3	−54.6	−67.6	−57.9
Government consumption	1.1	2.6	1.5	0.4	2.0	1.1	−5.0	−3.3	−4.6
Export	26.0	8.0	9.9	26.5	8.3	9.9	37.4	14.6	22.9
Import	−6.0	2.0	−5.2	−16.7	−2.3	−11.5	−27.8	−16.4	−34.3
(Change of price)									
GDP	18.2	26.2	26.4	18.3	26.0	26.4	13.8	22.0	20.6
Household consumption	22.2	29.9	29.3	22.4	29.8	29.2	18.2	27.5	25.6
Capital formation	22.3	29.7	30.0	22.1	29.6	30.0	19.0	28.0	26.5
Government consumption	16.1	25.4	21.1	15.9	25.4	21.1	14.1	24.5	18.3
Export	22.4	29.2	27.9	22.2	29.1	27.9	18.6	26.3	22.3
Import	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Change of current account/GDP	7.6	2.7	5.0	11.7	6.5	8.3	19.5	23.8	24.5
Labor input	10.8	18.3	18.4	10.0	17.5	18.4	−0.3	5.6	8.6
Capital input	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wage	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Rental price	22.3	29.7	30.0	22.1	29.6	30.0	12.9	21.5	20.0

Note: Results of model simulation. The effect of exchange rate depreciation by 33%.

overinvestment. Thus simulation was also made for the "Case of Lower Return on Capital," assuming that in addition to import constraints, the rate of return on capital declines by 10 percentage points.

(2) Standard Case

The effect of depreciation in the exchange rate will generally spread in the following manner. First, export volume will increase due to lower dollar prices of exports. The import volume will decrease due to higher prices of imports in local currency. As a result of current account surplus and the outflow of capital, domestic investment will slow down.[13] Since the rise in external demand exceeds the drop in domestic demand, real GDP will nonetheless increase.

However, the extent of change varies from country to country. In the standard case, the increase in export volume is a significant 26.0% in Korea, but 8.0% and 9.9% for Malaysia and Thailand respectively. This difference is mainly attributable to a smaller increase in the price of export goods in Korea compared with Malaysia and Thailand. The reason for this lower price hike is the higher percentage of imported materials used in the production of export goods in Malaysia and Thailand. Another reason is, due to the closure of the simulation, namely the constraint that the amount of total capital is assumed unchanged, the price of capital will increase by a wide margin in Malaysia and Thailand, economies short of capital. Also, a 33% rise in import prices will theoretically result in lower import volume. The result is that while the volume declines in Korea and Thailand, it increases by 2.0 % in Malaysia. This result is obtained uniquely by the applied general

13 This simulation examines short-term effects. Thus capital stock is fixed. This may generate a situation where the concentration of domestic resources will shift from investment goods production sectors to export goods production sectors, leading to a fall in investment. Although investment demand induced by the increase in export demand is considered to be a long-term phenomenon, this factor is not reflected in this simulation.

equilibrium model. The reason for the increase in import volume despite the sharp rise in import prices is because the production structure for export goods in Malaysia is largely dependent on imported intermediate materials. In such a structure, the import volume of intermediate materials must be increased in order to increase the production of export goods.

Turning to the current account, a significant surplus occurs in Korea where export volume increases and import volume falls. But in Malaysia, an increase in surplus is minimal because export volume increases, while import volume decreases slightly. Thailand represents an intermediate case between the two countries. Because an increase in current account surplus indicates corresponding capital outflow, the impact on domestic investment is a large18.3 % decline in Korea and a relatively minor 4.1 % fall in Malaysia.

With regard to the impact on real GDP, Malaysia had the highest 5.6 % as a decline in investment is modest in spite of a small rate of increase in external demand. In Korea, the impact is smaller 4.6 % because a significant boost in external demand accompanies a large fall in investment. The impact is the smallest 3.8 % in Thailand among the three countries.

(3) Case of Import Constraint

In this model, intermediate goods, investment goods and consumption goods respectively consist of domestic goods and imported goods, which are assumed to be incomplete substitutes, following Armington assumption. Their proportions are determined by CES production functions.

Take intermediate inputs as an example. Let *SIGMA1(c)* be the value of Armington elasticity between domestic goods and import goods, the relationship between quantities demanded for domestic goods and import goods as *x1(c,s,i)*. Then the combined demand (*x1_s(c,i)*) will be expressed as equation 3-1, where *p1(c,s,i)* is the respective prices of domestic goods and import goods, and *p1_s(c,i)* is the combined price.

$$x1(c,s,i) = x1\_s(c,i) - SIGMA1(c) * [p1(c,s,i) - p1\_s(c,i)] \quad (3\text{-}1)$$

In other words, the rates of change of demand for domestic and import goods are obtained as follows. The rate of change of the combined demand minus the difference between the prices of domestic and import goods and the combined price multiplied by the Armington elasticity. This is also true for investment goods and consumption goods.

In this case, the Armington elasticities between domestic and import goods for intermediate goods, investment goods, and consumption goods were set twice the standard values. Since the prices of import goods rise due to exchange rate depreciation, demand for domestic goods will increase and import goods decrease. But by doubling the value of substitution between imports and domestic goods, adverse effect on imports is exaggerated.[14]

The economic impact in this case is basically similar to that of the standard case, but substitution by domestic products was more pronounced due to import difficulties, and thus the decrease in imports was greater than in the standard case. Even in Malaysia, which showed a 2.0 % increase in the standard case, imports fell by 2.3 %. Since there was less reliance on import goods whose price increased sharply, production prices for export goods edged lower in Korea and Malaysia. This resulted in a larger increase in export compared with the standard case.

