ADB INSTITUTE

CENTRE D'ETUDES PROSPECTIVES ET D'INFORMATIONS INTERNATIONALES

KOREA INSTITUTE FOR INTERNATIONAL ECONOMIC POLICY

INTERNATIONAL CONFERENCE ON EXCHANGE RATE REGIMES IN EMERGING MARKET ECONOMIES

17-18 December 1999 – Tokyo,Japan

Session 3 : the choice of an exchange rate Regime Revisited

«On the Desirability of a Regional Basket Currency Arrangement»

by T. Ito, E. Ogawa and Y. Sasaki

Document n°12

With the support of

ASSOCIATION FRANÇAISE DES BANQUES

THE FRENCH MINISTRY OF FINANCE
Treasury Directorate

THE GERMAN MINISTRY OF FINANCE

CAISSE DES DÉPÔTS ET CONSIGNATIONS
Institut CDC

On the Desirability of a Regional Basket Currency Arrangement*

Eiji Ogawa[a], Takatoshi Ito[b], and Yuri N. Sasaki[c]

December 13, 1999

Correspondences:
Professor Eiji OGAWA
Department of Commerce
Hitotsubashi University
Kunitachi, Tokyo 186-8601
Japan
Email: cc00104@srv.cc.hit-u.ac.jp

* This paper is prepared for the CEPII-KIEP-ADBI conference, December 17-18, 1999. Views expressed here are authors' own, and not necessarily those of institutions with which the authors were affiliated at present or in the past.

[a] Professor, Hitotsubashi University.
[b] Deputy Vice Minister for International Affairs, Ministry of Finance.
[c] Assistant Professor, Takachiho University.

1. Introduction

One of the lessons from the Asian Currency Crises is the danger of the *de facto* dollar peg adopted by the Asian economies that had extensive trade and investment relationship with countries other than the United States. When the yen appreciated vis-à-vis the U.S. dollar, the Asian economies enjoyed the boom, or a bubble in some cases, due to increased exports. But, when the yen depreciated, the Asian economies tended to experience a recession, or a burst bubble. The experience of the Asian boom and bust in the 1990s, along with the yen-dollar exchange rate fluctuation, is a stark reminder of risk of the fixed exchange rate regime.

An obvious solution for this problem is to increase flexibility of the exchange rate. If the baht had appreciated when the yen appreciated in the 1993-95, the boom in Thailand might have been checked; and if the baht had depreciated along with the yen in 1996-97, then the decline in exports could have been mitigated. This kind of exchange rate flexibility could have been achieved either by free floating or managed floating.

The so-called "two-corner solution" has become a popular view among some researchers and policy makers in the post-crisis discussions. (See Eichengreen (1999), for example.) According to this view, free floating, an ultimate flexibility, and a currency board, ultimate inflexibility, are only stable regime in the long run. Any intermediate regime—managed float or fixed exchange rate regime without adopting the currency board—is unstable. The advocates of the two corner solution cite the fact that Hong Kong and Argentina, both currency board economies, survived the currency crisis of the neighboring economies.

Would free floating be a solution for Asian economies (other than Hong Kong) as indicated by the two corner solution advocates? We think that free floating would not necessarily avoid future crises. First, even advanced countries find it necessary to intervene occasionally. Foreign exchange rates sometimes become misaligned with fundamentals. The U.S. dollar in 1984-85 and the yen in 1995 are the obvious example of overvaluation. Misalignment needs to be corrected by intervention and some policy adjustment. Second, the worst of the Asian crises, say November 1997 to January 1998, came long after the Asian economies moved to flexible exchange rate regime. When contagion from neighboring countries comes, free floating would cause the downward spiral of regional currencies. A devaluation of a currency would bring down the currencies of trade- and investment-related countries. Those who praise China to be a barrier to stop a contagious devaluation spiral in the region by maintaining the fixed exchange rate should also be advocating some sort of managed float in times of crisis.

Thus, an emerging market economy is advised to consider managing the exchange rate, to avoid excessive volatility and to maintain stability of the real effective exchange rate. The question is what would be a reference rate for appropriate real effective exchange rate and how much fluctuation is excessive.

This paper considers the following question that is related to the questions posed above. For the emerging economy, the real effective exchange rate stability is important. Typical Asian economy exports about one-third to the United States and one-third to Japan, and the rest to countries in the Asian region (and EU). Therefore, to simplify, we consider the case that country A (B, respectively) exports to the U.S., Japan, and country B (A, respectively). Therefore, the real effective exchange rate calculation includes the currency of neighboring country. This is the extension of the model in Ito, Ogawa, and Sasaki (1998), in which an Asian country was considered in isolation.

The optimality of the exchange rate regime is defined as the one which minimizes the fluctuation of the trade balances, when the yen-dollar exchange rate fluctuates. Ito, Ogawa, and Sasaki proposed how to calculate the optimal weights when the emerging market economy exports to Japan and the United States only. The optimal weights were calibrated with some assumptions on the demand elasticities and export shares. In this paper, the model includes the neighboring emerging market as well as Japan and the United States. What makes difficult and interesting in this model is that the optimal weights may depend on what the neighboring country is adopting as weights. In the extreme case, if country A is adopting the dollar peg, country B should adopt the dollar peg; and if country B is adopting the dollar peg, then country A should adopt the dollar peg. Namely, the dollar peg is a Nash equilibrium. However, if country A is using a currency basket which mirrors the export shares, adjusted for demand elasticities, then country B should adopt a (similar) currency basket; and if country B is using a currency basket, then country A should adopt a currency basket. The currency basket is also a Nash equilibrium.

