Deepening Interdependence in the Asia-Pacific Region:

An Empirical Study Using a Macro-Econometric Model[♦]

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ABSTRACT

In this paper, we construct a macro-econometric model that captures the international production network developed over the Asia-Pacific region in order to quantify how the deepening interdependence affects economic activities in this region. The model includes monetary and currency policy rules to reflect the differing policy combinations observed in individual countries. We identify the paths through which economic shocks spill over the Asia-Pacific region via simulations and explore the effects of one country's policy shift on foreign countries as well as on itself.

I. INTRODUCTION

East Asia experienced high economic growth for a decade from the mid-1980s, an experience which has been called the "East Asian miracle" (Figure 1).[1] The growth rates in these countries, however, slowed down after the Asian Currency Crisis in 1997. The IT depression since 2001 caused their growth rates to deteriorate further, and this was exacerbated by the terrorist attacks in the US (September 11, 2001).

Although the magnitude of shocks partly explains the sharp drop in the growth rates in the East Asian countries in the late 1990s, it is more important to recognize how the economic structure of the Asia-Pacific region has itself played an integral role in reinforcing such shocks. A remarkable fact about economic developments in the 1980s' Asian economies is that the total exports and imports grew faster than the total production (Figure 2). More importantly, the intra-regional trade in East Asia grew more rapidly than the total trade. In fact, the share of intra-regional trade increased from 20 percent in 1980 to 38 percent in 2002 in East Asia (excluding Japan, Figure 3).[2]

The rapid expansion of intra-regional trade in East Asia reflects the speed at which international specialization has developed within this area. The East Asian economies have developed an international production network, in which they trade parts and intermediate goods back and forth and eventually export final goods to huge markets such as the US and Japan. This international dispersion of the production process is one of the main forces that drive the expansion of intra-region trade in the East Asian economies.[3]

The development of international specialization has merits and demerits for small economies like those in East Asia. By devoting their limited resources to narrow fields, they have been able to enhance the international competitiveness of the East Asian economies as a whole. The "East Asian Miracle" was achieved as the result of this mutually complementary growth among the East Asian economies, which grew as if

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[1] In this paper, we use "East Asia" to refer the NIES (South Korea, Hong Kong, and Singapore), the ASEAN (Thailand, the Philippines, Indonesia, and Malaysia), and China.

[2] The share of intra-East Asian trade, including Japan, out of the total trade volume in the area increased from 33 percent in 1980 to 48 percent in 2002.

[3] See Isogai, et al. (2002) for details on the recent intra-East Asia trade developments.

they were a single entity. Yet, this deepening of interdependence also worked as a mechanism for transmitting negative shocks experienced in one country all over the area. Economic turmoil was made worse by the fact that this East Asian international specialization has developed spontaneously and the institutions to govern it have yet to become fully evolved.

The relationship between Japan and East Asia has become closer in recent years. In fact, Japan's export share to East Asia increased from 22 percent in 1980 to 35 percent in 2002 (Figure 4-1), while Japan's import share from East Asia increased from 21 percent in 1980 and reached 37 percent in 2002 (Figure 5-1). In terms of its trade with Japan, East Asia has made itself as important as the US, with which Japan's trading volume has, since the World War II, been the largest of all its trading partners.[4] Japan has been involved in the East Asian production network, supplying parts and capital equipment to the East Asian economies and importing consumption goods from them. Therefore, understanding trade interdependence within East Asia is of great importance for Japan.

An increased intimacy among the Asia-Pacific economies has created an environment where one country's policymaking has substantial effects on others. In order to avoid another Asian currency crisis, the East Asian governments and central banks have involved themselves into monetary and currency policy reform aggressively. In fact, bilateral swap arrangements are actually promoted between the ASEAN countries under the *Chiang Mai Initiative*. From the empirical point of view, an introduction of currency basket peg policy into East Asia is an interesting issue. Some economists go further to discuss the possibility of an Asian single currency. Another hot issue is China's currency reform. As China achieves high economic growth, its *de facto* US dollar peg policy becomes a world concern and there are arguments over the desirability of China's policy shift to the free floating system.

The purpose of this paper is to construct a multi-country macro-econometric model that incorporates the East Asian production network discussed above and to quantify the effects of the area's deepening interdependence on economic activities. In Section II, we build the *Asian Economy Model*, which links ten countries – eight East

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[4] The relative expansion of the US share with Japan was not remarkable. The US share of Japan's total imports was 17 percent in 1980 and remained the same in 2002, while its share of Japan's total exports rose from 24 percent in 1980 to 29 percent in 2002.

Asian countries, Japan, and the US.[5] In Section III, we model a variety of monetary and currency policy combinations for the individual countries. Section IV examines the basic properties of the model via simulations. In Section V, we apply the model to analyze three current issues: the desirability of currency basket peg policy in East Asia, the anticipated effects of China's currency policy reform, and the non-negativity constraints on the Japanese nominal interest rates. Section VI concludes our discussion. Appendix A is a brief description of the monetary and currency policies in the East Asian countries. Appendix B contains the notes on the estimation and calibration of the model equations.

II.   BASIC STRUCTURE OF THE MODEL

In this section, we introduce the basic structure of the Asian Economy Model. The model comprises four building blocks: trade, production, prices, and policy rules.[6] We explain the first three here and postpone the policy issues until the next section.

A.   Trade

The core of the Asian Economy Model is a set of aggregate import functions for individual countries. Import growth rates are defined as follows:

$$\Delta \ln M_i(t) = \Sigma_{k=0}^{3} \alpha_{1ik} \Delta \ln X_i(t+k)$$
$$+ \Sigma_{k=0}^{3} \alpha_{2ik} \Delta \ln D_i(t-k) + \Sigma_{k=0}^{3} \alpha_{3ik} \Delta \ln RE_i(t-k), \quad (2\text{-}1)$$

where M_i denotes country i's aggregate imports, X_i its aggregate exports, D_i its domestic demand, RE_i its real effective exchange rate. Aggregates of imports, exports, and domestic demand are all real values and denominated in local currencies. The Δ is the first-difference operator.

Equation (2-1) is an orthodox aggregate import function in that aggregate imports depend on domestic demand and the real effective exchange rate. One characteristic of

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[5] The model covers ten economies: Japan, the US, Indonesia, Singapore, Thailand, the Philippines, Malaysia, South Korea, Hong Kong, and China. We also have the "rest of the world" in the model. The countries that are not treated explicitly in this paper constitute the "rest of the world" in our model.

[6] All in all, we have a macro-econometric model that consists of about 180 equations.

equation (2-1) worth thinking is the fact that exports affect imports. A large portion of East Asia's imports consists of parts and capital or intermediate goods, which are processed into high value-added intermediate or final goods and ultimately exported back out of the country. As a result, in a system where the international production network is so well developed, imports and exports are highly correlated. Another point that should be noted about equation (2-1) is that current imports are determined by future exports, reflecting that it takes time for imported intermediate goods to be exported after being processed.[7]

For simplicity, we fix import shares for each country. That is, we assume that other countries' respective shares of an individual country's imports are constant.[8] In this case, growth rates of bilateral imports are equal to those of aggregate imports.

$$\Delta \ln M_{ji}(t) = \Delta \ln M_j(t), \tag{2-2}$$

where M_{ji} denotes country j's imports from country i. The assumption of fixed import shares allows practitioners to save the time that it would take to estimate too many bilateral import functions. Moreover, the assumption is roughly supported by data in the short run. When a trade structure transforms rapidly, however, the assumption of fixed import shares appears unrealistic. In particular, confronted with the very rapid increase in China's share of Japan's imports since the 1990s, it is evident that we should take the model as only a rough approximation of reality.

Aggregate export functions are derived from the aggregate import functions. Denote country i's aggregate exports by X_i and country i's exports to country j by X_{ij}. Then one country's aggregate exports are given by $X_i(t) = \Sigma_j X_{ij}(t)$. Log-linearizing this relationship gives us

$$\Delta \ln X_i(t) = \Sigma_j \theta_{ij} \Delta \ln X_{ij}(t), \tag{2-3}$$

In equation (2-3), θ_{ij} is the share of country i's exports that go to country j ($\theta_{ij} = X_{ij} / X_i$), which is constant, as are import shares. Notice that country i's exports

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[7] Bayoumi (1996) used a VECM to analyze intra-Asia regional trade. His model includes export volume in the import functions and thus shares similar properties with our model. A difference is that our model uses lead variables for exports and we build a structural model. By using lead variables for exports, we incorporate the forward-looking factors into the model.

[8] This is a difference between our model and that of Kamada, et al. (1998). Their model is based on bilateral import functions.

to country j are equal to country j's imports from country i. Using equation (2-2), we finally obtain growth rates of aggregate exports as follows:

$$\Delta \ln X_i(t) = \Sigma_j \theta_{ij} \Delta \ln M_j(t), \tag{2-4}$$

which tells us that each country's export growth rate is an average of the growth rates of other countries' imports weighted by their export shares.

The real effective exchange rates, one of the explanatory variable in the import functions, are defined in terms of wholesale prices (or producer prices) so as to emphasize imports of production materials.[9] That is,

$$\Delta RE_i(t) = \{\Delta \ln WPI_i(t) - \Delta \ln E_i(t)\} - \Sigma_j \delta_{ij}\{\Delta \ln WPI_j(t) - \Delta \ln E_j(t)\}, \tag{2-5}$$

where WPI_i denotes country i's wholesale price index, E_i its nominal exchange rate against the US dollar (denominated in its local currency), and δ_{ij} the share of country i's imports that come from country j.[10]

B. Production

We make domestic demand as simple as possible. Basically, the determinants of domestic demand are past income and the real long-term interest rate.[11]

$$\Delta \ln D_i(t) = \Sigma_{k=0}^{3} \beta_{1ik} \Delta \ln Y_i(t-k) - \beta_{2i} \Delta RL_i(t) + \beta_{3i} RC_i(t-1), \tag{2-6}$$

where RL_i is country i's real long-term interest rate, defined later. Note that the domestic demand function includes the ratio of the current account balance to potential output as an explanatory variable. This is to model the situation in which a country's current account deteriorates and foreign investors pull out their operating capital or refrain from making new investment, thereby hindering that country's production activity. This effect is expected to be serious, especially for many East Asian countries, although it is less of an issue in Japan (see Goldstein et al. [2000]).

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[9] Instead of whole sale prices, consumer prices are used for China, where production-side price indices are unavailable.

[10] The data for the real effective exchange rates are necessary to estimate equation (2-1). We construct them, as defined by equation (2-5). In doing so, we treat δ_{ij} as time-variant. In the model simulation, however, we fix δ_{ij} at the year 2002 average.

[11] For Japan, we divide domestic demand into private demand and public demand and treat the latter as exogenous.

By definition, GDP is equal to the sum of domestic demand and foreign demand, that is, $Y \equiv D + X - M$. Log-linearizing this relationship around the benchmark-year level gives

$$\Delta \ln Y_i(t) = \mu_{1i} \Delta \ln D_i(t) + \mu_{2i} \Delta \ln X_i(t) - \mu_{3i} \Delta \ln M_i(t), \qquad (2\text{-}7)$$

where $\mu_{1i} = D_i / Y_i$, $\mu_{2i} = X_i / Y_i$, and $\mu_{3i} = M_i / Y_i$, which are all fixed.

We assume that potential output follows the trend of actual output. Explicitly, potential growth is given by a one-year moving average of actual growth rates:

$$\Delta \ln PY_i(t) = \Delta \ln Y_i(t-4, t-1), \qquad (2\text{-}8)$$

where PY_i is country i's potential output and $A(t-h, t-k)$ denotes the moving average of variable A from period $t-h$ to $t-k$. When potential output is considered to move more slowly, the length of the moving average should be longer.

The output gap is defined as

$$GAP_i(t) = \ln Y_i(t) - \ln PY_i(t). \qquad (2\text{-}9)$$

Note that equation (2-8) alone leaves the level of potential output undetermined and thus the level of the output gap is also undetermined in equation (2-9). In this paper, we calculate the level of potential output so that the output gap is averaged to zero over the course of the sample period.

The real short-term interest rate is obtained from the Fisher equation:

$$RS_i(t) = I_i(t) - \Delta \ln CPI_i(t+1), \qquad (2\text{-}10)$$

where RS_i is country i's short-term interest rate and CPI_i is the consumer price index. We use the term structure model of interest rates and define the real long-term interest rate as a 2-quarter forward moving average of the real short-term interest rate:

$$RL_i(t) = RS_i(t, t+1) \qquad (2\text{-}11)$$

Various assumptions are admissible for the length of the moving average.

Next, we define the ratio of the current account balance to potential output, which is a key element in the domestic demand functions, as described below. By definition, we have $RC \equiv (X - M) / PY$. Log-linearizing this, we obtain the following relationship.

$$\Delta RC_i(t) = \lambda_{1i}\Delta \ln X_i(t) - \lambda_{2i}\Delta \ln M_i(t) - \lambda_{3i}\Delta \ln PY(t),\qquad (2\text{-}12)$$

where $\lambda_{1i} = X_i/PY_i$, $\lambda_{2i} = M_i/PY_i$, and $\lambda_{3i} = (X_i - M_i)/PY_i$, which are all fixed. Notice that we standardize the current account balance by potential output rather than by actual output. This is because a country's foreign deficit should be evaluated against its ability to repay.