In comparison with the standard case, the rate of decrease of import goods was larger so that the ratio of current account surplus to GDP rose by around 4 %. Therefore, external demand made higher contribution to economic growth. Capital outflow will also increase to the extent that the current account surplus increases. This will have a stronger impact on investment, as the magnitude of decrease widens.

Therefore, whereas external demand makes a sig-

14 Among NIES and ASEAN countries, there are cases where domestic substitutes for import goods are not produced. Under such circumstances, production activities will halt if parts cannot be imported. In fact, there were many companies that suspended operations in the wake of the crisis because they could not procure imported intermediate goods. Such a strict condition is not applied in this simulation due to the technical restriction of the model.

nificant contribution, the decline in investment and other domestic demand component is greater, and thus the overall impact on real GDP is 0.4-0.8 % smaller than the standard case.

(4) Case of Lower Return on Capital

In this model, the following equation sums up the relation between the rate of change of current return on capital (*r1cap(i)*), the rate of change of the rental price of capital (*p1cap(i)*), and the rate of change of the price of investment goods (*p2tot(i)*).

$$r1cap(i) = 2.0 * (p1cap(i) - p2tot(i)) \qquad (3 - 2)$$

In other words, the rate of change of current return on capital is two times the difference between the rate of change of the price of investment goods and the rate of change of the rental price of capital, i.e., the rate of change of gross return on investment. The multiplier 2.0 represents the ratio of gross profit to net profit (gross profit minus depreciation).

Assume that the rate of change of fixed capital formation for industry *i* is *x2tot(i)*, the rate of change of its capital stock *x1cap(i)*, and global return on capital omega. Then, investment behavior of the industry is expressed by,

$$x2tot(i) - x1cap(i) = 0.33 * [r1cap(i) - omega] \qquad (3 - 3)$$

This equation indicates that investment is allocated according to relative change in profitability in specific industry, multiplied by an elasticity of 0.33.[15]

In the case of lower return on capital, in addition to the assumptions made in the previous case, the current return on capital, or *r1cap(i)*, is assumed to decrease by 10 % across all industries. The simulation results shows that the rise in capital rental price is around 10 % points lower than the standard case and import restraint case, thereby curbing an increase in general domestic prices.

With regard to the impact on trade, more restrained upward pressure on domestic production cost of export goods will lead to an increase in export volume by 37.4 % in Korea, 14.6 % in Malaysia, and 22.9 % in Thailand. On the other hand, because the relative price differential between domestic and import products increases, import volume will decrease by 27.8 % in Korea, 16.4 % in Malaysia and 34.3 % in Thailand. As a result, the ratio of current account to GDP will change, generating a significant surplus of 19.5 % in Korea, 23.8 % in Malaysia, and 24.5 % in Thailand.

In the case of lower return on capital, the rise in prices is not just lower than in the standard case. But income generated from capital has to decrease relative to the two previous cases to the extent that the rental price of capital decreases (the rise in rental price of capital is curbed). For this reason, not only the allocation on investment decreases sharply but consumption will also decrease due to a fall in income, resulting in a large decline in domestic demand. Real GDP increases by 1.0 % in Malaysia. But it decreases by 1.4 % in Korea and 0.6 % in Thailand because negative contribution by domestic demand exceeds positive contribution by external demand.

(5) Effects on Industries

Exchange rate depreciation, results in an increase in export volume due to lower export prices, and a decrease in import volume due to higher import prices. Because of capital outflow and concentration of resources in the production of export goods, investment activities will mark a sizeable fall.

While such is the macroeconomic effect, the impact of depreciation varies by industry because the input-output and the trade structure differ for each industry (Table 8).

First, the impact will vary, depending on whether the industry's production is oriented toward domestic or external demand. The higher the weight on external demand, the higher the rate of increase of production. However, changes in export volume heavily depend on changes in the cost of its domestic production. The change in production cost is deeply associated with the input structure. And since the in-

15 The equation, Saving-Investment Differential = Current Account Surplus, is used to calculate the total amount of fixed capital formation in one country.

Table 8 Changes in Output due to Exchange Rate Depreciation in External & Domestic Market-Oriented Industries

(%)

	Standard case		Case of import constraint		Case of lower return on capital	
	External	Domestic	External	Domestic	External	Domestic
Korea	3.2	2.8	3.6	2.3	3.7	−2.4
Malaysia	4.2	1.9	4.7	1.0	5.8	−4.8
Thailand	2.9	1.4	3.2	0.9	4.6	−3.8

Note: Results of model simulations. Impact of 33% currency depreciation. Figures for external demand-oriented industry is a total for mining and manufacturing industries with over 25% export ratio. Domestic demand-oriented industry is a total for all other industries. External demand-oriented industry in Korea includes textiles/apparel, automobiles, other transport equipment, electric machinery, and general machinery; in Malaysia, mining, food, textiles/apparel, chemicals, metals, other transport equipment, electrical machinery, general machinery, and other manufacturing industries, and in Thailand, mining, food, textiles/apparel, chemicals, other transport equipment, electrical machinery, general machinery, and other manufacturing industries.

crease rate of the price of imported intermediate goods are greater than that of domestic intermediate goods, the greater the proportion of imported intermediate inputs, the higher its production cost, leading to a smaller increase in export volume.

Even though import prices increase, import volume will not decrease for all products. The structure of the model is such that if the relative price on imports increase, then their shares in intermediate goods, investment goods and consumption goods will decrease. However, If absolute quantities demanded for these goods increase, the import volume of individual goods will not necessarily decrease. Especially since the production function has the Leontief-type fixed input structure, demand for intermediate inputs will also increase in industries where production increases together with exports. Thus despite a fall in the share of imports, it is not rare to see cases where import volume increase. In Malaysia, as mentioned earlier, the overall import volume increased under the standard case.