Which of the Nash equilibria is chosen depends on the inertia as well as rational calculation. If countries can coordinate, then they should choose the best among Nash equilibria. This process of choosing an optimal Nash equilibria can be regarded as a regional currency arrangement. Coordination failure could occur if a country has some obstacles for coordination from political or social obstacles against breaking inertia.

The rest of the paper is organized as follows. Section 2 explains the model. Section 3 examines the impacts of the exchange rate changes on the trade balances. Section 4 defines and solves for an optimal currency regime.

2. Model

(1) Settings

Our earlier work, Ito, Ogawa, and Sasaki (1998), considered the question of choosing optimal weights in the basket currency system for a country that export goods to the United States and Japan. An ASEAN country was modeled as a one-sector economy where a representative firm assembles parts imported from Japan and the United States into manufactured products. It was supposed that a representative firm in one ASEAN country competed with Japanese firms and/or U.S. firms in Japanese and U.S. markets in the model. We extend our earlier model to include another neighboring country in the model in order to analyze interactions of the exchange rate policies among ASEAN countries.

We assume that a representative firm in country A imports parts from the United States and Japan and supplies its products to markets in the United States, Japan, and country B as well as a domestic market.[1] Also, a representative firm in country B imports parts from the United States and Japan and supplies its products to markets in the United States, Japan, and country A as well as a domestic market.

Asian countries export their goods and services mainly to Japan, the United States, and neighboring Asian countries. For example, Thailand exports one-fourth to Japan, one-fifth to NIES (Korea, Singapore, Hong Kong, and Taiwan) and ASEAN-4 countries (Thailand, Philippines, Indonesia, and Malaysia), one-seventh to the United States. These three categories account for more than 60 percent. Similarly, Malaysia exports to 22 percent, 34 percent and 17 percent to Japan, to the U.S., and to Asian countries, respectively. The sum of these three categories reaches 72 percent. The structure is similar in Indonesia and the Philippines. Table 1 shows the export shares by destination to Japan, US, Asian countries, and four European countries (Germany, France, UK, and Italy). Therefore, the assumptions of the model, Country A exports to Japan, the U.S., and neighboring country B, is not far off from the reality.

Each market in countries A and B is supposed to be a duopoly market where both country A and B firms compete with each other. Markets in the United States and Japan are monopolistic competitive. Firms in Country A and B compete with many domestic firms in each of the Japanese and U.S. markets. They supplies their products in the U.S. and Japanese monopolistic competitive markets given average prices of their domestic products made in the United States and Japan. We assume that all firms in countries A and B have identical cost functions. Each firm maximizes its profits in terms of its own home currency.

Profits of a firm in country A in terms of its own home currency A (π_A) is calculated

[1] Ohno (1989) examined pass-through effects of exchange rates on export pricing behavior in manufacturing after taking account of prices of raw materials. Marston (1990) modeled a similar pricing to market model.

as

$$\pi_A = P_A^A d(q_A) + E^{A/Y} P_J^A f_A(q_J^A) + E^{A/\$} P_{US}^A g_A(q_{US}^A) + E^{A/B} P_B^A h_A(q_B) \\ - E^{A/Y} P_m^Y \omega_m^J Q_A - E^{A/\$} P_m^\$ \omega_m^{US} Q_A - C(Q_A) \tag{2.1}$$

where P_A^A: a price of the country A firm's products in the domestic market in terms of the home currency A, P_J^A: a price of the country A firm's products in the Japanese market in terms of the yen, P_{US}^A: a price of the country A firm's products in the U.S. market in terms of the dollar, P_B^A: a price of the country A firm's products in the country B market in terms of the currency B, P_m^Y: a price of parts imported from Japan in terms of the yen, $P_m^\$$: a price of parts imported from the United States in terms of the dollar, Q_A: outputs of the country A firms products $(Q_A = d_A(q_A) + f_A(q_J^A) + g_A(q_{US}^A) + h_A(q_B))$, d_A: a demand function for the country A firm's products in the domestic market, f_A: a demand function for the country A firm's products in the Japanese market, g_A: a demand function for the country A firm's products in the U.S. market, h_A: a demand function for the country A firm's products in the country B markets, $C(\cdot)$: a cost function of the country A and B firms, $q_J^A \equiv P_J^A / P_J$: a relative price of the country A firm's products relative to the Japanese products in the Japanese market, $q_{US}^A \equiv P_{US}^A / P_{US}$: a relative price of the country A firm's products relative to the U.S. products in the U.S. market, $q_A \equiv P_A^A / P_A^B$: a relative price of the country A firm's products relative to the country B firm's products in the country A market, $q_B \equiv P_B^A / P_B^B$: a relative price of the country A firm's products relative to the country B firm's products in the country B market, P_J: a price of the Japanese products in the Japanese market in terms of the yen, P_{US}: a price of the U.S. products in the U.S. market in terms of the dollar, P_B^B: a price of the country B firm's products in the country B market in terms of the currency B, P_A^B: a price of the country B firm's products in the country A market in terms of the currency A, $E^{A/Y}$: an exchange rate of the yen in terms of country A currency, $E^{A/\$}$: an exchange rate of the dollar in terms of country A currency, $E^{A/B}$: an exchange rate of country B currency in terms of country A currency, ω_m^J: a share of parts imported from Japan, ω_m^{US}: a share of parts imported from the United States.