C. Prices

In this paper, the entire structure of prices is based on wholesale prices (WPI). For country i, the inflation rate in wholesale prices is determined by the Phillips curve:

$$\Delta \ln WPI_i(t) = \gamma_{0i} + \gamma_{1i}\Delta \ln WPI_i(t-1) + \gamma_{2i}GAP_i(t-1)$$
$$- \gamma_{3i}\{\Delta \ln RE_i(t) - \Delta \ln WPI_i(t)\}.\qquad (2\text{-}13)$$

The current inflation rate depends primarily on past inflation rates and the output gap. A secondary effect on the inflation rate comes from import prices, and thus we include the depreciation rate of the nominal effective exchange rate ($\Delta \ln RE_i - \Delta \ln WPI_i$) as an explanatory variable for the inflation rate.

Changes in wholesale prices are transmitted into the consumer price index gradually over time. Explicitly, we let the inflation rate of consumer prices be a one-year moving average of the inflation rates of wholesale prices.

$$\Delta \ln CPI_i(t) = \Delta \ln WPI_i(t-3,t).\qquad (2\text{-}14)$$

We can adopt different lengths of moving average across different countries, because the length of the moving average should reflect the speed at which cost changes in upstream industries are passed into price changes in downstream industries.

III. MONETARY AND CURRENCY POLICY RULES

The exchange rate and interest rates in a country are closely linked with those in foreign countries, though controlled partly by its local monetary authority. In particular, in a country allowing free capital movements, the uncovered exchange rate parity condition implies strong international linkages between interest rates and exchange rates. As a result, such a country cannot determine its interest rates and exchange rate in isolation.

We also take care of the *open-economy tri-lemma*, which tells us that the three

policy goals, "independent monetary policy," "free capital mobility," and "exchange rate stability," cannot be achieved simultaneously.[12]   If a country desires to pursue an independent monetary policy to stabilize its domestic economy, then it has to give up either exchange rate stability or free capital movement.   Similarly, if a country prefers to invite foreign capital by stabilizing its exchange rate and liberalizing its capital markets, then it has to abandon an independent monetary policy.   These theoretical relationships are vital when we construct individual countries' actual policy combinations.

We classify the ten countries into four groups according to their adopted monetary and currency policy: (a) Policy-making in Japan and the US may be reasonably described by the *Taylor rule*.[13]   (b) Malaysia, Hong Kong, and China can be considered to have adopted a *US dollar peg exchange rate* policy. (c) Singapore and Indonesia make use of a *currency basket system*.   (d) Thailand, the Philippines, and South Korea adopt an *inflation targeting policy*.   Nonetheless, we try to avoid excessive generalization of the diverse policy combinations observed in the East Asian economies and take the greatest care to keep the individual characteristics of each country's real policy-making process.   Below, we first describe the monetary and currency policy in Japan and the US, and then proceed to show what modifications are required to model the remaining countries' monetary policies.

A.   Japan and the US

Since capital movements are free in Japan, the exchange rate should satisfy the uncovered exchange rate parity condition.   Denote country i's nominal short-term interest rate by I_i and the US rate by I_{us}.   Let $RISK_i$ be country i's risk premium relative to the US's.   Then, uncovered exchange rate parity is satisfied when

$$I_i(t) = I_{us}(t) + \Delta \ln E_i(t+1) + RISK_i(t) . \tag{3-1}$$

The short-term interest rate is determined by the well-known Taylor rule, according to which the monetary authority controls the nominal short-term interest rate,

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[12] Different names are given to the same notion: *unholy trinity*, *impossible theorem*, *inconsistent trinity*, and *incompatible trinity*.

[13] Since the zero interest rate policy (1999) and the quantitative easing policy (2002), the uncollateralized overnight call rate (the monetary policy instrument) has remained at the zero percent level in Japan.   Under this situation, the Taylor rule is not an appropriate policy rule. We return to this problem in Section V.

paying attention to the CPI inflation rate:

$$I_i(t) = C_i(t) + \chi_{1i}\{\Delta \ln CPI_i(t) - \Delta \ln CPI_i^*\} + \chi_{2i} GAP_i(t), \qquad (3\text{-}2)$$

where $\Delta \ln CPI_i^*$ denotes the steady-state rate of consumer price inflation. C_i summarizes all factors other than the inflation rate and the output gap. Explicitly, it is the sum of the steady-state real interest rate, the steady-state inflation rate, and the deviation of the risk premium from its steady-state value:

$$C_i(t) = RS_i^* + \Delta \ln CPI_i^* + \kappa_i\{RISK_i(t) - RISK_i^*\}, \qquad (3\text{-}3)$$

where RS_i^* is the real short-term interest rate in the steady state.[14]

This paper's standard assumption is $\kappa_i = 1$ in equation (3-3). This implies that the nominal short-term interest rate rises in exactly the same amount as an increase in the risk premium for Japan. Together with equations (3-1) and (3-2), this means that the nominal exchange rate of the yen vis-à-vis the US dollar is independent of the risk premium. This relationship holds, when Japan's credit risk is properly evaluated in its domestic financial market and there is no difference in the degree of risk aversion between Japan and the US. To the contrary to the assumption, suppose that Japanese investors undervalue Japan's credit risk relative to their US counterparts. This implies that $\upsilon_i < 1$. In such a case, the yen would depreciate against the US dollar. This is because the yen would have to appreciate in the future to compensate for the smaller increase in its nominal short-term interest rate. We consider this latter case when we simulate the situation of the Asian Currency Crisis in Section V.

The US financial sector is almost the same as Japan's. Differences are that in the US case, it is not necessary to specify an uncovered exchange rate parity condition and that the US risk premium is zero by definition.

B.   East Asian Countries

The East Asian countries adopt various combinations of monetary and currency policy (see Table 1 and Appendix A for detail). In addition, the extent to which capital

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[14] Equation (3-3) has to hold even in the steady-state, implying that the following equation has to hold:

$$RISK_i^* = (RS_i^* + \Delta \ln CPI_i^*) - (RS_{us}^* + \Delta \ln CPI_{us}^*).$$

That is, the risk premium in the steady-state is equal to the difference in the steady-state real interest rate between country i and the US.

controls remain in place differs across countries. In this paper, we try to balance two objectives: adequate reflection of this diverse reality against the need to keep our model of monetary policy, currency policy, and capital controls as simple as possible.

(i) Malaysia, China, and Hong Kong

Consider first the US dollar peg policy adopted by Malaysia and China and also Hong Kong's currency board. For Malaysia, the US dollar peg means that the ringgit is fixed against the US dollar and thus can be expressed as follows:

$$\Delta \ln E_i(t) = 0 . \tag{3-4}$$

We can describe Malaysia's exchange rate policy by replacing equation (3-2) with equation (3-4). The same relationship may be applied to the currency policies adopted by China and Hong Kong. Note that we assume away the uncovered exchange rate parity condition for Malaysia and China, since they maintain relatively strict capital controls in comparison to other East Asian countries. Instead, we assume that Malaysia's nominal interest rate is determined along with the inflation rate of consumer prices, while China's is treated as exogenous.

(ii) Singapore and Indonesia

We construct Singapore's currency basket by averaging the depreciation rates of other countries' currencies, using their import shares as currency weights.[15] To obtain Singapore's currency basket policy, we equate the depreciation rate of the currency basket to that of the Singapore dollar:

$$\Delta \ln E_i(t) = \Sigma_j \delta_{ij} \Delta \ln E_j(t) . \tag{3-5}$$

We can describe Singapore's monetary policy by replacing equation (3-2) with equation (3-5).

Indonesia is planning to adopt an inflation targeting policy, but the introduction has not yet completed. For this reason, we assume that the Indonesian government pegs the rupiah to a currency basket, consisting of the US dollar and the yen.[16]

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[15] Singapore has been using a currency basket since 1981, but the weight of each currency in the basket has not been announced. In this paper, we substitute import shares for these weights for simplicity. Alternatively, we could use estimation results from Frankel and Wei (1994), Seki (1995), and Fukuda and Ji (2001).

[16] With reference to Kawai (2002), we construct the target currency basket for Indonesia,

(iii) South Korea, Thailand, and the Philippines

Some of the East Asian countries adopts an inflation targeting policy (South Korea in 1998, Thailand in 2000, and the Philippines in 2002).[17] Since the history of inflation targeting policy is rather short in these countries, we have only limited knowledge of the mechanism with which they commit themselves to this policy. For this reason, we should be satisfied, for the time being, with estimating the following equation.

$$I_i(t) = \phi_{0i} + \phi_{1i}\Delta \ln CPI_i(t) + \phi_{2i}\Delta \ln E_i(t) . \tag{3-6}$$

That is, monetary authorities monitor not only inflation rates of consumer prices, but also depreciation rates of their currencies, since the latter are a possible cause of future inflation.[18]

IV. BASIC PROPERTIES OF THE MODEL

In this section, we analyze the quantitative properties of the Asian Economy Model by hitting it with external shocks. We investigate the following three types of shocks: (i) The growth rate of Japan's domestic demand decreases by 1 percent; (ii) the growth rate of US domestic demand decreases by 1 percent; (iii) the growth rate of East Asia's domestic demand decreases by 1 percent (excluding Japan). Key simulation results are summarized in Table 2.

(i) A 1 percent decline in the growth rate of Japan's domestic demand

First, we simulate the situation where the growth rate of Japan's domestic demand decreases by 1 percent per annum (a -0.25 percent decline every quarter for four quarters <periods 1 to 4>). The effects on the Japanese economy are shown in Figure 6-1. The declines in Japan's exports are driven by three forces. First, the yen depreciation caused by the Japanese recession works to increase its exports. Second, however, the decrease in the Japanese domestic demand causes a decline in its imports

consisting of the Japanese yen and the US dollar.

[17] Thailand adopts a managed floating currency system, which is considered to be a de facto currency basket peg policy. Taking into Kawai's (2002) report into consideration, we construct a currency basket consisting of the Japanese yen and the US dollar.

[18] If the Phillips curve does not include the output gap as an explanatory variable, inflation targeting and exchange rate targeting are almost the same.

and thus decreases in foreign countries' exports. This results in a decrease in foreign countries' imports from Japan, i.e., a decrease in Japan's exports. Third, the worsening of the current account of the East Asian economies causes capital outflow and slows their production activity. This shrinkage reduces demand for goods exported from Japan. The current simulation shows that the second and third forces outweigh the first effects with a consequence of the declines in Japan's exports.

The decreases in prices are also worth remarking. There are two opposing forces that drive the price movements in Japan. First, the depreciation of the yen puts upward pressure on Japan's price level. Second, however, prices are put under downward pressure generated by the negative output gap due to the recession. The current simulation says that the second force is overwhelming in comparison to the first.

Faced with the worsening of the output gap and the deflation, the monetary authority must lower the nominal short-term interest rate in accordance with the Taylor rule. Since the late 1990s, however, the short-term interest rate has already reached zero percent in Japan. Thus the monetary authority no longer has the option to lower the interest rate. In this case, the economic slump and the resulting deflation are likely to be severer than shown in the simulation here. We return to this issue in Section V below.

Next, we turn to the effects of the Japanese recession on the Thai economy (Figure 6-2). The Thai baht depreciates against the US dollar. This is a consequence of market investors foreseeing that the monetary authority will lower the interest rate when the negative output gap expands in future. What is more important, however, is that the real effective exchange rate will appreciate in spite of the Thai baht depreciation, since many of other countries' currencies depreciate more than the baht. Consequently, the Thai exports and real GDP continue deteriorating. In addition, the decline in foreign demand leads to a decrease in the ratio of the current account balance to potential output, which impacts negatively on Thailand's domestic demand (see equation 2-6).

(ii) A 1 percent decline in the growth rate of US domestic demand

Next, we simulate the situation where the growth rate of US domestic demand declines by 1 percent per annum (a -0.25 percent decline every quarter for four quarters <periods 1 to 4>). A point worth remarking is the effect on Japanese exports, shown in Figure 7-1. Japan's exports fall below their baseline by -1 percent after a year and -2 after two years (see also Table 2). Since the US is Japan's biggest export market, it is quite

natural that a recession in the US economy has a direct impact on the Japanese economy.

Nonetheless, the magnitude of the impact is quite large, when we remember that the US share of Japan's total exports is at most 30 percent.   The following additional effects are important in explaining this: The recession in the US induces a reduction in Asia's exports to US markets; this in turn reduces Japan's exports to Asia.   At the same time, Japan experiences the appreciation of the real effect exchange rate, which squeezes its net exports.   These effects work synergistically to cause the world income to shrink.