Since productive resources are concentrated on the production of export products, investment activities will drop sharply across all industries. As a result, production will fall substantially in industries whose output has a high share of investment goods.

(6) Rapid Recovery after the Crisis

The Asian economies made a significant turnaround during the 1997-98 period, with the ratio of current account balance to GDP shifting from -1.7 % to 12.8 % in Korea, from -5.1 % to 13.0 % in Malaysia, and from -2.1 % to 12.7 % in Thailand. In 1998, however, due to a major drop in domestic demand including consumption and investment in the private sector, the real economic growth rate posted -6.7 % in Korea, -7.5 % in Malaysia, and -10.2 % in Thailand. Then again, entering 1999, the real growth rate showed a steep gain against the initial forecasts of slow recovery, with 10.7 % in Korea, 5.4 % in Malaysia and 10.2 % in Thailand. The major engine of this strong growth was exports that showed a hefty increase due to the depreciation of the local currencies. It may be also attributable to a boost in exports of electrical and electronic machinery supported by the ongoing Information Technology (IT) revolution, as well as expanding export demand driven by the bustling US economy.

As the simulation showed, domestic demand plunged at the time of the crisis, offsetting the benefits brought about by the exchange rate depreciation. However, once the confusion subsides and production activities are back on a normal track, the export-lead growth materializes. Nonetheless, this recovery is heavily leaning on the export sector; while the export-oriented industry shows a robust growth, the domestic market-oriented sector posts only a small increase. Further, the effects of export expansion and currency depreciation may be short-lived, since they are effective only when the real exchange rate depreciates, i.e., when the price level stays unchanged despite a fall in the nominal exchange rate. However, they will be-

come ineffective once the real exchange rate gets back to the former level due to price hikes.

CHAPTER 3 THE EFFECTS OF DECLINING INVESTMENT/GDP RATIO

1. TRENDS IN INVESTMENT RATIO AND SAVING RATIO AFTER THE ASIAN CRISIS

Capital stock accumulated during the high economic growth period in East Asia, which increased the capacity of output, and there is no doubt that this trend provided underpinnings for high economic growth in the region.[16]

East Asia is unique for its high investment ratio to GDP, and also for the high saving ratio that supports its investment (Table 9). The high saving ratio can be attributed to 1) an increase in income resulting from rapid economic growth, and 2) inflation reined in by macroeconomic economic stabilization policies, which kept real interest rate positive, giving an incentive to saving. In the area of financial system, 1) efforts were made to ensure the stable banking system in order to keep depositors' confidence in the financial institutions, and 2) the postal savings system was developed to accommodate small-sum depositors and rural depositors. The high investment ratio can be attributed to the robust investment demand generated by the stable macroeconomy and rapid growth, and a strong drive by governments of various policies to promote investment. For example, the governments took to policy lending by establishing financial institutions to provide financing to agriculture and small- and medium-sized enterprises, and development banks to meet long-term financing needs. They also adopted a tax policy to increase corporate internal reserves and thus investment. And by limiting the outflow of capital, the government channeled domestic savings into investment, curbed the interest rate on deposit and thus the lending rate. Tariff and foreign exchange policies also kept down the relative price of investment goods and capital equipment, inducing investment activities.

After the Asian currency crisis, domestic demand

Table 9 Ratio of Investment & Savings to GDP Before & After the Asian Crisis

(%)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Korea	Saving Ratio	37.2	37.2	36.3	36.0	35.0	35.2	33.7	33.1	42.3	34.1	30.9	27.9
	Investment Ratio	37.7	39.9	37.3	35.5	36.1	37.0	38.4	35.0	29.0	27.3	28.5	27.2
	Difference	-0.5	-2.7	-1.0	0.5	-1.1	-1.8	-4.7	-1.9	13.3	6.8	2.4	0.7
Indonesia	Saving Ratio	32.3	33.5	35.3	32.5	32.2	28.5	27.3	29.9	19.1	18.5	15.2	18.0
	Investment Ratio	30.7	32.0	32.4	29.5	31.1	31.9	30.7	31.3	18.0	17.5	13.0	17.5
	Difference	1.6	1.5	2.9	3.0	1.1	-3.4	-3.4	-1.4	1.1	1.0	2.2	0.5
Philippines	Saving Ratio	33.4	33.5	36.5	37.7	39.6	39.7	42.9	37.3	39.6	37.7	35.4	35.0
	Investment Ratio	31.2	37.2	35.1	37.8	41.2	43.6	41.5	42.9	26.7	23.7	24.1	25.0
	Difference	2.2	-3.7	1.4	-0.1	-1.6	-3.9	1.4	-5.6	12.9	14.0	11.3	10.0
Thailand	Saving Ratio	34.3	36.1	36.0	34.9	34.6	33.4	33.6	32.4	39.3	36.4	36.3	36.0
	Investment Ratio	41.4	42.8	40.0	39.9	40.2	41.4	41.7	33.2	26.1	26.8	30.4	33.0
	Difference	-7.1	-6.7	-4.0	-5.0	-5.6	-8.0	-8.1	-0.8	13.2	9.6	5.9	3.0

Sources: Figures through 1999 are from *World Development Indicators*, World Bank, figures for 2000 and 2001 are estimates using *Asian Development Outlook 2000*, Asian Development Bank. The investment ratio is the ratio of domestic fixed capital formation (gross domestic fixed capital formation in Indonesia) to GDP. The saving ratio is the ratio of gross domestic savings (nominal GDP – total consumption expenditure) to GDP.

16 Economic Planning Agency (1999) said "There are different views on the extent of contribution that technical progress and economic efficiency had on high economic growth in East Asia. However, the contribution ratio to total factor productivity averages around 20 %, and it is agreed that increase of capital stock and labor had a significant contribution on economic growth."