Profits of a firm in country B in terms of the home currency B (π_B) is calculated as

$$\pi_B = P_B^B d_B(1/q_B) + E^{B/Y} P_J^B f_B(q_J^B) + E^{B/\$} P_{US}^B g_B(q_{US}^B) + E^{B/A} P_A^B h_B(1/q_A) \\ - E^{B/Y} P_m^Y \omega_m^J Q_B - E^{B/\$} P_m^\$ \omega_m^{US} Q_B - C(Q_B) \tag{2.2}$$

where P_J^B: a price of the country B firm's products in the Japanese market in terms of the yen, P_{US}^B: a price of the country B firm's products in the U.S. market in terms of the dollar, Q_B: output of the country B firm's products $(Q_B = d_B(1/q_B) + f_B(q_J^B) + g_B(q_{US}^B) + h_B(1/q_A))$, f_B: a demand function for the country B firm's products in the Japanese market, g_B: a demand function for the country B firm's products in the U.S. market, h_B: a demand function for the country B firm's products in country A markets, $q_J^B \equiv P_J^B / P_J$: a relative price of the country B firm's products relative to the Japanese products in the Japanese market, $q_{US}^B \equiv P_{US}^B / P_{US}$: a relative price of the country B firm's products relative to the U.S. products in the U.S. market.

From first order conditions of equation (2.1), profit-maximizing prices of the country A firm in Japanese, the United States, countries A and B markets, respectively, are derived as

$$P_J^A = \mu_J^A \frac{C_A}{E^{A/Y}} \tag{2.3}$$

$$P_{US}^A = \mu_{US}^A \frac{C_A}{E^{A/\$}} \tag{2.4}$$

$$P_A^A = \mu_A^A C_A \tag{2.5}$$

$$P_B^A = \mu_B^A \frac{C_A}{E^{A/B}} \tag{2.6}$$

$$C_A \equiv \omega_m^J E^{A/Y} P_m^Y + \omega_m^{US} E^{A/\$} P_m^{\$} + C'(Q_A) \tag{2.7}$$

where $\mu_i^A \equiv \varepsilon_i^A(q_i^A)/\left\{\varepsilon_i^A(q_i^A)-1\right\}$ (for $i = J, US, A, B$) denotes markups of the country A firm's products in each of the Japanese, U.S., country A, and country B markets, ε_i^A (for $i = J, US, A, B$) denotes a price elasticity of demand for the country A firm's product in the each of Japanese, U.S. country A and country B markets

We convert equations (2.3) to (2.6) into a logarithm form and derive reaction functions of country A firm in the Japanese, the United States, and country A and B markets given the prices of the products made in Japan, the United States, and country B, respectively.

$$\log P_J^A = \frac{\eta_J^A}{1+\eta_J^A} \log P_J + \frac{1}{1+\eta_J^A}\left(\log C_A - \log E^{A/Y}\right) \tag{2.8}$$

$$\log P_{US}^A = \frac{\eta_{US}^A}{1+\eta_{US}^A} \log P_{US} + \frac{1}{1+\eta_{US}^A}\left(\log C_A - \log E^{A/\$}\right) \tag{2.9}$$

$$\log P_A^A = \frac{\eta_A^A}{1+\eta_A^A} \log P_A^B + \frac{1}{1+\eta_A^A} \log C_A \tag{2.10}$$

$$\log P_B^A = \frac{\eta_B^A}{1+\eta_B^A} \log P_B^B + \frac{1}{1+\eta_B^A}\left(\log C_A - \log E^{A/B}\right) \tag{2.11}$$

where $\eta_i^A \equiv \mu_i^{A\prime} q_i^A / \mu_i^A$ (for $i = J, US, A, B$) denotes price elasticity of the markups of the country A firm's products in each of the Japanese, U.S., country A, and country B market.

Also, from first order conditions of equation (2.2), profit-maximizing prices of the country B firm in Japanese, the United States, countries A and B markets, respectively, are derived as

$$P_J^B = \mu_J^B \frac{C_B}{E^{B/Y}} \tag{2.12}$$

$$P_{US}^B = \mu_{US}^B \frac{C_B}{E^{B/\$}} \tag{2.13}$$

$$P_B^B = \mu_B^B C_B \tag{2.14}$$

$$P_A^B = \mu_A^B \frac{C_B}{E^{B/A}} \tag{2.15}$$

$$C_B \equiv \omega_m^J E^{B/Y} P_m^Y + \omega_m^{US} E^{B/\$} P_m^{\$} + C'(Q_B) \tag{2.16}$$

where $\mu_i^B \equiv \varepsilon_i^B(q_i^b)/\left\{\varepsilon_i^B(q_i^B)-1\right\}$ (for $i = J, US, A, B$) denotes markups of the country B firm's products in each of the Japanese, U.S., country A, and country B markets, ε_i^B

(for $i = J, US, A, B$) denotes a price elasticity of demand for the country B firm's product in each of the Japanese, U.S., country A, and country B markets.

We convert equations (2.12) to (2.15) into a logarithm form and derive reaction functions of country A firm in the Japanese, the United States, and country A and B markets given the prices of the products made in Japan, the United States, and country B, respectively.

$$\log P_J^B = \frac{\eta_J^B}{1+\eta_J^B}\log P_J + \frac{1}{1+\eta_J^B}\left(\log C_B - \log E^{B/Y}\right) \qquad (2.17)$$

$$\log P_{US}^B = \frac{\eta_{US}^B}{1+\eta_{US}^B}\log P_{US} + \frac{1}{1+\eta_{US}^B}\left(\log C_B - \log E^{B/\$}\right) \qquad (2.18)$$

$$\log P_B^B = \frac{\eta_B^B}{1+\eta_B^B}\log P_B^A + \frac{1}{1+\eta_B^B}\log C_B \qquad (2.19)$$

$$\log P_A^B = \frac{\eta_A^B}{1+\eta_A^B}\log P_A^A + \frac{1}{1+\eta_A^B}\left(\log C_B + \log E^{A/B}\right) \qquad (2.20)$$

where $\eta_i^B \equiv \mu_i^{B\prime} q_i^B / \mu_i^B$ (for $i = J, US, A, B$) denotes price elasticity of the markups of the country B firm's products in each of the Japanese, U.S., country A, and country B markets.