(iii) A 1 percent decline in the growth rates of domestic demand across all of the East Asian economies (excluding Japan)

Finally, we simulate the case where the growth rates of domestic demand decrease across all of the ASEAN economies, the NIES economies, and China by 1 percent per annum (a -0.25 percent decline every quarter for four quarters <periods 1 to 4>).   As shown in Figure 8-1 and Table 2, the decrease in Japanese exports is a half of that observed for the decline in US domestic demand after a year and one fourth after two years.

This result has an important implication, when combined with the results obtained in the earlier simulation of a decrease in the US domestic demand.   Both the US and the East Asian countries have 30 percent shares of total Japanese exports.   Nevertheless, the magnitude of the impact on the Japanese economy differs dramatically, depending on where the shock comes from.   This difference reflects the respective roles that the two economic areas play in the world economy: the US as the "world's largest consumer" and the East Asian economies as the "world factory."   A decrease in domestic demand in the East Asian economies, which are not final destinations of consumption goods, has a relatively small impact on Japan, and indeed on the global economy.

V.   POLICY ANALYSIS

In this section, we conduct policy simulation, using the model developed in the preceding sections.   In the previous section, we explore the model's properties under the policy rules being employed by the East Asian economies in 2004.   As observed

there, the international production network developed within the East Asia has created an environment where one country's policymaking has substantial effects on foreign countries. The purpose of this paper is to give useful insights to the following three issues: the desirability of currency basket peg for East Asia, the anticipated effects of China's currency reform on the Asia-Pacific region, and the spillover effects of the non-negativity constraint on the nominal interest rates in Japan.[19]

A. The Desirability of Currency Basket System for East Asia

Here we discuss desirable monetary and currency policies for East Asia. There are many advocators for the currency basket peg policy after the Asian Currency Crisis in 1997. There is, however, a little evidence on how desirable the currency basket peg policy is. The purpose of this section is to quantify the stabilization effects of the currency basket peg policy in the basis of our econometric model.

Since it is unrealistic to examine all the possible policy combinations for the ten countries, we introduce the following two policy regimes as well as the current regime described in Section III. First, the "US dollar peg regime" describes a situation in which all the countries, except for Japan and the US, are assumed to employ a US dollar peg policy.[20] This regime is broadly consistent with the situation before the Asian Currency Crisis (1997). As history has demonstrated, it was not only a key determinant of the "East Asian Miracle," but also proved to be instrumental in compounding the effects of the crisis. Second, the "currency basket regime" describes the situation where all the countries, except for Japan and the US, peg their currencies to their respective currency baskets. The East Asian countries are assumed to construct their own currency baskets with import shares as currency weights and to peg their currencies to these baskets (we have already assumed the same scheme for Singapore).

The preferred choice of policy regime for the East Asian countries may differ,

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[19] Our model does not discuss the generation mechanism of currency crisis and leaves open the following questions: Why and how did the past currency crises occur? Our model is designed to show the most plausible behavior of the East Asian economies before and after a currency crisis occurs.

[20] Remember that Malaysia, Hong Kong, and China currently employ a dollar peg policy. Therefore, there are five countries (Indonesia, Singapore, Thailand, South Korea, and the Philippines) that would be required to change their policy rules to conform to the US dollar peg regime.

depending on the nature of the shock that hits their economies. We prepare two scenarios in this paper. First, we consider the scenario where the growth rate of US domestic demand drops. Examples are the IT depression since 2001 and the terrorist attacks in 2001. The economic turbulence originating in the US was transmitted to East Asia and amplified in a chain-reaction of real economic deterioration through the production network developed in the area. Second, we consider the scenario where the Thai economy is hit simultaneously by an increase in risk premium and a decline in the growth rate of domestic demand. In doing so, we have in mind the Asian Currency Crisis, which was initiated by a speculative attack on the Thai baht and subsequently had negative impacts on the real economic activity.

We start with the first scenario that assumes a 1 percent decline in the growth rate of US domestic demand (a -0.25 percent decline every quarter for four quarters <periods 1 to 4>). The top panel of Table 3(1) is the summary of the evaluations of the three policy regimes, i.e., the current, the US dollar peg and the currency basket regimes, in terms of the standard deviation of the output gap. In the middle and bottom panels, we put an "o" on the country whose standard deviation of the output gap is reduced more than 5 percent by a shift from the US dollar peg regime to the currency basket regime or to the current regime. We put an "x" on the country whose standard deviation of the output gap is increased more than 5 percent by the same shift.[21] Starting from the US dollar peg regime, two of the eight East Asian economies – the Philippines and South Korea – receive big stabilization effects from the shift to the currency basket regime, while no big gains and no substantial losses are created by the shift to the current regime. In the bottom panel, we consider a shift from the current regime to the currency basket regime or to the US dollar peg regime. Starting from the current regime regime, two economies gain substantially from a shift to the currency basket regime, while no economies in East Asia lose much from the same shift. These results show the superiority of the currency basket regime to the current regime as well as to the US dollar peg policy for some East Asian economies.

The second scenario assumes that the growth rate of the Thai domestic demand decreases by 10 percent (a -2.5 percent decline every quarter for four quarters <periods

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[21] A question arises about the appropriate criteria to use in evaluating the preferred policy rule. There is a consensus among developed countries to use both the volatility of their business cycles (the output gap or the volatility of GDP) and inflation rates. There is no consensus, however, on whether the same criteria are applicable for East Asian countries. Although this paper uses the output gap volatility as a welfare criterion, we do not exclude other options.

1 to 4>) and Thailand's risk premium rises 10 percent (once in period 1).[22] Table 3(2) presents the summary of evaluations. Starting from the US dollar peg regime, there are four economies in East Asia that grain much from a shift to the currency basket regime, while South Korea is only one economy that grains substantially from a shift to the current regime. Starting from the current regime, three economies gain substantially from a shift to the currency basket regime, while South Korea loses much with such a shift. The last point makes it difficult to put an ordering between the currency basket regime and the current regime.

To sum up, our simulation analyses show that the currency basket regime is superior to the US dollar peg regime at least in the two scenarios examined above. However, in the case of the Thai shocks, South Korea prefers the current regime to the currency basket regime, while some others have reversed preferences. Therefore, it is hard to put an unambiguous ordering between the currency basket regime and the current regime. The evaluation of the currency basket peg regime becomes harder if we take into account more scenarios than considered above. Our analysis also suggests that given the current regime as an initial regime, a shift of the East Asian economies to the currency basket regime calls for very tough negotiations among themselves.

B. China's Currency Policy Reform and its Anticipated Effects

China's recent economic achievements have been remarkable. The country's growth rate in the 1990s reached 9.7 percent on average.[23] In world rankings of nominal GDP, China was 11th in 1990, but had climbed to 6th in 2000 (following the US, Japan, Germany, the UK, and France).[24] This high growth in China was primarily attributed to the government's export-oriented economic policy. Actually, China's exports almost quadrupled during the 1990s, and the country's share of world exports rose to about 5 percent in 2002.[25]

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[22] In the above argument, we assume $\kappa_i = 0$ as an alternative to our standard assumption $\kappa_i = 1$. As pointed out in section III, a rise in the Thai baht's risk premium has no impact on the exchange rate under the latter assumption. Under the former assumption, however, the domestic evaluation of credit toward Thailand is higher than the overseas evaluation.

[23] China, *Statistical Yearbook* (2001).

[24] IMF, *World Economic Outlook (WED) Database* (October 2001).

[25] IMF, *Direction of Trade Statistics*.

As China achieves high economic growth, there occurs much criticism on the current Chinese currency policy. As pointed out in Section III, China adopts a *de facto* US dollar peg system. Under this system, the Chinese yuan does not appreciate, even when the economy grows fast. This can be a big economic threat to its neighbors. They insist loudly that the Chinese government should shift its currency policy to the free floating system. Under the latter system, the yuan is expected to appreciate in line with economic growth in China or with economic downturn in foreign countries.

Below, we first examine what is expected to occur with the yuan appreciation. By doing so, we have a numerical sense about the effects of the yuan's variability on economic activity in the Asian-Pacific region. Second, we simulate the shift of China's currency policy from the current US dollar peg policy to an inflation targeting policy and investigate its effects on the economic fluctuation in the Asia-Pacific region.

First, we examine the effects of the yuan appreciation on the Asia-Pacific neighbors. To do so, we simulate the situation where the yuan appreciates by 10 percent once in period 1, while keeping the *de facto* US dollar peg system. As shown in Figure 9, the yuan appreciation boosts up the Chinese imports and its neighbors' exports. From the quantitative point of view, however, a 10 percent appreciation of the yuan has only limited impacts on the growth rate outside China. For instance, as shown in the figure, the real output in Thailand increases by 0.23 percent after a year, which is much smaller than its growth rate of 5.4 percent in 2002. The effects on Japan and the US are even smaller: The Japanese real output increases less than 0.04 percent and the US real output rises only 0.005 percent.[26]

In spite of the quantitatively limited impacts on the economic activity in the Asia-Pacific region, China's currency policy reform is a hot issue for the world economy. We explore the possible effects of China shifting its currency system from the *de facto* US dollar peg system to the free floating system. We assume that China adopts an inflation targeting policy after it abandons the US dollar peg policy and also that it is still interested in the stabilization of the yuan against the US dollar. We use equation (3-6) as an inflation targeting formula and give China the averaged rules of South Korea, Thailand, and the Philippines.[27] The evaluation of China's currency

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[26] Note that we do not take into account the possible effect that the yuan appreciation shifts China's exports to its neighbors. Therefore, the effects of China's currency policy reform estimated above may be subject to underestimation.

[27] The parameter on $\Delta \ln CPI$ is 3.87 and that on $\Delta \ln E$ is 0.33.

policy reform depends on the nature of shocks. Three types of shocks are considered: (i) a negative demand shock originating in China, (ii) a negative demand shock originating in the US, and (iii) a negative demand shock originating in Japan.

We start with the case of a 1 percent decline in the growth rate of the Chinese domestic demand (a -0.25 percent decline every quarter for four quarters <periods 1 to 4>). A shift from the US dollar peg to the free floating system does not always harm the Chinese economy. Under the free floating system, the depressing shocks on the Chinese economy may be weakened owing to a reduction in its imports that is caused by the depreciation of the yuan. Table 4(1) shows the standard deviations of the output gap in the ten economies. We put an "o" on the country whose standard deviation of the output gap is reduced more than 5 percent by the reform and an "x" on the country whose standard deviation of the output gap is increased more than 5 percent by the reform. We can see that China enjoys a substantial gain from its currency reform in the face of its own recession. In contrast, all the foreign countries will be annoyed with a greater economic instability due to a reduction in exports that is caused by the yuan depreciation.

Next, we consider the case of a 1 percent decline in the US domestic demand growth rate (a -0.25 percent decline every quarter for four quarters <periods 1 to 4>). Under the free floating system, the yuan appreciation in the face of the US recession harms the Chinese economy. In contrast, its neighbors can avoid substantial drops in their exports, owing to the yuan appreciation. Table 4(2) shows that in the face of the US recession, the Chinese currency policy reform destabilizes China's own economy, but stabilizes five of the ten economies substantially. As for the US, it gains nothing by China's currency reform. It is also worth noting that Hong Kong economy suffers from a big shrinkage of real output in accordance with China's economic deterioration.

Finally, we discuss the case where the growth rate of the Japanese domestic demand declines by 1 percent per annum (a -0.25 percent decline every quarter for four quarters <periods 1 to 4>). We are sure that the Japanese yen depreciates, but not sure whether the yuan appreciates against the US dollar. According to the simulation result, the yuan appreciates against the dollar only slightly, and thus China's currency reform has no big impacts on the Asia-Pacific region in the case of Japan's recession. This is confirmed by looking at Table 4(3), which says that there are no substantial changes observed in the stability of the ten economies.

To sum up, China's currency policy reform benefits China itself, but harms its neighbors in the face of the Chinese economic recession. In the case of the US

recession, China's currency reform harms the Chinese own economy, but benefits a half of the ten investigated economies. We also examine impacts of a recession originating outside of China and the US with the Japanese recession as an example, but find no substantial effects on the Asia-Pacific economies. If the possibility of the US recession is taken most seriously, the Chinese government likes to keep the current *de facto* US dollar peg policy, while its neighbors are loud in claiming that the Chinese government should switch to the free floating system.

C. *The Non-Negativity Constraint on Nominal Interest Rates*

Here we discuss the spillover effects of the non-negativity constraint on the Japanese nominal interest rates on the Asia-Pacific region. Since the zero interest rate policy (1999) and the quantitative easing policy (2002), the uncollateralized overnight call rate has remained on the zero percent level in Japan. The negative effects of the non-negativity constraint on the Japanese economy have been discussed intensively for a long time, but those on the foreign countries have not attracted much attention so far. Depressing shocks originating in Japan will spill over the Asia-Pacific region, when the Bank of Japan fails to kill them due to the non-negativity constraint on nominal interest rates. Moreover, the effects on the Asian economies will feed back to the Japanese economy through the production network in which the Japanese economy is involved.