Table 10 Capital Stock Growth Rate

(%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Korea	14.2	14.0	11.5	10.6	10.7	10.9	10.3	9.2	3.0	5.8	6.7	6.1
Indonesia	8.7	9.3	8.5	8.3	8.9	9.8	10.2	10.0	1.8	-0.9	-0.2	1.8
Malaysia	9.1	10.7	10.6	11.2	12.1	13.3	12.7	12.1	6.3	5.0	5.2	5.7
Thailand	13.2	13.1	12.1	11.6	11.6	11.6	10.7	6.9	2.9	3.2	4.4	5.2

Note: Estimated from *World Development Indicators*, World Bank and *Asian Development Outlook 2000*, Asian Development Bank. Capital stock was estimated in the same way of the footnote No.9.

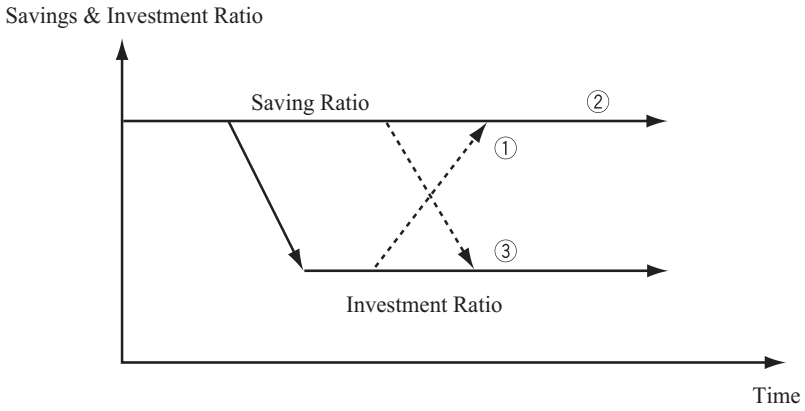
and, in particular, capital investment declined sharply. If economic recovery triggers investment activities to return to pre-crisis levels, then we can say that the Asian currency crisis was just a temporary slump and was not a threat to the potential growth of the Asian economies. However, if investment sentiment were slow to recover due to the collapse of the bubble economy and delays in addressing non-performing loans, then this would have a significant effect on the Asian economies because they relied primarily on capital accumulation, especially physical capital, among other factors, for economic growth. If such is the case, we cannot deny the possibility that they might come closer to a situation where, like Japan after the first oil crisis, there will be a slowdown in high investment ratio of the rapid economic growth period, moving the economy to the moderate growth path.

When comparing the ratio of fixed capital formation to GDP (investment ratio) between 1996 and 1998, namely before and after the crisis, it declined about 9 to 15 percentage points in major Asian countries-from 38.4 to 29.0 % in Korea, from 41.5 to 26.7 % in Malaysia, from 41.7 to 26.1 % in Thailand, and from 30.7 to 18.0 % in Indonesia. On the other hand, when the ratio of savings (which is GDP minus consumption) to GDP for the same period fell sharply in Indonesia from 27.3 to 19.1 %, but increased from 33.7 to 42.3 % in Korea, and from 33.6 to 39.3 % in Thailand. And a decline in Malaysia was small-from 42.9 to 39.6 %. Further, estimates based on figures from the Asian Development Bank (2000) indicate that the investment ratio that dropped sharply after the Asian currency crisis is showing some resilience from 2000 to 2001 in Thailand and Indonesia, but figures for Korea and Malaysia remained low and have yet to recover (Table 9).

The rate of growth of capital stock is shown in Table 10. In the first half of the 1990s, annual average of capital stock growth rate remained high at around 9 % in Indonesia and 11 to 12 % in Korea, Malaysia and Thailand. But this rate has slowed down as investment level dropped sharply after the Asian currency crisis. Although the rate showed a moderate increase in 1999 to 2001, it is still 0 to 2 % in Indonesia, and 4 to 6 % in Korea, Malaysia and Thailand. Therefore, if the contribution of capital input is calculated assuming that the ratio of added-value to capital is one third, the contribution of capital stock to growth will drop by 2 to 3 percentage points across the countries-from around 4 % before the crisis to 1 to 2 % after the crisis in Korea, Malaysia and Thailand, and from around 3 % to between 0 and 1 % in Indonesia.

However, the contribution of capital stock only affects medium- to long-term potential growth. It should be noted that if a wide gap between supply and demand, changes in the capacity utilization and durable periods of capital equipment are taken into consideration, a slowdown in the growth rate of capital stock should not immediately lead to lower growth. The Asian economies are said to have experienced a large deflationary gap due to negative growth in 1998. The effects of slowdown in the capital stock growth would only surface after the deflationary gap were narrowed. Since 1999, the economies have shown a V-shaped recovery at a faster pace than expected, and the current situation would not pose a problem if economic growth leads to higher investment, as in the pre-crisis period. However, if smooth progress is not

Figure 11 Evolution After the Asian Currency Crisis



made in structural reform and disposal of non-performing loans, which would hamper investment, then we may see some adverse effects in the future.

2. MODEL SIMULATION

This section analyzes the effects of a declining investment ratio on the Asian economies. Three patterns may be considered as shown in Figure 11, if we draw on different experiences during the Asian currency crisis. Initial decline in the investment ratio is common in all three patterns. In the first case, the investment ratio declines but recovers shortly afterwards (① in Figure 11). This may be considered a pattern associated with ordinary business cycles. In the second case, the investment ratio drops, whereas the saving ratio remains unchanged (②). Malaysia and Thailand fit this pattern. In the third case, the investment ratio drops and the saving ratio follows suit (③). Indonesia falls on this pattern.

In the first case, however, analysis is difficult because it is a static model where we can grasp the change from one equilibrium point to another, but cannot describe the process in between. Therefore, this section will focus on the second and the third case.