For simplicity, we assume that price elasticities of demand for the country A and B firms' product are equal to each other in each of the country A and B markets. That is, $\varepsilon_A^B = \varepsilon_A^A = \varepsilon_A$ and $\varepsilon_B^A = \varepsilon_B^B = \varepsilon_B$. Thus, price elasiticities of the markups of country A and B firms' products are equal to each other in each of the country A and B markets. That is, $\eta_A^B = \eta_A^A = \eta_A$ and $\eta_B^A = \eta_B^B = \eta_B$.

From equations (2.10) and (2.20), we obtain equilibrium prices for the country A and B firms' products in the duopoly market of country A:

$$\log P_A^A = \frac{1+\eta_A}{1+2\eta_A}\log C_A + \frac{\eta_A}{1+2\eta_A}\left(\log C_B + \log E^{A/B}\right) \qquad (2.21)$$

$$\log P_A^B = \frac{\eta_A}{1+2\eta_A}\log C_A + \frac{1+\eta_A}{1+2\eta_A}\left(\log C_B + \log E^{A/B}\right) \qquad (2.22)$$

From equations (2.11) and (2.19), we obtain equilibrium prices for the country A and B firms' products in the duopoly market of country B:

$$\log P_B^A = \frac{1+\eta_B}{1+2\eta_B}\left(\log C_A - \log E^{A/B}\right) + \frac{\eta_B}{1+2\eta_B}\log C_B \qquad (2.23)$$

$$\log P_B^B = \frac{\eta_B}{1+2\eta_B}\left(\log C_A - \log E^{A/B}\right) + \frac{1+\eta_B}{1+2\eta_B}\log C_B \qquad (2.24)$$

Equations (2.21) to (2.24) shows that the equilibrium prices of country A and B firms' products depend on not only marginal total costs of country A and B products but also the exchange rate of currency A against currency B.

(2) Relative prices and demand functions

From equations (2.8), (2.9), (2.17), and (2.18), we obtain equilibrium relative prices of country A and B firms' products relative to the Japanese and the U.S. domestic products in the Japanese and U.S. markets, respectively.

$$\log q_J^A = \varphi_J^A \left(\log C_A - \log E^{A/Y} - \log P_J\right) \qquad (2.25)$$

$$\log q_{US}^A = \varphi_{US}^A \left(\log C_A - \log E^{A/\$} - \log P_{US}\right) \qquad (2.26)$$

$$\log q_J^B = \varphi_J^B \left(\log C_B - \log E^{B/Y} - \log P_J\right) \qquad (2.27)$$

$$\log q_{US}^{B} = \varphi_{US}^{B}\left(\log C_{B} - \log E^{B/\$} - \log P_{US}\right) \tag{2.28}$$

Moreover, from equations (2.21) to (2.24), we obtain equilibrium relative prices of country A products relative to country B products in each of the country A and B markets, respectively.

$$\log q_{A} = \varphi_{A}\left(\log C_{A} - \log C_{B} + \log E^{A/B}\right) \tag{2.29}$$

$$\log q_{B} = \varphi_{B}\left(\log C_{A} - \log C_{B} - \log E^{A/B}\right) \tag{2.30}$$

where $\varphi_{J}^{A} \equiv \dfrac{1}{1+\eta_{J}^{A}}$, $\varphi_{US}^{A} \equiv \dfrac{1}{1+\eta_{US}^{A}}$, $\varphi_{J}^{B} \equiv \dfrac{1}{1+\eta_{J}^{B}}$, $\varphi_{US}^{B} \equiv \dfrac{1}{1+\eta_{US}^{B}}$, $\varphi_{A} \equiv \dfrac{1}{1+2\eta_{A}}$, $\varphi_{B} \equiv \dfrac{1}{1+2\eta_{B}}$.

Equations (2.29) and (2.30) show that the equilibrium relative prices depend on the marginal total costs and the exchange rate of currency A against currency B.

We specify demand functions for country A and B firms' products exporting to the Japanese, the U.S., and country A and B markets from equations (2.25) to (2.30).

$$\log f_{A} = \varepsilon_{J}^{A}\varphi_{J}^{A}\left(\log P_{J} + \log E^{A/Y} - \log C_{A}\right) \tag{2.31}$$

$$\log g_{A} = \varepsilon_{US}^{A}\varphi_{US}^{A}\left(\log P_{US} + \log E^{A/\$} - \log C_{A}\right) \tag{2.32}$$

$$\log h_{A} = \varepsilon_{A}\varphi_{A}\left(\log C_{B} - \log C_{A} + \log E^{A/B}\right) \tag{2.33}$$

$$\log f_{B} = \varepsilon_{J}^{B}\varphi_{J}^{B}\left(\log P_{J} + \log E^{B/Y} - \log C_{B}\right) \tag{2.34}$$

$$\log g_{B} = \varepsilon_{US}^{B}\varphi_{US}^{B}\left(\log P_{US} + \log E^{B/\$} - \log C_{B}\right) \tag{2.35}$$

$$\log h_{B} = \varepsilon_{B}\varphi_{B}\left(\log C_{A} - \log C_{B} - \log E^{A/B}\right) \tag{2.36}$$

The demands depend on the exchange rates as well as the marginal total costs, the Japanese and U.S. prices, and exchange rates.