We examine such complicated effects of the non-negativity constraint by simulation analysis, based on the Asian Economy Model developed in the preceding sections. For simplicity, we assume the non-negativity constraint only on the Japanese nominal interest rates. As Japan does, other countries may confront a non-negativity constraint. In this case, overall economic dynamics in the Asia-Pacific region will be different from those presented below. Nonetheless, we stick to the current simplified assumption so as to derive clear implications of the non-negativity constraint on the East Asian economies as well as on the Japanese economy.

We simulate a scenario in which the growth rate of Japan's domestic demand decreases. Big and persistent negative shocks are required to create the situation where the nominal short-term interest rate hits a non-negativity constraint. To do so, we assume that negative demand shocks, ε_D, on the Japanese growth rate follow a long-lasting autoregressive process with big innovations, η_D:

$$\varepsilon_{Dt} = \rho_D \varepsilon_{Dt-1} + \eta_{Dt} . \tag{5-1}$$

For concreteness, we assume ρ_D =0.8 and η_D = 0.025 for consecutive four quarters (periods 1 to 4; 10 percent shock per annum in total).

The effects on the Japanese economy are shown in Figure 10-1, where the two dynamics are generated with and without the non-negativity constraint on the Japanese nominal interest rates. Note that in the figure, the short-term nominal interest rate is shown as a deviation from its steady state level, which is 4.5 percent in the current case (the sample mean of the uncollateralized overnight call rate in Japan) and thus the non-negativity constraint is given by the dashed horizontal line of -4.5 percent level. In the current scenario, the short-term interest rate hits the zero-bound for about 2 years from the 4th quarter to the 13th quarter. The biggest discrepancy from the non-negativity constraint is 6 percent in the 8th quarter. As pointed out in Section IV, the economic slump and the resulting deflation are severer than those obtained if there were no non-negativity constraint.

The non-negativity constraint on the Japanese nominal interest rates has two opposing effects on the East Asian economies. First, the non-negativity constraint restricts a further decline in the Japanese short-term interest rate. Therefore the yen fails to depreciate much and the Thai real effective exchange rate avoids big appreciation. This has positive effects on the East Asian economies. In Figure 10-2, which depicts impulse responses of the Thai economy, we find that the decline in the output gap is smaller during the period of the 2nd to 5th quarters than that obtained without the non-negativity constraint. Second, however, the depression in the Japanese economy slows its import and spills over the East Asian countries. In the figure, the second effects overweigh the first during periods 6 to 13.

VI. CONCLUSION

In this paper, we try to understand the mechanism underlying the "rise and fall" of East Asia during the 1980s and 1990s through simulations using a macro-econometric model. We ascertain that the growth of the Asian economies was founded on the international production network developed in the area. We also show that this deep interdependence contributed to East Asia's vulnerability. Furthermore, we point out how rapidly international capital flows might exacerbate the business cycle in the East Asian economies.

We conduct simulations to see what implications these Asian economic

characteristics have for the Japanese and East Asia economies. A few decades ago, it was enough for Japan to pay attention to the US economy. Recently, however, the Japanese economy has become involved in the East Asian international production network and thus affected by the business cycle in East Asia. In order to consider the effect of the US business cycle on the Japanese economy, it is not enough to look only at its primary effects on the Japanese exports. We must also note that the US business cycle creates business cycles in East Asia and that these in turn affect Japanese exports.

As suggested in our model, exchange rates play important roles in the evolution of business cycles in the East Asian economies. Since the Asian Currency Crisis, much research has been devoted to the question of the optimal currency regime for the Asian region. This paper analyzes the same question from the viewpoint of an econometric model. Our simulation analyses favor the currency basket regime against the US dollar peg regime for the East Asian economies. Yet, after some countries have already implemented currency and monetary policy reforms, it seems hard to switch to another policy regime in near future. This paper's analyses also show that China and other East Asian countries have conflicting interests toward China's currency reform, when they manage their own economies especially in the face of the US business cycle. This suggests the necessity of enlarged policy coordination in East Asia in which the US as well as Japan and China are involved.

APPENDIX A

BRIEF CHRONOLOGY OF CURRENCY SYSTEMS IN EAST ASIA

The high growth in East Asia from the mid-1980s through the early 1990s was praised as the "East Asian miracle." This growth was supported by massive capital inflows from Japan, the US, and Europe. Many East Asian countries adopted a *de facto* US dollar peg policy to promote capital inflows from abroad. At the same time, many monetary authorities in East Asia preferred to adopt independent monetary policies. It was in this economic environment that the depreciation of the Thai baht in 1997 triggered the Asian Currency Crisis. In order to survive in the international community, East Asian countries were urged not only to deal with the crisis that confronted them, but also to establish a new currency system after the crisis passed away.

In this appendix, we discuss how the East Asian countries have operated their financial markets over the two decades since the early 1980s. Due to limitations of space, we are unable to present a comprehensive history of the Asian financial system. Instead, we focus on the major historical events that are indispensable for understanding the arguments in this paper. In doing so, we emphasize that the Asian Currency Crisis forced the monetary authorities in East Asia to acknowledge the risk of pursuing their economic goals in ignorance of the "open-economy tri-lemma." We review the evolution of policy systems in the East Asian economies, taking special note of "exchange rate market operations," "monetary policy in pursuit of domestic economic stability," and "capital controls."

(i) Indonesia

In 1978, Indonesia abandoned its fixed exchange rate system (the US dollar peg) and adopted a managed floating exchange rate system. The latter system was maintained until the Asian Currency Crisis in 1997. Capital and exchange transactions have been deregulated gradually over the past thirty years and have contributed to the high economic growth during the 1990s in Indonesia.

The outbreak of the Asian Currency Crisis in 1997 forced Indonesia to adopt an independent floating exchange rate system. When the depreciation of the Thai baht triggered the currency crises, the effects were transmitted all over East Asia and the Indonesian rupiah was also exposed to substantial downward pressure. At the beginning of the crisis, the monetary authority sought to preserve its managed floating system by widening the exchange rate target band. However, the authority was

eventually forced to give up the target band.

Indonesia currently maintains a managed floating exchange rate system and there has been some "non-internationalization" of the rupiah (regulations on offshore transaction of the rupiah) since 2001. Indonesia is now preparing to introduce an inflation targeting policy to replace the exchange rate as a nominal anchor.[28]

(ii) Singapore

In 1973, when the Bretton Woods System collapsed, the Monetary Authority of Singapore (MAS) adopted a managed floating exchange rate system in line with other industrialized countries. In 1981, the MAS shifted to a currency basket system and has maintained this system to date.[29]

The "non-internationalization" of the Singapore dollar is at the heart of this country's capital control policy. The purpose of this policy is to protect the Singapore dollar from being sold speculatively by non-residents. There is some discussion that the non-internationalization policy blocked currency speculation and limited the damage of the Asian Currency Crisis on the Singapore dollar.

In Singapore, the currency basket system is one of the measures by which to achieve price stability. The MAS operates domestic monetary policy in accordance with this system. As for capital controls, the non-internationalization policy is gradually being liberalized to foster the domestic capital market. For instance, non-residents are now allowed to buy the Singapore dollar necessary to buy stocks and bonds denominated in Singapore dollars.

(iii) Thailand

In 1984, Thailand adopted a currency basket system in place of its fixed exchange rate system (the US dollar peg). At first, the composition of the currency basket was determined on a trade-volume basis. As time passed, however, the weight of the US dollar became dominant in the currency basket. We can therefore consider Thailand to have been employing a *de facto* US dollar peg system, when the Asian Currency Crisis occurred. Though somewhat skewed in its make-up, the Thai currency basket system

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[28] The central bank had been a part of the government in Indonesia. In May 1999, the government amended the banking law and assured independence to the central bank.

[29] The MAS currency basket, composed of the currencies of the country's main trading partners, is managed so that it moves within a certain target band. So far, the MAS has kept secret both the currency composition of the basket and the target band.

lasted 13 years until the 1997 crisis.

During the first half of the 1990s, Thailand eased regulations on inward investment.   In particular, the Bangkok International Bank Facilities (BIBF; an offshore financial market established in 1993) allowed non-resident-to-resident transactions as well as non-resident-to-non-resident transactions.   The BIBF played a significant role in raising the enormous funds necessary for the country's economic growth.

In the second half of 1996, Thai exports slowed, putting the brakes on GDP growth.   Against this background, market investors began to suspect that the Thai baht might be overvalued.   Finally, in May 1997, foreign speculators began a massive sell-off of the baht.   In July, the monetary authority ran short of foreign currency reserves and could not protect the baht anymore.   The currency basket system was abandoned eventually.

Faced with this situation, the Thai government started to regulate capital inflows to the BIBF and resumed a de facto currency basket.   Furthermore, non-internationalization of the Thai baht (regulations on offshore transactions denominated in Thai baht) was introduced after the crisis.   As for domestic monetary policy, Thailand adopted an inflation targeting policy in May 2000, which it hoped would provide a new nominal anchor.

(iv) The Philippines

From 1994 to 1998, the Philippines employed a *de facto* US dollar peg.   Exchange control was implemented according to the "real demand principle" of exchange contracts.   Actual exchange control, however, was not very complete due to the existence of the *forex corporations*.

The Philippine peso weakened in the midst of the Asian Currency Crisis.   The monetary authority was forced to devaluate the peso in 1997.   The impact of the crisis on the Philippine economy, however, was smaller than on other ASEAN economies. This was because the low ratings of private companies under the Marcos Administration have discouraged foreign funds from entering the country in the first place.

The Philippines has been under an independent floating exchange rate system since 1998.   To provide a new nominal anchor, an inflation targeting policy has been in operation since 2002.   After the crisis, the government strengthened regulations on the forex corporations.

(v) Malaysia

When the Asian Currency Crisis occurred in 1997, Malaysia was under a managed floating exchange rate system. Even after a substantial depreciation during the crisis, the Malaysian ringgit still found itself under strong downward pressure due to the unstable financial system – a crash of equity prices and a rise in the non-performing-loan ratio.

Malaysia overcame the Asian Currency Crisis without assistance from the IMF. This was largely owing to restrictions on overseas borrowing that limited the amount of short-term debt, and also due to the country's adequate holdings of foreign exchange reserves. In 1998, new capital regulations (suspension of the offshore ringgit market and of overseas remission of equity-sales proceeds by non-residents) were introduced. At the same time, a fixed exchange rate system (the US dollar peg) was adopted.

As the Asian Currency Crisis receded, the government gradually removed the regulations governing overseas remission of equity-sales proceeds. To date, these regulations have been completely withdrawn. In contrast, the offshore ringgit market is still suspended. Thus, non-residents cannot carry out short-sales of the ringgit.

(vi) South Korea

In 1980, South Korea adopted a currency basket system in place of its fixed exchange rate system (the US dollar peg). In 1990, the country then adopted a managed floating exchange rate system and limited daily movements of the exchange rate. As for exchange controls, South Korea accepted its obligations under Article VIII of the IMF Article of Agreement in 1988 and removed all the restrictions on the won trading necessary for current account transactions. Of the restrictions on the capital account, the first to be liberalized was outward investment. This followed the emergence of the excess liquidity problem after South Korea became a current-account surplus country toward the end of the 1980s.

From 1995, however, a heating-up of South Korean domestic demand increased imports, while the combination of a strong won and a weakened yen reduced exports substantially. As a result, South Korea's current account fell into substantial deficit. A large portion of this deficit was financed with short-term loans from the country's local banks. From 1997, following the bankruptcy of some *chaebols* (South Korean conglomerates), non-performing loans piled up in the banking sector. When short-term foreign funds fled overseas, the Korean won experienced a dramatic depreciation. At the end of 1997, the South Korean monetary authority was forced to shift to an independent floating exchange rate system.

In 1997, South Korea called for IMF economic assistance and started a series of structural reforms: tightening of macroeconomic policy, reform of its financial and corporate sectors, liberalization of capital transactions (especially related to inward investment). South Korea adopted an inflation targeting policy in 1998 and placed "price stability" at the heart of its monetary policy.

(vii) Hong Kong

In 1974, following the breakdown of the Bretton Woods System, Hong Kong abandoned its currency board system, in which the Hong Kong dollar was pegged to the British pound, and adopted a floating exchange rate system instead. In 1983, however, the Hong Kong monetary authority returned to the currency board system in response to the massive speculation triggered by the dispute over Hong Kong's reversion to China from the UK.

A currency board system differs from a fixed exchange rate system in that it requires bank notes to be fully backed by foreign reserves. This requirement is considered to enhance the stability of the exchange rate by reinforcing the credibility of the government commitment to exchange the currency for foreign reserves on demand. In 1998, during the Asian Currency Crisis, foreign speculators started what is known as "double trading," i.e., selling short both in the Hong Kong dollar market and in the Hong Kong stock market. The Hong Kong Monetary Authority, however, tamed the stock market successfully through its aggressive market intervention.

Under the currency board system, Hong Kong is unable to control monetary aggregates freely. Therefore, it cannot ease monetary policy and expand the money supply to stimulate the domestic economy. The corollary of Hong Kong's desire to stabilize its exchange rate is that it gives up its independent monetary policy instead.