First, let us consider case 2 where the investment ratio falls but the saving ratio remains unchanged. Here a fall of the investment ratio by one percentage point is considered. As seen in Chapter 2, in the ORANI-G Model, the rate of change in nominal household consumption demand is the sum of the rate of change in nominal GDP and a shift variable with respect to household consumption; and real government consumption is linked to real household consumption expenditure (see equations 2-1 and 2-3).

If the shift variable of household consumption is zero, then the nominal consumption growth rate is equal to the nominal GDP growth rate, with the consumption ratio and saving ratio unchanged. Further, since the difference between savings and investment is, by definition, equal to the current account surplus, reduction in the investment ratio is brought about by an exogenous increase in the current account balance to GDP ratio by one percentage point. In case 3, the saving ratio and the investment ratio both decline. We will examine a case where both variables fall by one percentage point. First, the saving ratio may decline if the consumption ratio increases . One percentage point increase in the consumption ratio may be brought about by an exogenous shock to the shift variable (*f3tot*). As shown in the simulation in Chapter 2, its values may be obtained, using equation 2-3: 1.55 % in Korea, 1.46 % in Indonesia, 1.79 % in Malaysia and 1.56 % in Thailand. Further, since the difference between savings and investment is the current account surplus, the saving ratio and the investment ratio may be lowered by the same amount if the ratio of change in the current account to GDP is exogenously fixed. It differs from Chapter 2 in that the current account will change exogenously. Whereas the saving ratio fell, but the investment ratio did not decline in Chapter 2, the investment ratio also declines in this case, lead-

ing to a completely different result.

The model was closed in following manner. In order to compare the short-term effect against the long-term effect, a simulation was carried out for the case that includes capital accumulation effect in which induced investment increases capital stock, leading to an increase in production (long-term effect); and for the case that does not include this type of capital accumulation effect (short-term effect). As mentioned, changes in the current account balance were considered an exogenous variable. Also, the country's labor input was fixed, while wages were endogenous. Foreign prices were fixed.

(1) Short-Term Effect (without the capital stock accumulation effect)

First, let us look at the short-term effect (without the capital stock accumulation effect) (Table 12). The investment will decline with a fall in the investment ratio, but depressed investment flow does not necessarily affect capital stock adversely. It may be considered that this case looks at the short-term effect assuming that the decrease in investment can be offset by changes in the capacity utilization rate and so forth.

The effect of one percentage point decline in the investment ratio will spread as follows. First, the fall in the investment ratio will result in a sharp drop in investment by 3.1 % in Korea and Malaysia, 3.8 % in Indonesia and 2.6 % in Thailand. The lower investment level will lead to lower domestic demand and a decline in the price level. The GDP deflator will decrease by 1.4 % in Korea, 1.5 % in Indonesia, 0.4 % in Malaysia and 0.5 % in Thailand. The export prices also declined by 1.0 % in Korea, 1.1 % in Indonesia, 0.3 % in Malaysia and 0.5% in Thailand, and since import prices are fixed unchanged, exports will increase and imports will decrease in volume, leading to current account surplus. Since export prices will drop and import prices are fixed, the terms of trade will worsen, the level of domestic welfare will drop, and consumption will decrease slightly. Therefore,

Table 12 Effect of Fall in Investment Ratio (Short-Term Effect)

(%)

	Only Investmenht ratio decline				Investment & Saving ratio decline			
	Korea	Indonesia	Malaysia	Thailand	Korea	Indonesia	Malaysia	Thailand
(Change of quantity)								
GDP	−0.1	0.0	0.0	−0.1	0.0	0.0	0.0	0.0
Household consumption	−0.4	−0.3	−0.2	−0.3	1.5	1.4	1.9	1.6
Capital formation	−3.1	−3.8	−3.1	−2.6	−2.5	−3.2	−2.7	−2.2
Government consumption	−0.4	−0.3	−0.2	−0.3	1.5	1.4	1.9	1.6
Export	2.7	2.9	0.7	1.1	−0.4	−0.4	−0.2	−0.4
Import	−1.4	−1.9	−0.7	−1.5	−0.2	−0.3	−0.1	−0.2
(Change of price)								
GDP	−1.4	−1.5	−0.4	−0.5	0.3	0.3	0.1	0.2
Household consuption	−1.0	−1.3	−0.2	−0.3	0.3	0.3	0.1	0.1
Capital formation	−0.9	−1.2	−0.2	−0.3	0.1	0.1	0.1	0.1
Government consumption	−1.3	−1.2	−0.3	−0.5	0.2	0.1	0.1	0.2
Export	−1.0	−1.1	−0.3	−0.5	0.2	0.2	0.1	0.2
Import	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change of current account/GDP	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0
Labor input	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capital input	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wage	−1.6	−1.9	−0.7	−0.7	0.2	0.2	0.2	0.5
Rental price	−1.4	−2.0	−0.5	−0.6	0.2	0.2	0.2	0.1

Note: Results of model simulation. Effect of one percentage point fall in the investment ratio only and in both investment ratio and saving ratio. A change in the investment ratio does not affect total capital stock.

Table 13 Effect on Production in the Asian Countries (Short-Term Effect)

(%)

		Agriculture	Mining	Manufacturing	Electricity	Construction	Services
Only investment ratio decline	Korea	0.1	0.5	0.8	0.3	−2.8	0.0
	Indonesia	0.4	0.8	1.0	0.0	−3.6	−0.2
	Malaysia	0.1	0.1	0.4	0.1	−2.8	−0.1
	Thailand	0.2	0.2	0.2	0.1	−2.6	0.0
Both investment and saving ratio decline	Korea	0.3	−0.6	−0.4	0.2	−2.3	0.7
	Indonesia	0.2	−0.2	−0.1	0.8	−3.0	0.6
	Malaysia	0.0	−0.1	−0.1	0.4	−2.5	0.5
	Thailand	0.1	−0.1	−0.3	0.5	−2.1	0.5

Note: Results of model simulation. Effect of a single one percentage point decline in the investment ratio, and one percentage point decline in both investment ratio and saving ratio. A change in the investment ratio does not affect total capital stock.

real GDP will decline by a small amount.