3. Effects of exchange rates on trade balances

We analyze effects of exchange rates on trade balances of countries A and B. In our model, their trade balances are equal to a total export value less a sum of total costs of imported parts and an import value from the other ASEAN country. Therefore, we represent the trade balances in terms of the dollar for countries A and B, respectively:

$$T_{A} = E^{\$/Y}P_{J}^{A}f_{A} + P_{US}^{A}g_{A} + E^{\$/B}P_{B}^{A}h_{A} - E^{\$/Y}P_{m}^{Y}\omega_{m}^{J}Q_{A} - P_{m}^{\$}\omega_{m}^{US}Q_{A} - E^{\$/A}P_{A}^{B}h_{B} \tag{3.1}$$

$$T_{B} = E^{\$/Y}P_{J}^{B}f_{B} + P_{US}^{B}g_{B} + E^{\$/A}P_{A}^{B}h_{B} - E^{\$/Y}P_{m}^{Y}\omega_{m}^{J}Q_{B} - P_{m}^{\$}\omega_{m}^{US}Q_{B} - E^{\$/B}P_{B}^{A}h_{A} \tag{3.2}$$

We derive a relationship between fluctuations in the trade balances and those in the exchange rates from equations (3.1) and (3.2).

$$\begin{aligned}\hat{T}_{A} = &\left\{\left(\tau_{A}^{ExJ} - \tau_{A}^{ImJ}\right)\hat{E}^{A/Y} - \left(\tau_{A}^{ExJ} - \tau_{A}^{ImJ} - \tau_{A}^{ImB}\right)\hat{E}^{A/\$} - \tau_{A}^{ExB}\hat{E}^{B/\$}\right\}\\ &+\left\{\tau_{A}^{ExJ}\hat{P}_{J}^{A} + \tau_{A}^{ExUS}\hat{P}_{US}^{A} + \tau_{A}^{ExB}\hat{P}_{B}^{A} - \tau_{A}^{ImB}\hat{P}_{A}^{B}\right\}\\ &+\left\{\tau_{A}^{ExJ}\hat{f}_{A} + \tau_{A}^{ExUS}\hat{g}_{A} + \tau_{A}^{ExB}\hat{h}_{A} - \tau_{A}^{ImJUS}\hat{Q}_{A} - \tau_{A}^{ImB}\hat{h}_{B}\right\}\end{aligned} \tag{3.3}$$

$$\begin{aligned}\hat{T}_{B} = &\left\{\left(\tau_{B}^{ExJ} - \tau_{B}^{ImJ}\right)\hat{E}^{B/Y} - \left(\tau_{B}^{ExJ} - \tau_{B}^{ImJ} - \tau_{B}^{ImA}\right)\hat{E}^{B/\$} - \tau_{B}^{ExA}\hat{E}^{A/\$}\right\}\\ &+\left\{\tau_{B}^{ExJ}\hat{P}_{J}^{B} + \tau_{B}^{ExUS}\hat{P}_{US}^{B} + \tau_{B}^{ExA}\hat{P}_{A}^{B} - \tau_{B}^{ImA}\hat{P}_{B}^{A}\right\}\\ &+\left\{\tau_{B}^{ExJ}\hat{f}_{B} + \tau_{B}^{ExUS}\hat{g}_{B} + \tau_{B}^{ExA}\hat{h}_{B} - \tau_{B}^{ImJUS}\hat{Q}_{B} - \tau_{B}^{ImA}\hat{h}_{A}\right\}\end{aligned} \tag{3.4}$$

where $\tau_{A}^{ExJ} \equiv E^{\$/Y}P_{J}^{A}f_{A}/T_{A}$, $\tau_{A}^{ExUS} \equiv P_{US}^{A}g_{A}/T_{A}$, $\tau_{A}^{ExB} \equiv E^{\$/B}P_{B}^{A}h_{A}/T_{A}$, $\tau_{A}^{ImJ} \equiv E^{\$/Y}P_{m}^{Y}\omega_{m}^{J}Q_{A}/T_{A}$, $\tau_{A}^{ImUS} \equiv P_{m}^{\$}\omega_{m}^{US}Q_{A}/T_{A}$, $\tau_{A}^{ImB} \equiv E^{\$/A}P_{A}^{B}h_{B}/T_{A}$, $\tau_{B}^{ExJ} \equiv E^{\$/Y}P_{J}^{B}f_{B}/T_{B}$, $\tau_{B}^{ExUS} \equiv P_{US}^{B}g_{B}/T_{B}$, $\tau_{B}^{ExA} \equiv E^{\$/A}P_{A}^{B}h_{B}/T_{B}$, $\tau_{B}^{ImJUS} \equiv (E^{\$/Y}P_{m}^{Y}\omega_{m}^{J} + P_{m}^{\$}\omega_{m}^{US})Q_{B}/T_{B}$, $\tau_{B}^{ImA} \equiv E^{\$/B}P_{B}^{A}h_{A}/T_{B}$.

The first line in equations (3.3) and (3.4) represent direct effects of the exchange rates on the trade balances. The second line represents effects of the exchange rates via indirect effects of the exchange rates via pricing behavior of country A and B firms. The third line represents indirect effects on the trade balances via trade volumes.

The direct effects of the exchange rates on the trade balances depend upon relative sizes of exports and imports because the country A and B firms import parts from Japan and the United States and exports products these countries and country B. If the direct effects of the exchange rates on the trade balances are dominant over the second and third indirect effects, the Marshall-Lerner condition is violated.