(viii) China

China abolished its dual exchange rate system, whereby official and market rates coexisted, in 1994 and has only a single market exchange rate today. China employs a managed floating exchange rate system. Nonetheless, the Chinese yuan moves against the US dollar by only tiny amounts. Thus, we can consider this to be a *de facto* US dollar peg system.

China continues to impose strict exchange controls, even after it accepted in principle its obligations under Article VIII of the IMF Article of Agreement in 1996. The purpose of exchange control is to achieve exchange rate stability. In China, (i) currency trading necessary for current account transactions is free; but (ii) that

necessary for capital transactions is strictly controlled. It is thanks to this strict regulation as well as its great current account surplus that China managed to keep the yuan stable in the face of the Asian Currency Crisis, despite the rumors of the yuan depreciation.

As described above, China pursues exchange rate stability, while controlling capital movements strictly. This leaves the Chinese government room for conducting monetary policy to manage the domestic economy.

The WTO accession in December 2001, however, is changing the environment surrounding the Chinese system of regulations. The main obligation incurred in the country's accession to the WTO was the removal of regulations on trade and direct investment, including reductions in import tariffs and removal of non-tariff barriers. As the Chinese market opens up to the global economy, there will emerge considerable pressure for it to deregulate its capital controls. If China wishes to keep its monetary policy independent and to relax capital controls, it will have to allow the Chinese yuan to move more flexibly than to date.

APPENDIX B

NOTES ON ESTIMATION AND CALIBRATION OF THE MODEL

This appendix gives notes on the estimation and calibration of the model equations. We discuss the estimation of import functions, domestic demand functions, Phillips curves, and policy reaction functions below. We admit that it is desirable to employ an estimation technique with which we can avoid simultaneous equation bias, e.g., the full information maximum likelihood estimator or the three step least square estimator. However, there are many equations to be estimated in the current model. For this reason, we estimate the individual equations separately by OLS. The estimation results are shown in Tables 5 to 8.

(i) Import Functions

As Goldstein and Khan (1985) mention, there are many difficulties involved in estimating import functions. In particular, researchers often encounter problems with the sign of the estimated parameter on the real effective exchange rate. This has been known to suggest that a country's imports will increase when its currency depreciates. This is counterintuitive when we think about imports of final goods. The depreciation of the importing country's currency raises the prices of imported goods relative to those of domestic goods and should thus reduce import demand.

This problem of sign reversal on the real effective exchange rate is not necessarily ridiculous, when we consider that the demand for imports is in part derived from exports. Suppose the Japanese yen depreciates. The prices of Japanese export goods decline relative to foreign equivalents; thus demand for them increases. As a result, new demand is created for imports of intermediate goods. If the increase in imports of intermediate goods were to exceed the decrease in final goods coming from the depreciation of the yen, Japanese net imports would increase.

As pointed out before, the import functions, equation (2-1), include export volumes as explanatory variables. The first term on the right hand side of equation (2-1) is interpreted as a derived demand for import goods springing from current and future exports. If we follow the above argument and include this term in the import function, then it absorbs any increase in imports caused by currency depreciation; thus the estimated parameter on the real effective exchange rate takes the expected sign; and the intuition that currency depreciation reduces import volumes is restored.

Table 5 presents the estimation results of aggregate import functions. The sample period spans the 1990s (quarterly bases). The fit of the equations is not bad. This shows empirically the potential of equation (2-1) as a general form for import functions. We should also note that, for all countries other than the US, Indonesia, and Singapore, the parameter on the real effective exchange rate takes the theoretically expected sign, though insignificant in most cases.

(ii) Domestic Demand Functions

Table 6 shows the estimation results of domestic demand functions (quarterly bases). Most of samples span over the 1990s, though only short samples are available for some countries. Looking at our OLS estimates, we see that the fit of the domestic demand function is unsatisfactory for most countries. The fit is extremely poor for the Philippines and China. Thus, we treat these countries' domestic demands as exogenous in the analysis. The low coefficients of determination may imply that the current treatment of domestic demand is too simple to adequately reflect reality. Thus, improvements will be required in future.

Let us examine the significance of the ratio of the current account balance to potential output in the domestic demand function. This ratio is not statistically significant in the domestic demand functions for most countries. Yet, it has some impacts on the domestic demand of Thailand, Malaysia, and Hong Kong and we have left this ratio to reflect the possibility that the trade deficit causes outflows of foreign capital, which in turn discourage both investment and production activities.

(iii) Philips Curves

Table 7 shows the estimation results of the Phillips curves. The fit of the model is good for most countries, with the exception of the Philippines and the US. The significance of individual explanatory variables varies from country to country. For Singapore and the ASEAN countries, the effects of the output gap on prices are insignificant, whereas those of the nominal effective exchange rate are significant. Thus, the Phillips-curve relationship does not hold well in these countries. In the other countries, however, the output gap is a significant variable in explaining price movements, implying that the Phillips-curve relationship holds.

(iv) Policy Reaction Functions

Finally, Table 8 presents the estimation results of the Taylor rule in equation (3-2) for

Japan and the US.[30] As for South Korea, Thailand, and the Philippines, which have adopts inflation targeting policies, we estimate equation (3-6), considering that a change in the exchange rate has more significant effects on the inflation rate than that in the output gap does.[31] According to the estimation results, these policy rules suit the data rather well. Note, however, that the results are based on a limited sample period (the period following the Asian Currency Crisis). Thus, we should be careful when using these results below.

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[30] See Kamada and Muto (2000).

[31] Only a few years have passed since South Korea, Indonesia, Thailand, and the Philippines first adopted inflation targets. Taking into consideration this limited data availability, we estimate policy reaction functions since 1998, immediately following the Asian Currency Crisis.

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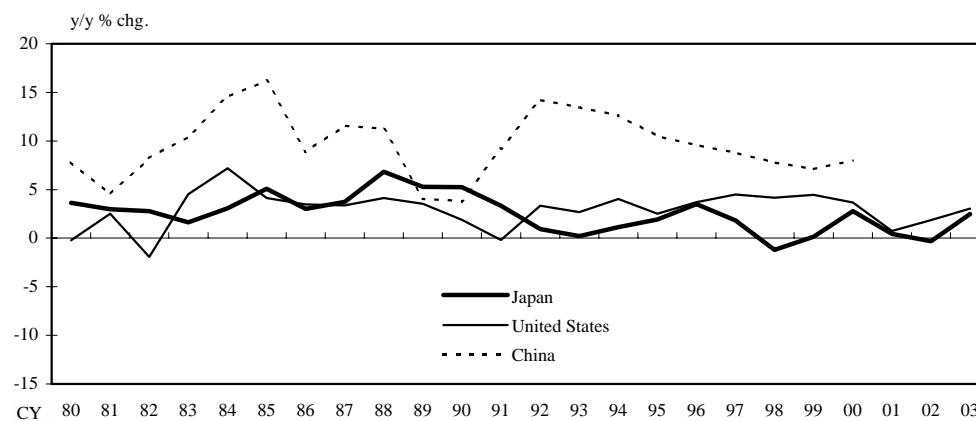
Figure 1

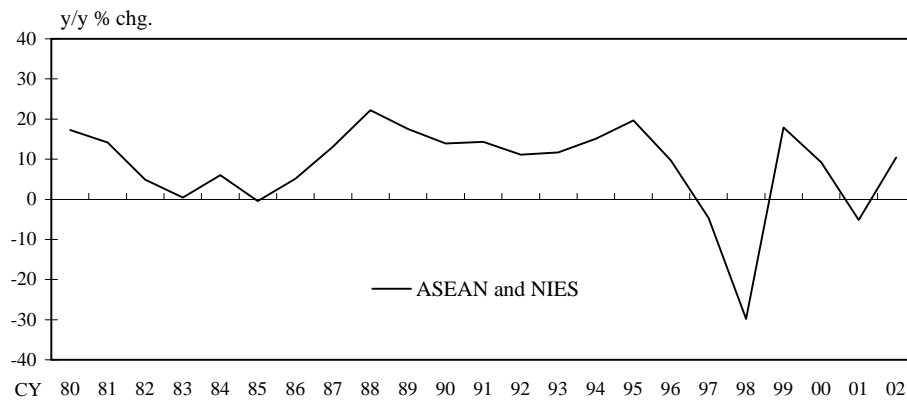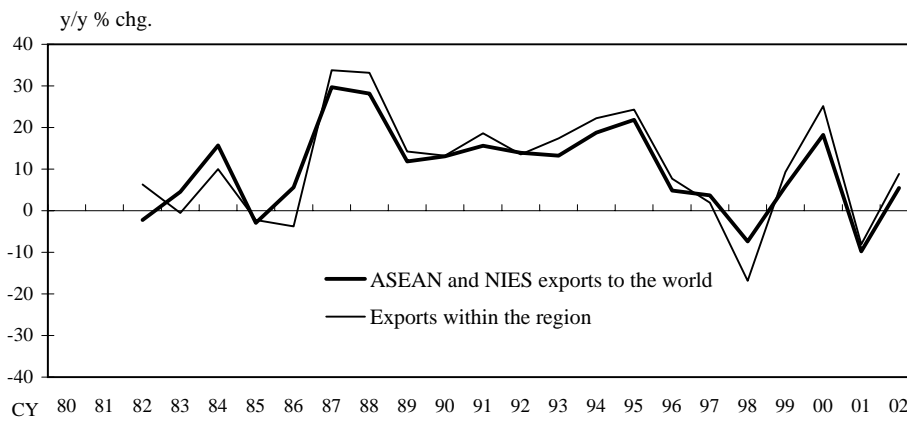**Real GDP Growth in the Asia-Pacific Region**

(1) ASEAN
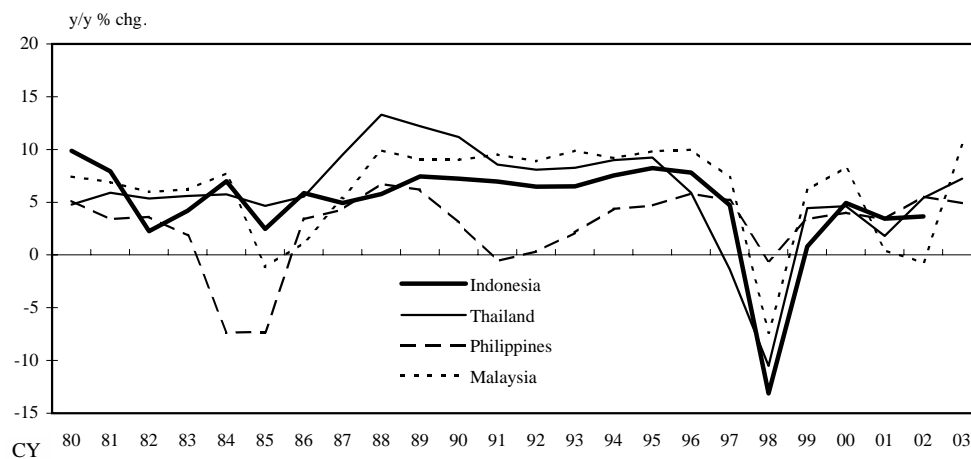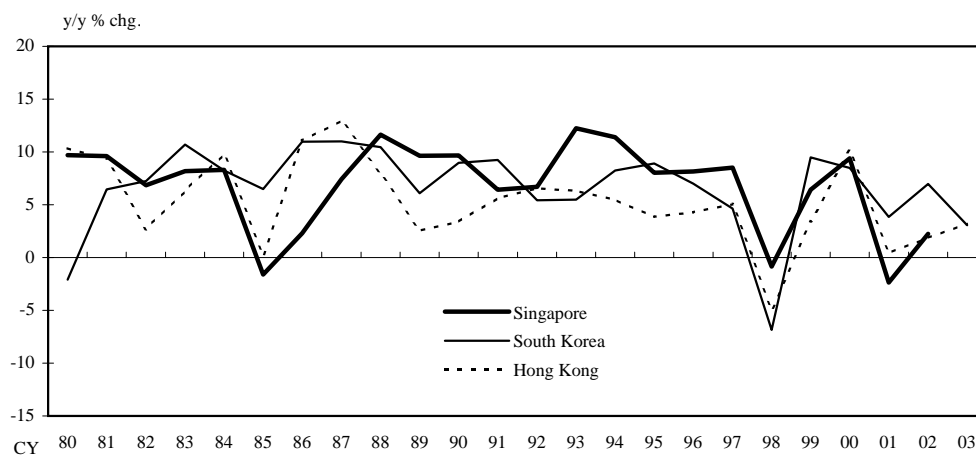
y/y % chg.
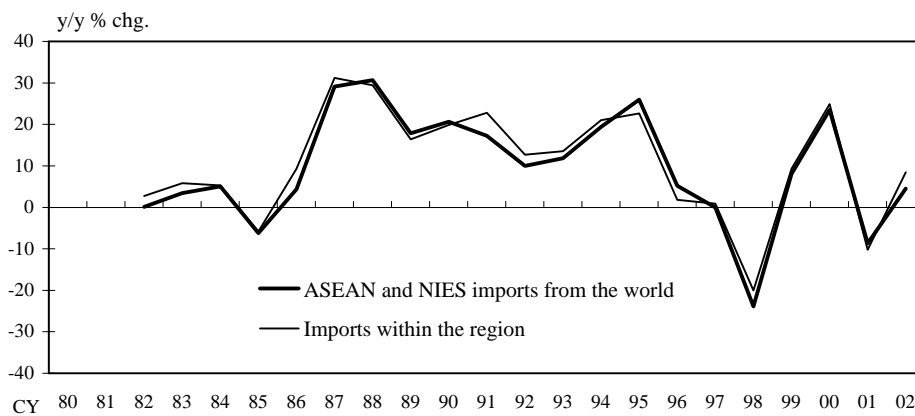

(2) NIES

y/y % chg.