Next, the effect of one percentage point decline in both investment ratio and saving ratio will spread as follows. First, investment will fall sharply by 2.5% in Korea, 3.2 % in Indonesia, 2.7 % in Malaysia, and 2.2 % in Thailand. However, since the saving ratio also declines and the consumption ratio increases in this case, household consumption will increase by 1.5 % in Korea, 1.4 % in Indonesia, 1.9 % in Malaysia, and 1.6 % in Thailand. In other words, the proportion of the components of final demand will shift from investment demand toward consumption demand, and any effect that changes domestic demand is neutralized. Therefore, unlike the above case where only the investment ratio declines, the prices do not necessarily fall. On the other hand, a trend toward service economy will accelerate with higher consumption, and demand for factors of production will rise, resulting in upward pressure on GDP deflator, which will rise by 0.3 % in Korea and Indonesia, 0.1 % in Malaysia, and 0.2 % in Thailand. Export prices will also increase in these countries, thus the terms of trade will become more favorable, the level of domestic welfare will not fall, and the effect on real GDP will be almost nil.

If we compare the first case of a single decline in the investment ratio with the second case of a decline in both investment ratio and saving ratio, there is no significant change in real GDP, but there are significant differences in changes in production volume among industries (Table 13). First, in the case of a single decline in the investment ratio, investment will decrease, while exports will increase; therefore production will decrease in the construction industry that primarily produces investment goods, but production will increase in the manufacturing industry since export goods account for a large part of its output, and output will barely increase in the service industry. On the other hand, in the case with a decline in both investment ratio and saving ratio, investment will decrease and consumption will increase. Here, production will decrease in the construction industry, as in the above case, but output will increase in the service industry due to a large proportion of consumer goods in its output, and production will decrease in the manufacturing industry.

(2) Long-Term Effect (with the capital stock accumulation effect)

This section will look at the long-term effect (with the capital stock accumulation effect) (Table 14). This simulation takes into consideration the effect from capital accumulation: induced investment increases capital stock and leads to an increase in production. Here, investment will decline with a fall in the investment ratio. Since a decline in investment flow will lead to a decline capital stock, long-term effect will prevail.

The effect of a single one percentage point decline in the investment ratio will spread as follows. First, a decline in the investment ratio will result in a sharp drop in investment: 5.3 % in Korea, 7.7 % in Indonesia, 4.5 % in Malaysia and 5.9 % in Thailand. Due to the lower investment level, in the long-term, capital stock and investment will drop by the same rate, which will lead to a decline in supply capacity.

Table 14 Effect on the Economy of Fall in Investment (Long-Term Effect)

(%)

	Only Investment ratio decline				Investment & Saving ratio decline			
	Korea	Indonesia	Malaysia	Thailand	Korea	Indonesia	Malaysia	Thailand
(Change of quantity)								
GDP	−2.6	−4.0	−2.5	−4.1	−2.1	−3.4	−2.2	−3.4
Household consumption	−2.6	−3.6	−2.0	−3.6	−0.3	−1.4	0.3	−1.2
Capital formation	−5.3	−7.7	−4.5	−5.9	−4.3	−6.6	−4.0	−5.0
Government consumption	−2.6	−3.6	−2.0	−3.6	−0.3	−1.4	0.3	−1.2
Export	−0.1	−1.4	−2.0	−2.7	−2.6	−3.9	−2.6	−3.6
Import	−3.0	−4.5	−2.5	−3.8	−1.6	−2.5	−1.7	−2.1
(Change of price)								
GDP	−0.4	1.1	1.2	1.1	1.1	2.5	1.5	1.5
Household consumption	−0.5	0.7	0.6	0.6	0.8	2.0	0.8	0.8
Capital formation	−0.1	1.3	0.4	0.8	0.8	2.3	0.6	0.9
Government consumption	−1.2	1.7	0.2	−0.2	0.3	2.7	0.5	0.5
Export	0.1	0.6	0.8	1.1	1.0	1.6	1.0	1.5
Import	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change of current account/GDP	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0
Labor input	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capital input	−5.6	−8.1	−4.6	−6.0	−4.5	−7.0	−4.1	−5.1
Wage	−2.6	−1.6	−0.6	−2.2	−0.6	0.5	0.3	−0.9
Rental price	2.6	6.0	3.9	3.1	3.4	7.1	4.1	3.2

Note: Results of model simulation. Effect of a single one percentage point decline in the investment ratio, and a one percentage point decline in both investment ratio and saving ratio. A change in the investment ratio is directly translated into a change in total capital stock.

While a sharp drop in imports will lead to current account surplus, real GDP will also decline by 2.6 % in Korea, 4.0 % in Indonesia, 2.5 % in Malaysia and 4.1 % in Thailand.

The effect of one percentage point decline in both investment ratio and saving ratio is similar to the above case: investment will decline by 4.3 % in Korea, 6.6 % in Indonesia, 4.0 % in Malaysia and 5.0 % in Thailand, with capital stock level declining respectively. However, a rise in the consumption ratio will limit change in household consumption to a decline of 0.3 % in Korea, 1.4 % in Indonesia, an increase of 0.3 % in Malaysia and a decline of 1.2 % in Thailand. Therefore, the drop in real GDP will be smaller compared with the above case where only the investment ratio declined. GDP would decline by 2.1 % in Korea, 3.4 % in Indonesia, 2.2 % in Malaysia and 3.4 % in Thailand.