The indirect effects via the pricing behaviors are represented in terms of fluctuations in the exchange rates as follows:

$$
\begin{aligned}
&\tau_A^{ExJ}\hat{P}_J^A+\tau_A^{ExUS}\hat{P}_{US}^A+\tau_A^{ExB}\hat{P}_B^A-\tau_A^{ImB}\hat{P}_A^B \\
&=\left\{-\frac{\tau_A^{ExJ}(1-\alpha_1)}{1+\eta_J^A}+\frac{\tau_A^{ExUS}\alpha_1}{1+\eta_{US}^A}+\frac{\tau_A^{ExB}\alpha_1(1+\eta_B)}{1+2\eta_B}-\frac{\tau_A^{ImB}\alpha_1\eta_A}{1+2\eta_A}\right\}\hat{E}^{A/Y} \\
&+\left\{-\frac{\tau_A^{ExUS}(1-\alpha_2)}{1+\eta_{US}^A}+\frac{\tau_A^{ExJ}\alpha_2}{1+\eta_J^A}-\frac{\tau_A^{ExB}(1-\alpha_2)(1+\eta_B)}{1+2\eta_B}-\frac{\tau_A^{ImB}(1+\eta_A+\alpha_2\eta_A)}{1+2\eta_A}\right\}\hat{E}^{A/\$} \qquad (3.5) \\
&+\left\{\frac{\tau_A^{ExB}\alpha_1\eta_B}{1+2\eta_B}-\frac{\tau_A^{ImB}\alpha_1(1+\eta_A)}{1+2\eta_A}\right\}\hat{E}^{B/Y} \\
&+\left\{\frac{\tau_A^{ExB}(1+\eta_B+\eta_B\alpha_2)}{1+2\eta_B}+\frac{\tau_A^{ImB}(1-\alpha_2)(1+\eta_A)}{1+2\eta_A}\right\}\hat{E}^{B/\$}
\end{aligned}
$$

$$
\begin{aligned}
&\tau_B^{ExJ}\hat{P}_J^B+\tau_B^{ExUS}\hat{P}_{US}^B+\tau_B^{ExA}\hat{P}_A^B-\tau_B^{ImA}\hat{P}_B^A \\
&=\left\{-\frac{\tau_B^{ExJ}(1-\alpha_1)}{1+\eta_J^B}+\frac{\tau_B^{ExUS}\alpha_1}{1+\eta_{US}^B}+\frac{\tau_B^{ExA}\alpha_1(1+\eta_A)}{1+2\eta_A}-\frac{\tau_B^{ImA}\alpha_1\eta_B}{1+2\eta_B}\right\}\hat{E}^{B/Y} \\
&+\left\{-\frac{\tau_B^{ExUS}(1-\alpha_2)}{1+\eta_{US}^B}+\frac{\tau_B^{ExJ}\alpha_2}{1+\eta_J^B}-\frac{\tau_B^{ExA}(1-\alpha_2)(1+\eta_A)}{1+2\eta_A}-\frac{\tau_B^{ImA}(1+\eta_B+\alpha_2\eta_B)}{1+2\eta_B}\right\}\hat{E}^{B/\$} \qquad (3.6) \\
&+\left\{\frac{\tau_B^{ExA}\alpha_1\eta_A}{1+2\eta_A}-\frac{\tau_B^{ImA}\alpha_1(1+\eta_B)}{1+2\eta_B}\right\}\hat{E}^{A/Y} \\
&+\left\{\frac{\tau_B^{ExA}(1+\eta_A+\eta_A\alpha_2)}{1+2\eta_A}+\frac{\tau_B^{ImA}(1-\alpha_2)(1+\eta_B)}{1+2\eta_B}\right\}\hat{E}^{A/\$}
\end{aligned}
$$

where $0<\alpha_1\equiv\frac{\omega_m^J E^{A/Y}P_m^Y}{C_A}<1$, $0<\alpha_2\equiv\frac{\omega_m^{US}E^{A/\$}P_m^\$}{C_A}<1$, $0<\alpha_3\equiv\frac{C'(Q_A)}{C_A}<1$, $0<\beta_1\equiv\frac{\omega_m^J E^{B/Y}P_m^Y}{C_B}<1$, $0<\beta_2\equiv\frac{\omega_m^{US}E^{B/\$}P_m^\$}{C_B}<1$, $0<\beta_3\equiv\frac{C'(Q_B)}{C_B}<1$. For simplicity, we assume that the country A and B firms have same cost structures. That is, $\alpha_1=\beta_1$, $\alpha_2=\beta_2$, $\alpha_3=\beta_3$.

Equations (3.5) and (3.6) show that the indirect effects of the exchange rates via pricing behaviors depend on the exchange rates of home currencies against the dollar and the yen. The indirect effects mean that the exchange rates have effects on the product prices of both the country A and B firms. Changes in the domestic product prices have effects on export values while changes in the other ASEAN firm's product prices have effects on import values. In equations (3.5) and (3.6), coefficients on the exchange rates of the other ASEAN currency against the dollar are clearly positive while coefficients on the other exchange rates are ambiguous.

The indirect effects via the trade volumes are represented in terms of fluctuations in the exchange rates as follows:

$$\begin{aligned}
&\tau_A^{ExJ}\hat{f}_A+\tau_A^{ExUS}\hat{g}_A+\tau_A^{ExB}\hat{h}_A-\tau_A^{ImJUS}\hat{Q}_A-\tau_A^{ImB}\hat{h}_B\\
&=\left\{\tau_A^{TJ}\varepsilon_J^A\varphi_J^A(1-\alpha_1)-\tau_A^{TUS}\varepsilon_{US}^A\varphi_{US}^A\alpha_1\right\}\hat{E}^{A/Y}\\
&+\left\{\tau_A^{TUS}\varepsilon_{US}^A\varphi_{US}^A(1-\alpha_2)-\tau_A^{TJ}\varepsilon_J^A\varphi_J^A\alpha_2+\tau_A^{TB}\varepsilon_A\varphi_A\alpha_3+\tau_A^{ImB}\varepsilon_B\varphi_B\alpha_3\right\}\hat{E}^{A/\$}\\
&-\left\{\tau_A^{TB}\varepsilon_A\varphi_A-\tau_A^{ImB}\varepsilon_B\varphi_B\right\}\alpha_3\hat{E}^{B/\$}
\end{aligned}\tag{3.7}$$