(3) Large countries

y/y % chg.

Source: International Monetary Fund, "International Financial Statistics."

Figure 2

Output and Trade in the Asia-Pacific Region

(1) Nominal GDP

y/y % chg.

(2) Exports

y/y % chg.

(3) Imports

y/y % chg.

Note: "Nominal GDP," "Exports," and "Imports" are year-to-year percent changes of aggregated
       nominal GDP, exports, and imports denominated in dollars, respectively.

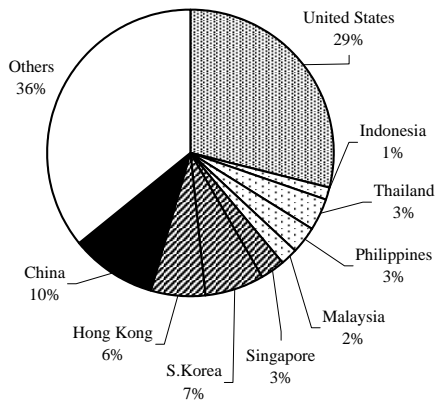Sources: International Monetary Fund, "International Financial Statistics," "Direction of Trade Statistics.'

Figure 3

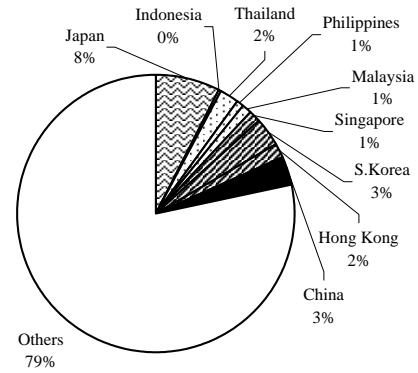**Intra-regional Trade Ratio in East Asia**

Figure 4-1

Export Shares (1)

1. Japan

United States
29%

Others
36%

Indonesia
1%

Thailand
3%

Philippines
3%

Malaysia
2%

Singapore
3%

S.Korea
7%

Hong Kong
6%

China
10%

2. The United States

Indonesia
0%

Thailand
2%

Philippines
1%

Japan
8%

Malaysia
1%

Singapore
1%

S.Korea
3%

Hong Kong
2%

China
3%

Others
79%

3. Indonesia

Japan
21%

Others
36%

United States
13%

Thailand
9%

Philippines
2%

Malaysia
1%

Singapore
4%

S.Korea
7%

Hong Kong
2%

China
5%

4. Singapore

Japan
7%

United States
15%

Others
32%

Indonesia
3%

Thailand
5%

Philippines
2%

Malaysia
18%

S.Korea
4%

Hong Kong
9%

China
5%

5. Thailand

Japan
15%

Others
37%

United States
20%

Indonesia
2%

Philippines
8%

Malaysia
2%

Singapore
4%

S.Korea
2%

Hong Kong
5%

China
5%

Note: Figures are average values of quarterly data in 2002.
Source: International Monetary Fund, "International Financial Statistics," "Direction of Trade Statistics."

Figure 4-2

Export Shares (2)

6. The Philippines

Japan
15%

Others
30%

United States
24%

China
4%

Indonesia
1%

Hong Kong
7%

Thailand
7%

S.Korea
4%

Singapore
5%

Malaysia
3%

7. Malaysia

Japan
11%

Others
30%

United States
20%

China
6%

Indonesia
2%

Hong Kong
6%

S.Korea
3%

Thailand
17%

Singapore

Philippines
4%

8. South Korea

Japan
9%

United States
20%

Others
40%

Indonesia
2%

Thailand
3%

Philippines
1%

Malaysia
2%

China
15%

Singapore
2%

Hong Kong
6%

9. Hong Kong

Japan
5%

United States
21%

Others
27%

Indonesia
0%

Thailand
2%

Philippines
1%

Malaysia
1%

China
40%

S.Korea
2%

Singapore
1%

10. China

Japan
15%

United States
21%

Others
34%

Indonesia
1%

Thailand
2%

Philippines
1%

Hong Kong
18%
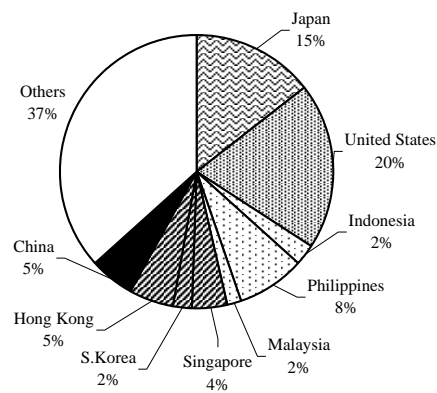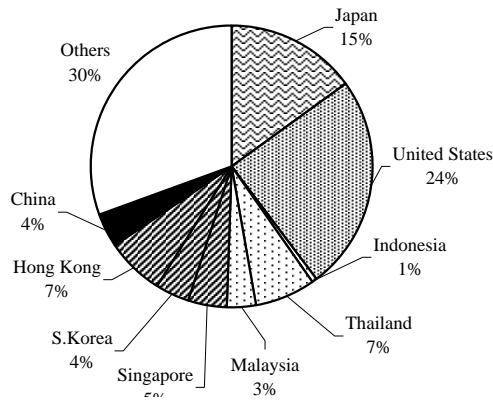
S.Korea
5%

Singapore
2%

Malaysia
1%

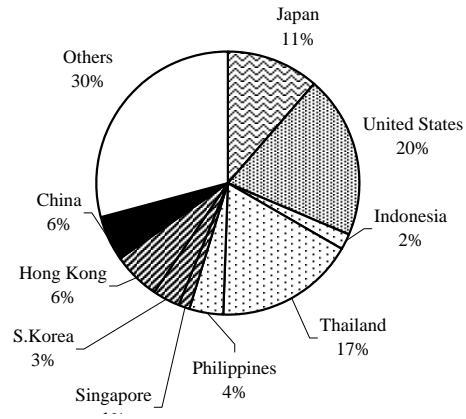Note: Figures are average values of quarterly data in 2002.
Source: International Monetary Fund, "International Financial Statistics," "Direction of Trade Statistics."

Figure 5-1

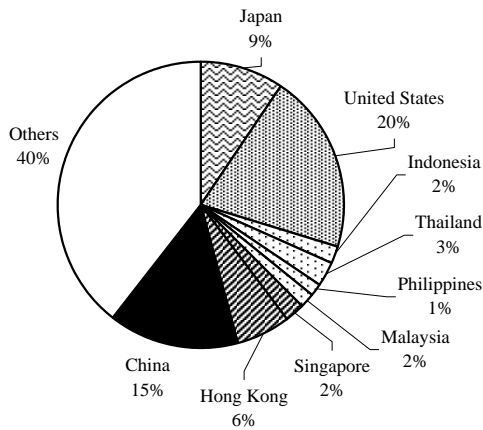**Import Shares (1)**

1. Japan

United States
17%

Indonesia
4%

Thailand
1%

Philippines
3%

Malaysia
2%

Singapore
3%

S.Korea
5%

Hong Kong
0%

China
19%

Others
46%

2. The United States

Japan
10%

Indonesia
1%

Thailand
1%

Philippines
1%

Malaysia
1%

Singapore
2%

S.Korea
3%

Hong Kong
1%

China
11%

Others
69%

3. Indonesia

Japan
14%

United States
8%

Thailand
13%

Philippines
4%

Malaysia
0%

Singapore
3%

S.Korea
5%

Hong Kong
1%

China
8%

Others
44%

4. Singapore

Japan
13%

United States
14%

Indonesia
5%

Thailand
5%

Philippines
2%

Malaysia
18%

S.Korea
4%

Hong Kong
2%

China
8%

Others
29%

5. Thailand

Japan
23%

United States
10%

Indonesia
2%

Philippines
4%

Malaysia
2%

Singapore
6%

S.Korea
4%

Hong Kong
1%

China
8%

Others
40%

Note: Figures are average values of quarterly data in 2002.
Source: International Monetary Fund, "International Financial Statistics," "Direction of Trade Statistics."

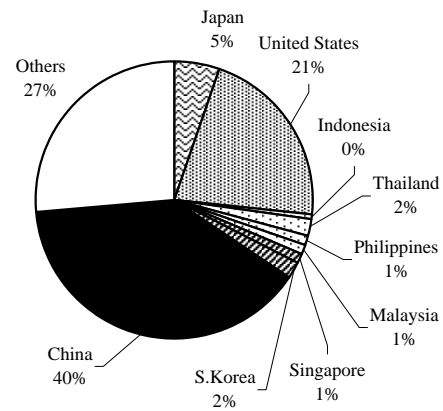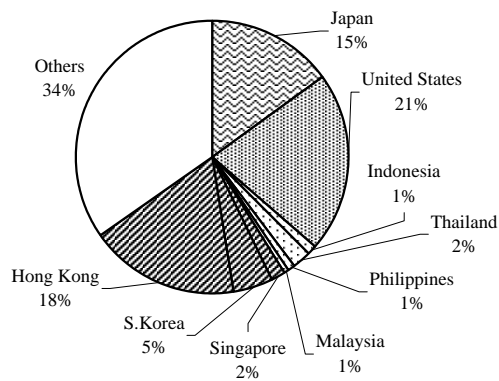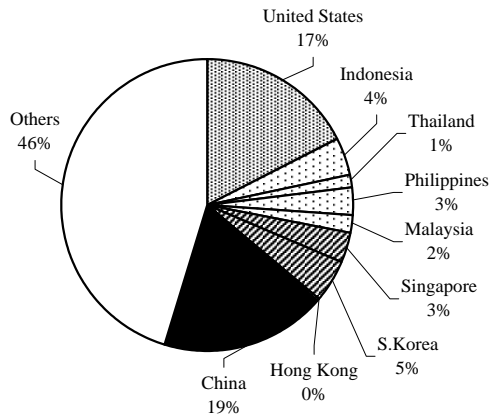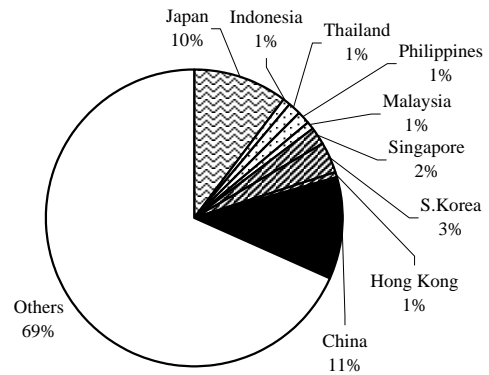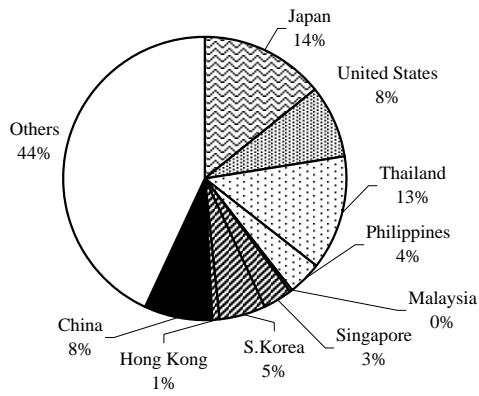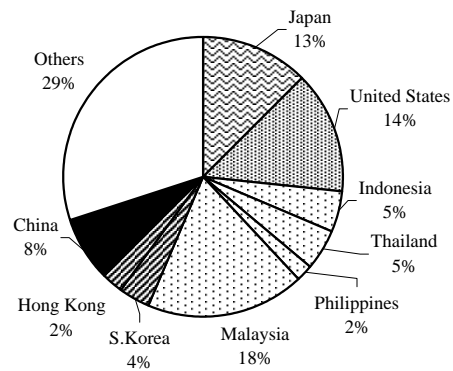Figure 5-2

Import Shares (2)