In summary, if we consider the short-term effects where a drop in new investments can be offset by a change in capital utilization rate and so forth, the effect on GDP is almost neutral. But if we consider the long-term effect including the effect of capital stock accumulation, the negative effect on GDP will be greater for each country. Even in the latter case, however, the negative effect can be alleviated when the consumption ratio increases rather than when capital outflow occurs with current account surplus.

With regard to the effect on industries, the short-term effect will lead to an increase in production in some industries and a decrease in others. In particular, when both investment ratio and saving ratio decline, production will decrease in the manufacturing industry and increase in the service industry, indicating a trend toward service economy. However, if a decline in the investment ratio continues and eventually affects the level of capital stock, production will decrease across all industries even if there may be some variation in the extent of decrease among different industries, regardless of whether the saving ratio falls or not (Table 15). Although in the short-term, the service industry will benefit from drop in the in-

Table 15 Effect on Industries of Fall in Investment (Long-Term Effect)

(%)

		Agriculture	Mining	Manufacturing	Electricity	Construction	Services
Only investment ratio decline	Korea	−0.5	−1.8	−2.1	−2.7	−5.1	−2.8
	Indonesia	−1.4	−1.8	−4.0	−4.3	−7.5	−4.6
	Malaysia	−1.0	−1.5	−2.7	−2.7	−4.3	−3.0
	Thailand	−0.7	−2.4	−4.6	−4.0	−5.8	−4.1
Both investment and saving ratio decline	Korea	−0.3	−2.5	−2.7	−2.3	−4.1	−1.6
	Indonesia	−1.3	−2.4	−4.3	−2.8	−6.4	−3.1
	Malaysia	−1.0	−1.5	−2.9	−2.1	−3.8	−2.2
	Thailand	−0.7	−2.3	−4.3	−3.1	−4.9	−3.0

Note: Results of model simulation. Effect of a single one percentage point decline in the investment ratio, and one percentage point decline in both investment ratio and saving ratio. A change in investment ratio is directly translated into a change in total capital stock.

vestment ratio and the saving ratio, their prolonged decline will also affect it in term of decreased level of capital stock. Naturally the impact will vary, depending on the degree of change in the saving ratio.

CONCLUSION

This paper used an applied general equilibrium model and examined how several changes in the conditions in the East Asian region had impacts on these economies and their industrial structures before and after the currency crisis.

If one uses a theoretical model, it is only possible to know whether a variable would take a positive or negative direction. An applied general equilibrium model, however, has a major advantage in that numerical information can be fed into it, thus allowing us to examine not only the direction but also the extent of change. Further, when one economic measure produces a positive effect on a certain variable while another has a negative effect, the theoretical model may fail to grasp even the direction of its change resulting from their combined effect. An applied general equilibrium model, on the other hand, may capture the combined effect of different measures because it can account for the quantity of change. In cases where there is theoretical knowledge but it is hard to figure out how the economy would evolve in the realistic setting, an applied general equilibrium model is a powerful tool for making simulation experiments. In particular, it is a tool befitted to the analysis of growth in East Asia where the industrial sector may be further divided into many industries and structural change is deeply involved in the process of economic growth.

Until the currency crisis broke out in 1997, East Asia had sustained high growth for a long period. The export-led industrialization, for which the region's economies strived, linked an increase in the supply that makes use of domestic surplus resources with rising export demand, thereby contributing to the economic success of East Asia. Since foreign demand was much larger than the economic scale of the region, the constraint to growth imposed by inadequate domestic demand was removed. In the area of labor supply, there was cheap and abundant surplus labor in the agricultural sector, and the quality of labor force improved significantly because of the better primary education system. In the area of capital stock accumulation, resources were allocated intensively to the manufacturers of export goods by using all available means, while the promotion of direct investment accelerated inflows of foreign capital and technology.

Resources are not infinite, however, and growth driven by increased factor inputs, which characterized East Asian economic growth, has to face a major turning point. In ASEAN countries, increased factor inputs largely contributed to economic growth and we could not confirm that labor input lost steam before the crisis. In contrast, expansion in labor input markedly slowed down among NIES from the mid-1980s and, in particular, in the manufacturing sector, it came to a complete halt.

Chapter 1 looked into whether export-led industrialization is sustainable, and shed light on the mechanism of transition from industrialization to a service economy. As economy expands, a labor surplus economy evolves into a labor shortage economy, causing upward pressure on the wage level. If wages rise faster than growth, so does the household income with increasing labor share in income distribution, thus rapidly boosting demand in the service sector. The wage hike will also undermine the international competitiveness of the labor-intensive manufacturing sector, which, in turn, will put a brake on export growth. A rise in the allocation of income for the household will trigger a dramatic move for the service industries, since structure differs greatly between consumption demand, which has a large share of the service sector, and the export demand, which is dominated by goods.

The extent of the pressure for expanding the service sector varies from country to country. It is strongly felt in NIES. If exports are to increase under such circumstances, the focus of resource inputs should shift from labor, whose cost has risen, to capital; output should increase with fewer inputs by improving productivity; and competitive edge should be maintained by curbing a rise in prices. To sustain the export-led industrialization, such a "gear-shift" was necessary.

In the second half of the 1980s and thereafter, Korea sought to expand exports by pursuing the economies of scale. As a result, capital inputs rose in the manufacturing sector, leading to a rise in TFP. However, since TFP growth in the service sector remained low, the export sector had to raise its level of investment and productivity. The ratio of investment to GDP thus increased despite the higher share of consumption and lower saving ratio, which brought about excessive reliance on capital inflows from overseas. One cannot deny the possibility that this led to the Asian currency crisis. NIES have already entered the stage where even greater significance should be attached to how to convert the stimulus from domestic demand to economic growth. Productivity should have increased not only in the export goods industries but also in the domestic goods industries and in particular the service sector in order to achieve a well-balanced growth.