$$\begin{aligned}
&\tau_B^{ExJ}\hat{f}_B+\tau_B^{ExUS}\hat{g}_B+\tau_B^{ExA}\hat{h}_B-\tau_B^{ImJUS}\hat{Q}_B-\tau_B^{ImA}\hat{h}_A\\
&=\left\{\tau_B^{TJ}\varepsilon_J^B\varphi_J^B(1-\alpha_1)-\tau_B^{TUS}\varepsilon_{US}^B\varphi_{US}^B\alpha_1\right\}\hat{E}^{B/Y}\\
&+\left\{\tau_B^{TUS}\varepsilon_{US}^B\varphi_{US}^B(1-\alpha_2)-\tau_B^{TJ}\varepsilon_J^B\varphi_J^B\alpha_2+\tau_B^{TA}\varepsilon_B\varphi_B\alpha_3+\tau_B^{ImA}\varepsilon_A\varphi_A\alpha_3\right\}\hat{E}^{B/\$}\\
&-\left\{\tau_B^{TA}\varepsilon_B\varphi_B-\tau_B^{ImA}\varepsilon_A\varphi_A\right\}\alpha_3\hat{E}^{A/\$}
\end{aligned}\tag{3.8}$$

where $\tau_A^{TJ}\equiv\tau_A^{ExJ}-\tau_A^{ImJUS}w_J^A$, $\tau_A^{TUS}\equiv\tau_A^{ExUS}-\tau_A^{ImJUS}w_{US}^A$, $\tau_A^{TB}\equiv\tau_A^{ExB}-\tau_A^{ImJUS}w_B^A$, $\tau_B^{TJ}\equiv\tau_B^{ExJ}-\tau_B^{ImJUS}w_J^B$, $\tau_B^{TUS}\equiv\tau_B^{ExUS}-\tau_B^{ImJUS}w_{US}^B$, $\tau_B^{TB}\equiv\tau_B^{ExA}-\tau_B^{ImJUS}w_A^B$.

Equations (3.7) and (3.8) shows that the indirect effects of the exchange rates via trade volumes depend on the exchange rates of both the ASEAN currencies against the dollar and the yen. The exchange rates have effects on the product prices, which change the relative prices of the products in the Japanese, the United States, and ASEAN markets. The changes in the relative prices have effects on the demand for the products in the markets. The demand for an ASEAN country firm's products is equivalent to export volumes of the country in our model. On one hand, changes in outputs have effects on import volume because the ASEAN economies import all of the parts from Japan and the United States. Moreover, an ASEAN economy imports products from the other ASEAN country. Thus, the exchange rates have effects on both the export volumes and the import volumes. In equations (3.7) and (3.8), all the effects of the exchange rates are ambiguous.

Thus, the effects of the exchange rates on the trade balances are in general ambiguous when we summate all of the direct and indirect effects in equations (3.3) and (3.4). It is impossible to suppose *a priori* directions in the effects of the exchange rates on the trade balances. Thus, it is necessary to conduct empirical analyze the effects.

4. Exchange rate policies

In this section, we use a two-country model to analyze their monetary authorities' exchange rate policies while taking into account interactions of their policies. At first, we derive optimal currency basket to stabilize fluctuations in trade balances. Then, we theoretically analyze possibilities of coordination failures by comparing losses for the monetary authorities between two situations:[2] a situation where both of the monetary authorities adopt the dollar peg at the same time and a situation where the monetary authorities of one country adopt an optimal currency basket peg while the monetary authorities of the other country adopt the dollar peg.

(1) Optimal currency baskets

We express the above effects of exchange rates on the trade balances of countries A and B in terms of rates of changes as follows:

$$\hat{T}_A=A_1\hat{E}^{A/Y}+A_2\hat{E}^{A/\$}+A_3\hat{E}^{B/Y}+A_4\hat{E}^{B/\$}\tag{4.1}$$

$$\hat{T}_B=B_1\hat{E}^{A/Y}+B_2\hat{E}^{A/\$}+B_3\hat{E}^{B/Y}+B_4\hat{E}^{B/\$}\tag{4.2}$$

As shown in the previous section, coefficients on all of the exchange rates are

[2] Bénassy-Quéré (1999) analyzed pegging the US dollar as a coordination failure.

ambiguous in our theoretical model because both of country A and B firms import parts from Japan and the United States and export their products to these countries. Moreover, the exchange rates have the direct and indirect effects on the trade balances.

A currency basket is defined as a weighted average of exchange rates of a home currency against the US dollar and the Japanese yen. Thus, a currency basket peg means that a currency basket fixed at a level. In other words, rates of changes in a currency basket, which is a weighted average of rates-of-changes in the exchange rates, is equal to zero:

$$w_A \hat{E}^{A/\$} + (1-w_A)\hat{E}^{A/Y} = 0 \tag{4.3}$$

$$w_B \hat{E}^{B/\$} + (1-w_B)\hat{E}^{B/Y} = 0 \tag{4.4}$$

where w_A: a weight on the US dollar in a currency basket for the country A, w_B: a weight on the US dollar in a currency basket for the country B.