6. The Philippines

Japan
20%

Others
27%

China
4%

Hong Kong
4%

S.Korea
8%

Singapore
4%

Malaysia
3%

Thailand
7%

Indonesia
2%

United States
21%

7. Malaysia

Japan
18%

Others
28%

China
8%

Hong Kong
3%

S.Korea
5%

Singapore
3%

Philippines
4%

Thailand
12%

Indonesia
3%

United States
16%

8. South Korea

Japan
20%

Others
43%

China
11%

Hong Kong
1%

Singapore
3%

Malaysia
1%

Philippines
1%

Thailand
2%

Indonesia
3%

United States
15%

9. Hong Kong

Japan
11%

United States
6%

Others
23%

Indonesia
1%

Thailand
5%

Philippines
2%

Malaysia
1%

Singapore
2%

S.Korea
5%

China
44%

10. China

Japan
18%

United States
9%

Others
49%

Indonesia
2%

Thailand
2%

Philippines
2%

Malaysia
1%

Hong Kong
4%

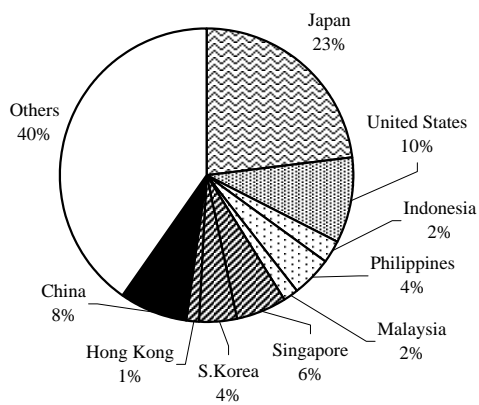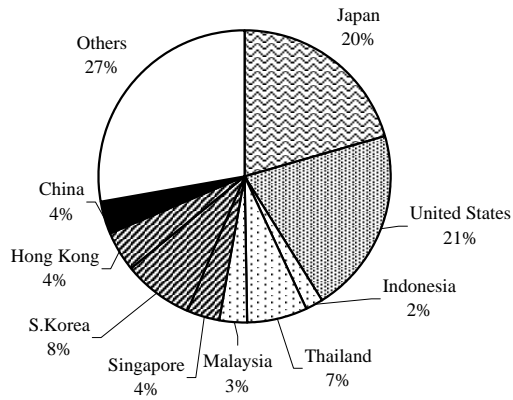S.Korea
10%

Singapore
3%

Note: Figures are average values of quarterly data in 2002.
Source: International Monetary Fund, "International Financial Statistics," "Direction of Trade Statistics."

Figure 6-1

Impulse Response: (i) A 1 percent decline in the growth rate of Japan's domestic demand <Effects on Japan>

(Percent deviation from baseline)

Real GDP

Domestic Demand (%)

Quarter

Exports (%)

Imports (%)

Nominal Exchange Rate (against US dollar) (%)

Real Effective Exchange Rate (%)

GAP (%)

WPI (%)

Nominal Short-term Interest Rate (%)

Currrent Account Balance to Potential GDP (%)

Figure 6-2

Impulse Response: (i) A 1 percent decline in the growth rate of Japan's domestic demand
<Effects on Thailand>

(Percent deviation from baseline)   **Real GDP**

(%)   **Domestic Demand**

Quarter

(%)   **Exports**

(%)   **Imports**

(%)   **Nominal Exchange Rate (against US dollar)**

(%)   **Real Effective Exchange Rate**

(%)   **GAP**

(%)   **WPI**

(%)   **Nominal Short-term Interest Rate**

(%)   **Currrent Account Balance to Potential GDP**

Figure 7-1

**Impulse Response: (ii) A 1 percent decline in the growth rate of US domestic demand
<Effects on Japan>**

(Percent deviation from baseline) **Real GDP**

(%) **Domestic Demand**

(%) **Exports**

(%) **Imports**

(%) **Nominal Exchange Rate (against US dollar)**

(%) **Real Effective Exchange Rate**

(%) **GAP**

(%) **WPI**

(%) **Nominal Short-term Interest Rate**

(%) **Currrent Account Balance to Potential GDP**

Quarter

Figure 7-2

**Impulse Response: (ii) A 1 percent decline in the growth rate of US domestic demand
\<Effects on Thailand\>**

(Percent deviation from baseline) **Real GDP**

(%) **Domestic Demand**

(%) **Exports** Quarter

(%) **Imports**

(%) **Nominal Exchange Rate (against US dollar)**

(%) **Real Effective Exchange Rate**

(%) **GAP**

(%) **WPI**

(%) **Nominal Short-term Interest Rate**

(%) **Currrent Account Balance to Potential GDP**

Figure 8-1

**Impulse Response: (iii) A 1 percent decline in the growth rate of East Asia's domestic demand
<Effects on Japan>**

(Percent deviation from baseline) **Real GDP**

(%) **Domestic Demand**

(%) **Exports**

(%) **Imports**

(%) **Nominal Exchange Rate (against US dollar)**

(%) **Real Effective Exchange Rate**

(%) **GAP**

(%) **WPI**

(%) **Nominal Short-term Interest Rate**

(%) **Currrent Account Balance to Potential GDP**

Quarter

Figure 8-2

Impulse Response: (iii) A 1 percent decline in the growth rate of East Asia's domestic demand
<Effects on Thailand>

(Percent deviation from baseline)

Real GDP

Domestic Demand

Exports

Imports

Nominal Exchange Rate (against US dollar)

Real Effective Exchange Rate

GAP

WPI

Nominal Short-term Interest Rate

Currrent Account Balance to Potential GDP

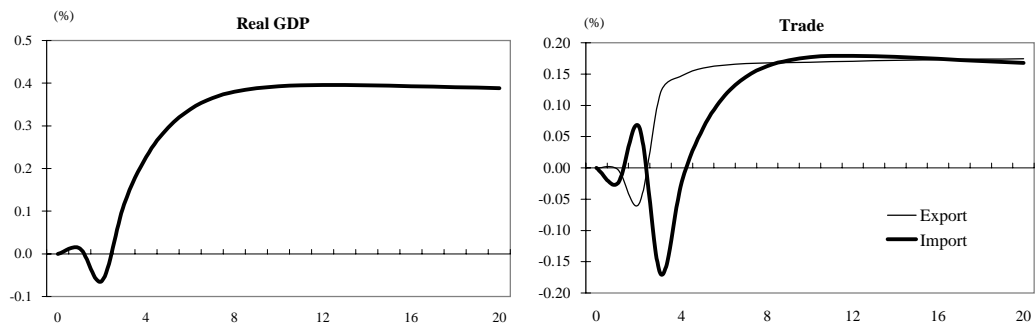Quarter

Figure 9

Effects of a 10 Percent Yuan Appreciation

(1) China

(2) Thailand

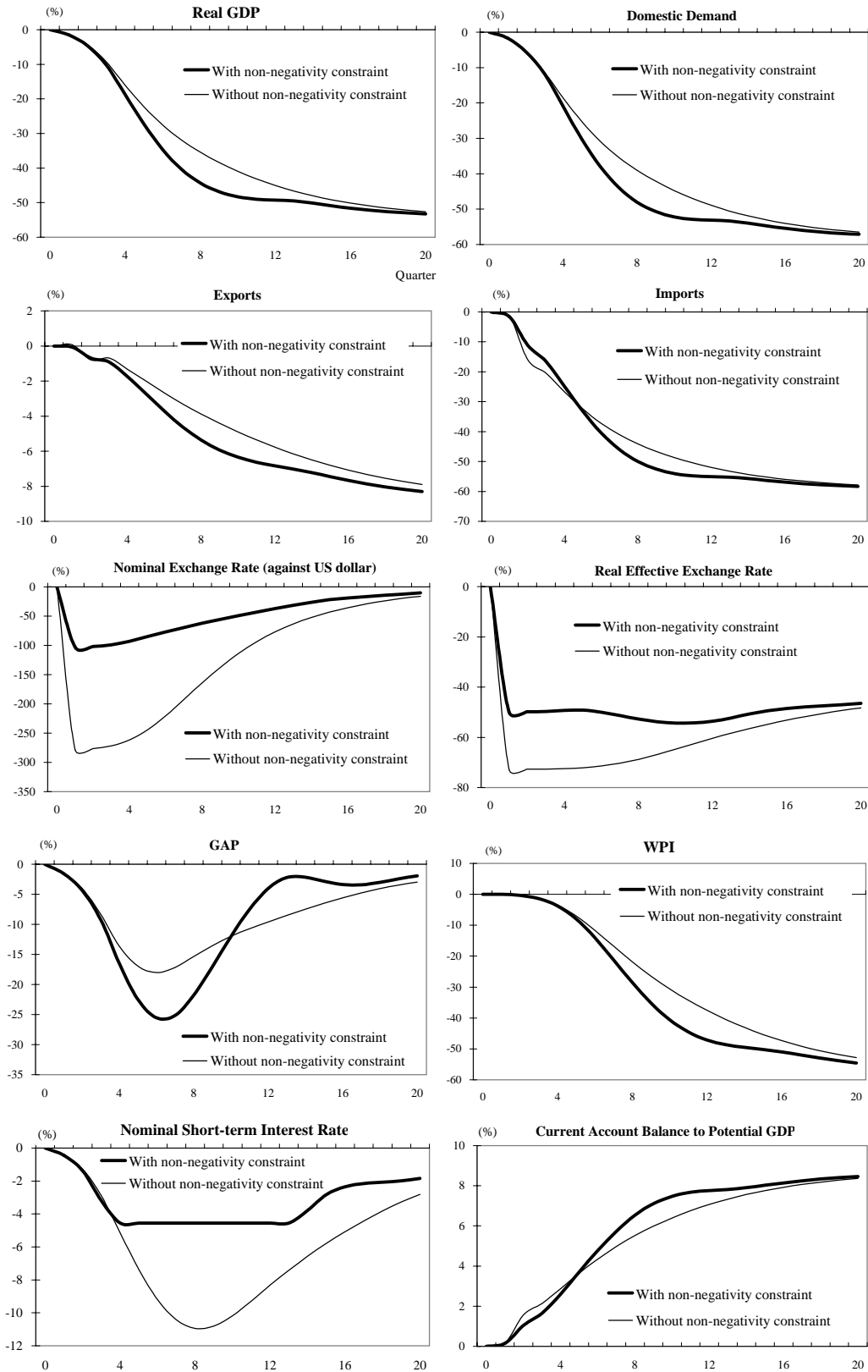(3) Japan

(4) US

Figure 10-1

Non-negativity Constraint on the Japanese nominal interest rates
<Effects on Japan>

Real GDP

(%)

- With non-negativity constraint
- Without non-negativity constraint

Quarter

Domestic Demand

(%)

- With non-negativity constraint
- Without non-negativity constraint

Exports

(%)

- With non-negativity constraint
- Without non-negativity constraint

Imports

(%)

- With non-negativity constraint
- Without non-negativity constraint

Nominal Exchange Rate (against US dollar)

(%)

- With non-negativity constraint
- Without non-negativity constraint

Real Effective Exchange Rate

(%)

- With non-negativity constraint
- Without non-negativity constraint

GAP

(%)

- With non-negativity constraint
- Without non-negativity constraint

WPI

(%)

- With non-negativity constraint
- Without non-negativity constraint

Nominal Short-term Interest Rate

(%)

- With non-negativity constraint
- Without non-negativity constraint

Current Account Balance to Potential GDP

(%)

- With non-negativity constraint
- Without non-negativity constraint

Figure 10-2

Non-negativity Constraint on the Japanese nominal interest rates
<Effects on Thailand>

(%) **Real GDP**
5
0
-5
-10
-15
-20
-25
0   4   8   12   16   20
Quarter

With non-negativity constraint
Without non-negativity constraint

(%) **Domestic Demand**
5
0
-5
-10
-15
-20
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

(%) **Export**
5
0
-5
-10
-15
-20
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

(%) **Import**
0
-5
-10
-15
-20
-25
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity

(%) **Nominal Exchange Rate (against US dollar)**
0
-5
-10
-15
-20
-25
-30
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

(%) **Real Effective Exchange Rate**
12
10
8
6
4
2
0
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

(%) **GAP**
2
0
-2
-4
-6
-8
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

(%) **WPI**
0
-1
-2
-3
-4
-5
-6
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

(%) **Nominal Short-term Interest Rate**
8
6
4
2
0
-2
-4
-6
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

(%) **Current Account Balance to Potential GDP**
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
0   4   8   12   16   20

With non-negativity constraint
Without non-negativity constraint

Table 1

Monetary and Exchange Rate Policies Both Before and After Asian Currency Crisis

	Before Asian Currency Crisis	After Asian Currency Crisis
Japan (yen)	Taylor Rule / Independent Floating (since February 1973)	
United States (dollar)	Taylor Rule / Independent Floating	
Indonesia (rupiah)	Managed Floating (since 1978)	Managed Floating (since 2001) / Preparing for Inflation Targeting
Singapore (Singapore dollar)	Managed Floating <Currency Basket> (since 1981)	
Thailand (baht)	Managed Floating <Currency Basket> (since November 1984)	Inflation Tageting (since May 2000) / Managed Floating (since July 1997)
The Philippines (peso)	Independent Floating <*de facto* Peg against the U.S. dollar> (since December 1994)	Inflation Tageting (since 2002) / Independent Floating (since March 1998)
Malaysia (ringgit)	Managed Floating (since 1973)	Fixed Peg Arrangements (since September 1998)
South Korea (won)	Managed Floating (since March 1990)	Inflation Targeting (since September 1998) / Independent Floating (since December 1997)
Hong Kong (Hong Kong dollar)	Currency Board Arrangements (since October 1983)	
China (yuan)	Managed Floating <*de facto* Peg against the U.S. dollar> (since 1994)	

Source: International Monetary Fund, "Annual Report."