The currency crisis that erupted in the summer of 1997 in Thailand spread later to Korea, Indonesia, Malaysia and the Philippines. These countries could not sustain capital inflows, and thus drastic capital outflows, largely short-term funds, took place. The exchange rates also depreciated on a massive scale. Ironically, capital movements from overseas that had underpinned the robust growth until then became a background of the crisis. Economies previously admired worldwide for high growth exposed a number of vulnerabilities, bringing a turnaround toward substantial negative growth in 1998. Entering 1999, however, the economies affected by the currency crisis rebounded and registered V-shaped recoveries well beyond the expectations. Capital outflows after the crisis caused exchange rate depreciation, which affected the financial sector adversely with soaring nonperforming assets but contributed to the economy through an increase in exports with additional help from the bustling US economy and a global increase in IT demand.

Chapter 2 examined the impact of exchange rate depreciation on individual economies and how much contribution it has made to their economic recoveries. According to the simulation, once the crisis phase, where investment returns suffer an extreme decline, passes and the economy is back to the normal phase, the exchange rate depreciation does have a significant effect. It should be noted, however, that the result was based on the assumption that there is no constraint in labor input and that the real exchange rate also depreciates, with the inflation rate less than the rate of nominal exchange rate depreciation. Because of the recession immediately after the crisis, the gap between supply and demand widened; the capacity utilization rate fell; and unemployment soared. This situation largely helped firms to hire employees without raising the wage level during the recovery period. As the deflation gap is being eliminated and wages rise, the depreciated nominal exchange rate will gradually lose its effect. In this sense, the effect of exchange rate depreciation should be considered only temporary.

Chapter 3 dealt with the effect of changes in investment trends after the crisis, examining the im-

pact on potential growth when investment will not recover. Recently a increasing number of observers have come to hold a view that as a result of the V-shaped recovery, the Asian currency crisis is already behind us. To be sure, production and employment have surpassed the pre-crisis levels in some countries, and in this sense we may say that the crisis is over. But when we compare growth between the pre- and post-crisis period in detail, we will find its growth pattern vary greatly between the two periods.

In East Asia, there is no doubt that capital accumulation took place at a rapid pace during the high growth period, leading to greater supply capacity and ensuring fast growth. Brisk investment demand was supported by an increase in domestic saving and capital inflows from overseas. However, in the aftermath of the Asian currency crisis, investment suffered a precipitating fall from the previous high levels and international capital movements shifted from net inflow to net outflow. Growth after the crisis was mainly propelled by an increased contribution of foreign demand, with a substantially declined contribution of investment. One of the reasons for the fall in investment was the collapse of the bubble created by unprofitable investment in real estate; excessive investment in anticipation of high growth, which increased non-performing assets; and continued outflows of short-term capital by foreigners. The cost of disposing non-performing assets will eventually have to be paid out of GDP growth. Therefore, funds to be allocated to investments in other circumstances will likely be channeled to repay non-performing assets. In addition, both investors and recipients may well be very cautious about renewed inflows of short-terms capital for the foreseeable future, and capital outflows may not be halted. It is at least difficult to consider turning to overseas short-term funds for financing investment as in the mid-1990's.

The present pattern of growth may be summed up as a reaction to a steep fall due to the crisis, indicating that the economies are merely going through an adjustment period. They have not recovered in the sense that they have returned to the structure which enabled them to bring back the high growth of the pre-crisis period. If economic recovery triggered investment to return to previous highs, then the Asian currency crisis may only be seen as a temporary setback without posing a significant problem in the potential growth for the Asian economies. However, if investment motives do not recover as the countries face problems addressing the non-performing assets and the collapse of the bubble, its impact will be considerable on the Asian economies that have relied much on capital accumulation (especially physical capital) among factors for high economic growth. In the short run, this may not emerge as a distinct problem since a fall in investment growth is offset by increased foreign demand. But in the longer run, it may be considered that this will lead to a decline in potential growth rate. The first step toward new sustainable growth after the crisis is to make the maximum effort to reform economic structure in individual countries, particularly to strengthen their financial system by making further progress in addressing non-performing assets; to promote foreign capital inflows with a focus on increasing direct investments through deregulation as well as relaxation of regulations with respect to foreign businesses in the domestic market; and to improve the efficiency of business operations in the corporate sector.

REFERENCES

Asian Development Bank(2000) "Asian Development Outlook 2000"

Ban Kanemi, Otsubo Shigeru, Ono Minoru, et al. (1999) "Development of a Japanese AGE Model for Analysis of Regulatory Reform", Discussion Paper No. 89, Economic Research Institute, Economic Planning Agency

Economic planning Agency (1999) "Asian Economy 1999"

Economic planning Agency (2000) "Asian Economy 2000"

Takatoshi Ito, et al. (2000) "East Asian Economic Growth with Structural Change", The Economic Analysis No. 160, Economic Research Institute, Economic Planning Agency

Hertel T.W ed (1997) "Global Trade Analysis: Modeling and Applications", Cambridge University Press

J.M. Horridge, B.R. Parmenter and K.R. Peason (1998) "ORANI-G: A General Equilibrium Model of the Australian Economy" http://www.monash.edu.au/policy/oranig.htm

Paul Krugman (1994) "The Myth of Asia's Miracle", Foreign Affairs, November / December 1994

World Bank (1993) "The East Asian Miracle: Public Policy and Economic Growth", World Bank

World Bank (2000) "East Asia Brief", September 2000