Table 2

Responses of Real GDP and Exports to Three Types of Shock

(i) A 1 percent decline in the growth rate of Japanese domestic demand

	Real GDP		Exports	
	First year	Second year	First year	Second year
Japan	-0.98	-1.30	-0.08	-0.13
United States	-0.01	-0.02	-0.16	-0.21
Indonesia	-0.08	-0.12	-0.34	-0.44
Singapore	-0.12	-0.16	-0.20	-0.28
Thailand	-0.20	-0.39	-0.26	-0.35
Philippines	-0.12	-0.14	-0.27	-0.36
Malaysia	-0.10	-0.14	-0.23	-0.31
South Korea	-0.06	-0.09	-0.19	-0.25
Hong Kong	-0.07	-0.08	-0.12	-0.17
China	-0.06	-0.08	-0.26	-0.35

(ii) A 1 percent decline in the growth rate of US domestic demand

	Real GDP		Exports	
	First year	Second year	First year	Second year
Japan	-0.17	-0.30	-1.03	-2.19
United States	-1.16	-2.22	-0.39	-0.97
Indonesia	-0.10	-0.37	-0.52	-1.44
Singapore	-0.43	-1.04	-0.75	-1.80
Thailand	-0.08	-1.05	-0.76	-1.78
Philippines	-1.58	-1.87	-0.90	-2.04
Malaysia	-0.34	-0.85	-0.80	-1.85
South Korea	-0.45	-1.02	-0.84	-1.81
Hong Kong	-0.11	-0.49	-0.89	-1.79
China	-0.08	-0.29	-0.82	-1.91

(iii) A 1 percent decline in the growth rate of East Asian domestic demand excluding Japan

	Real GDP		Exports	
	First year	Second year	First year	Second year
Japan	-0.04	-0.06	-0.50	-0.57
United States	-0.02	-0.04	-0.29	-0.32
Indonesia	-0.92	-1.10	-0.50	-0.56
Singapore	-0.48	-0.50	-0.66	-0.71
Thailand	-1.12	-1.46	-0.43	-0.48
Philippines	-0.67	-0.69	-0.45	-0.51
Malaysia	-0.37	-0.38	-0.54	-0.61
South Korea	-0.68	-0.57	-0.35	-0.39
Hong Kong	-0.42	-0.40	-0.37	-0.42
China	-0.97	-0.97	-0.46	-0.50

Note: Figures are percent deviations from baseline.

Table 3

Summary of the Output- Gap Based Evaluations of the Three Policy Regimes

(1) The Demand Shock in the US

(i) Standard Deviations of Output Gaps

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
Current regime	0.07053	0.50846	0.10942	0.26499	0.43161	0.42495	0.21556	0.25026	0.14411	0.08434
US dollar peg	0.07425	0.51078	0.10980	0.26634	0.45301	0.11251	0.21747	0.24263	0.14263	0.08555
Currecy basket regime	0.07206	0.51013	0.11052	0.26799	0.44572	0.08262	0.21779	0.14398	0.13751	0.08823

(ii) Significant Changes

< From the US doller peg regime to the current regime or to the currency basket regime >

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
Current regime	○					✕				
Currecy basket regime						○		○		

Note: an o indicates that standard deviation of the output gap is reduced more than 5 percent by a regime shift; an x indicates that standard deviation of the output gap is reduced more than 5 percent by a regime shift.

< From the current regime to the US dollar peg or to the currency basket regime >

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
US dollar peg	✕					○				
Currecy basket regime						○		○		

Note: same as above.

(2) The Risk-Premium and Demand Shocks in Thailand

(i) Standard Deviations of Output Gaps

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
Current regime	0.01404	0.00652	0.03335	0.12363	1.92619	0.02643	0.09062	0.01924	0.02582	0.01513
US dollar peg	0.01396	0.00647	0.03316	0.12822	1.92466	0.02590	0.09027	0.02851	0.02543	0.01494
Currecy basket regime	0.01440	0.00659	0.03342	0.12398	1.92484	0.02240	0.09098	0.02390	0.02229	0.01352

(ii) Significant Changes

< From the US doller peg regime to the current regime or to the currency basket regime >

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
Current regime								○		
Currecy basket regime						○		○	○	○

Note: an o indicates that standard deviation of the output gap is reduced more than 5 percent by a regime shift; an x indicates that standard deviation of the output gap is reduced more than 5 percent by a regime shift.

< From the current regime to the US dollar peg or to the currency basket regime >

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
US dollar peg								✕		
Currecy basket regime						○		✕	○	○

Note: same as above.

Table 4

China's Currency Reform

(1) The Demand Shock in China

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
De Facto US dollar Peg	0.00180	0.00116	0.00317	0.00878	0.01297	0.00289	0.00609	0.00328	0.01441	0.21434
Free floating system	0.00373	0.00151	0.00488	0.01559	0.03050	0.00670	0.01048	0.01107	0.05319	0.20102
Significant Changes	✕	✕	✕	✕	✕	✕	✕	✕	✕	◯

Note: The figures are standard deviations of output gaps; an o indicates that the standard deviation of the output gap is reduced more than 5 percent by the reform; an x indicates that the standard deviation of the output gap is increased more than 5 percent by the reform.

(2) The Demand Shock in the US

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
De Facto US dollar Peg	0.07053	0.50846	0.10942	0.26499	0.43161	0.42495	0.21556	0.25026	0.14411	0.08434
Free floating system	0.06219	0.50522	0.10507	0.24938	0.43424	0.39739	0.20415	0.21665	0.28539	0.13365
Significant Changes	◯			◯		◯	◯	◯	✕	✕

Note: same as above.

(3) The Demand Shock in Japan

	Japan	US	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
De Facto US dollar Peg	0.27966	0.00639	0.02552	0.03465	0.08454	0.03138	0.03031	0.01817	0.01901	0.01727
Free floating system	0.27961	0.00636	0.02548	0.03455	0.08420	0.03133	0.03026	0.01831	0.01899	0.01736
Significant Changes										

Note: same as above.

Table 5

Estimation Results for Import Functions

Dependent variable $\Delta \ln M_t$	Japan	United States	Indonesia	Singapore	Thailand	Philippines	Malaysia	Korea	Hong Kong	China
$\Delta \ln X_t$	0.381 (3.230)	0.362 (4.093)	0.694 (7.005)	0.708 (23.416)	—	0.498 (4.537)	0.788 (10.206)	0.570 (5.726)	0.848 (24.037)	0.329 (3.063)
$\Delta \ln X_{t+1}$	—	—	—	—	0.454 (2.804)	0.216 (2.006)	—	—	—	—
$\Delta \ln X_{t+2}$	—	—	—	—	—	—	—	—	—	—
$\Delta \ln D_t$	0.929 (3.010)	1.711 (6.919)	1.176 (4.140)	0.547 (18.479)	0.642 (2.980)	0.827 (3.830)	0.714 (10.705)	1.108 (4.757)	0.504 (9.677)	0.328 (1.910)
$\Delta \ln D_{t-1}$	—	—	—	—	—	—	—	—	—	—
$\Delta \ln D_{t-2}$	—	—	—	—	—	—	—	—	—	—
$\Delta \ln RE_t$	—	—	—	—	—	0.195 (1.278)	—	0.385 (2.590)	—	—
$\Delta \ln RE_{t-1}$	0.088 (1.351)	—	—	0.091 (2.098)	—	—	—	0.153 (1.255)	0.059 (1.720)	—
$\Delta \ln RE_{t-2}$	—	—	—	—	0.292 (1.470)	—	—	—	—	0.135 (1.081)
Dummy	97/4 -0.034 (-1.516)									2000/1 0.186 (3.821)
Sample period	92/2-03/4	90/1-03/4	93/2-03/4	90/3-03/3	93/2-03/3	90/2-03/3	91/2-03/4	90/3-03/4	90/3-02/1	94/2-00/3
R^2	0.214	0.548	0.563	0.947	0.392	0.397	0.792	0.715	0.965	0.549
DW	2.060	2.617	1.953	1.795	2.303	2.116	2.461	2.490	2.214	1.829

Note: t-values in parentheses.

Table 6

Estimation Results for Domestic Demand Functions

Dependent variable $\Delta \ln D_t$	Japan	United States		Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
$\Delta \ln Y_{t-1}$	0.635 (2.961)	0.369 (2.981)		0.683 (4.635)	0.506 (2.045)	1.023 (3.651)	–	1.361 (3.932)	0.753 (6.264)	1.034 (5.855)	–
$\Delta \ln Y_{t-2}$	–	0.630 (4.917)		–	–	–	–	–	–	–	–
$\Delta \ln Y_{t-3}$	–	–		–	–	–	–	–	–	–	–
ΔRL_t	-1.511 (-1.484)	-0.234 (-1.018)		–	–	–	–	–	-0.455 (-2.908)	–	–
RC_{t-1}	–	–		–	–	0.073 (-1.465)	–	0.100 (1.706)	–	0.077 (1.368)	–
Dummy	97/2 -0.051 (-4.637)	2002/1 0.013 (2.569)	2003/3 0.011 (2.306)	98/1 -0.166 (-6.523)	98/1 -0.109 (-3.620)			98/1 -0.135 (-2.867)	98/1 -0.157 (-8.309)		
Sample period	94/1-04/1	94/3-03/4		93/3-03/4	90/1-03/3	94/1-04/1	-	92/2-04/1	90/1-04/1	90/1-02/1	-
R^2	0.414	0.307		0.603	0.252	0.249	-	0.348	0.650	0.315	-
DW	2.215	2.038		1.765	2.125	1.616	-	2.664	1.682	2.191	-

Notes: 1. t-values in parentheses.
    2. The fit was poor for the Philippines and China. We treat these countries' domestic demands as exogenous.

Table 7

Estimation Results for Phillips Curves

Dependent variable $\Delta \ln WPI_t$	Japan	United States	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
Constant	-0.002 (-3.451)	0.002 (1.678)	0.010 (2.876)	–	0.003 (1.751)	0.011 (3.534)	0.004 (3.417)	–	–	–
$\Delta \ln WPI_{t-1}$	0.236 (2.400)	0.407 (3.125)	0.240 (4.883)	–	0.333 (3.493)	–	0.298 (2.415)	0.330 (3.354)	0.811 (11.076)	0.393 (2.844)
GAP_{t-1}	0.225 (4.380)	0.262 (1.818)	–	0.209 (2.205)	–	–	–	0.127 (1.467)	0.086 (1.681)	0.116 (1.800)
$\Delta \ln RE_t - \Delta \ln WPI_t$	–	–	-0.416 (-17.750)	-0.622 (-2.560)	-0.231 (-6.785)	-0.117 (-1.799)	-0.035 (-1.910)	-0.186 (-8.076)	-0.063 (-1.162)	–
Dummy	97/2 0.018 (4.256)			93/1 -0.089 (-4.300)		97/1 0.055 (2.554)	94/1 0.016 (3.492)			
Sample period	89/1-04/1	91/2-02/4	90/2-03/4	91/3-03/4	90/2-03/4	90/2-03/4	92/3-03/4	90/2-03/2	90/3-02/2	95/2-02/2
R^2	0.477	0.326	0.878	0.323	0.528	0.146	0.341	0.600	0.647	0.454
DW	2.077	1.722	2.158	2.241	2.290	1.509	1.844	1.990	2.705	2.498

Note: t-values in parentheses.

Table 8

Estimation Results for Policy Rules

Dependent variable I_t	Japan	United States	Indonesia	Singapore	Thailand	Philippines	Malaysia	South Korea	Hong Kong	China
Constant	0.046 (12.508)	0.042 (22.825)	0.065 (1.484)	–	-0.010 (-1.475)	0.047 (3.353)	–	0.038 (5.128)	–	–
$\triangle \ln CPI_t$	1.408 (2.648)	1.016 (4.191)	3.482 (4.735)	–	4.556 (6.646)	2.439 (2.542)	–	4.604 (5.600)	–	–
GAP_t	0.291 (1.089)	0.563 (2.661)	–	–	–	–	–	–	–	–
$\triangle \ln E_t$	–	–	0.300 (2.305)	–	0.471 (5.131)	0.341 (2.345)	–	0.179 (2.463)	–	–
Dummy					1998/2 2000/1 0.170 0.070 (6.273) (3.137)					
Sample period	84/2-95/4	92/1-02/4	97/3-03/4	-	98/1-04/1	98/1-03/4	-	98/1-03/4	-	-
R^2	0.184	0.368	0.555	-	0.871	0.311	-	0.679	-	-
DW	0.111	0.212	0.651	-	1.506	0.683	-	0.892	-	-

Note: t-values in parentheses.