When the monetary authorities peg the home currency to a currency basket, relationships between the exchange rates of the home currency against the US dollar or the Japanese yen and those of the Japanese yen against the US dollar are shown as follows:

$$\begin{cases} \hat{E}^{A/\$} = (1-w_A)\hat{E}^{Y/\$} \\ \hat{E}^{A/Y} = -w_A \hat{E}^{Y/\$} \end{cases} \tag{4.5}$$

$$\begin{cases} \hat{E}^{B/\$} = (1-w_B)\hat{E}^{Y/\$} \\ \hat{E}^{B/Y} = -w_B \hat{E}^{Y/\$} \end{cases} \tag{4.6}$$

If the monetary authorities adopt a dollar peg system and a weight on the US dollar in a currency basket is equal to unity, the exchange rate of the home currency against the US dollar is fixed at a level while the exchange rate of the home currency against the Japanese yen commoves with that of the Japanese yen against the US dollar. The home currency appreciates against the Japanese yen when the US dollar appreciates against the US dollar.

Both of the monetary authorities are assumed to choose weights on the US dollar and the Japanese yen in a currency basket in order to stabilize the fluctuation of their own trade balances that is caused by changes in the exchange rates[3]. Our optimality of the exchange rate policy is to stabilize fluctuations in trade balances in terms of the US dollar under a currency basket peg system. The monetary authorities minimize the squared rate of change in trade balances in terms of the US dollar. That is, the monetary authorities have the following objective functions to minimize:

$$\hat{T}_A^{\,2} = \left(A_1 \hat{E}^{A/Y} + A_2 \hat{E}^{A/\$} + A_3 \hat{E}^{B/Y} + A_4 \hat{E}^{B/\$} \right)^2 \tag{4.7}$$

$$\hat{T}_B^{\,2} = \left(B_1 \hat{E}^{A/Y} + B_2 \hat{E}^{A/\$} + B_3 \hat{E}^{B/Y} + B_4 \hat{E}^{B/\$} \right)^2 \tag{4.8}$$

By substituting equations (4.5) and (4.6) into equations (4.7) and (4.8), respectively, the objective functions are shown in terms of weights on the exchange rates, w_A and w_B.

$$\hat{T}_A^{\,2} = \left\{ A_1 + A_3 - (A_1 + A_2) w_A - (A_3 + A_4) w_B \right\}^2 \hat{E}^{Y/\$2} \tag{4.9}$$

$$\hat{T}_B^{\,2} = \left\{ B_1 + B_3 - (B_1 + B_2) w_A - (B_3 + B_4) w_B \right\}^2 \hat{E}^{Y/\$2} \tag{4.10}$$

From equations (4.9) and (4.10), we can obtain the first order conditions for

---

[3] The assumption was made in Ito, Ogawa, Sasaki (1998). Flanders and Helpman (1979), Lipschitz and Sundararajan (1980), and Flanders and Tishler (1981) emphasized only the real side of the economy in modeling the currency basket peg issue. On the other hand, Turnovsky (1982) and Bhandari (1985) used a general equilibrium macroeconomic model which included capital mobility. Bénassy-Quéré (1999) assumed that the monetary authorities are to stabilize both their external competitiveness and the real price of their external debt.

minimizing their objective functions.

$$(A_1+A_2)w_A+(A_3+A_4)w_B=A_1+A_3 \tag{4.11}$$

$$(B_1+B_2)w_A+(B_3+B_4)w_B=B_1+B_3 \tag{4.12}$$

Equation (4.11) is a reaction function for the monetary authorities of country A, which means that the monetary authorities of country A choose an optimal weight for minimizing their objective function given a weight chosen by the monetary authorities of country B (w_B). Also, equation (4.12) is a reaction function for the monetary authorities of country B. They choose an optimal weight for minimizing their objective function given a weight chosen by the monetary authorities of country A (w_A). Thus, both of the monetary authorities have to determine their optimal weights in a currency basket while they are affected by behavior of the other monetary authorities.

From equations (4.11) and (4.12), we derive a pair of optimal weights on the US dollar in a currency basket to stabilize their trade balances for both of the countries A and B at the same time:

$$w_A^*=\frac{(A_1+A_3)(B_3+B_4)-(A_3+A_4)(B_1+B_3)}{(A_1+A_2)(B_3+B_4)-(A_3+A_4)(B_1+B_2)} \tag{4.13}$$

$$w_B^*=\frac{(A_1+A_2)(B_1+B_3)-(A_1+A_3)(B_1+B_2)}{(A_1+A_2)(B_3+B_4)-(A_3+A_4)(B_1+B_2)} \tag{4.14}$$

If both of the monetary authorities of countries A and B could, at the same time, set w_A^* and w_B^*, respectively, trade balances would be stabilized in both of the countries. However, it is not always guaranteed that the optimal weights for the both countries are a stable equilibrium.

The condition for a stable equilibrium is

$$\left|\frac{A_1+A_2}{A_3+A_4}\right|>\left|\frac{B_1+B_2}{B_3+B_4}\right| \tag{4.15}$$

In this case, a pair of the weights proceeds along a converging process toward an equilibrium point (w_A^*, w_B^*). The weights for both of the countries should converge to their optimal equilibrium ones.

On the other hand, if

$$\left|\frac{A_1+A_2}{A_3+A_4}\right|<\left|\frac{B_1+B_2}{B_3+B_4}\right|, \tag{4.16}$$

a pair of the optimal weights is an unstable equilibrium. In this case, weights diverge out of the optimal weights once they are off the equilibrium point (w_A^*, w_B^*).

Thus, if inequality equation (4.16) is satisfied, an optimal weights point is unstable. Then, it is difficult for the monetary authorities to change their exchange rate policy to an optimal exchange rate policy.

(2) Dollar peg

If both of the monetary authorities adopt the dollar peg ($w_A=w_B=1$) at the same time, fluctuations in trade balances are calculated as follows:

$$\hat{T}_A{}^2{}_{(w_A=w_B=1)}=\left(A_2+A_4\right)^2\hat{E}^{Y/\$2} \tag{4.17}$$

$$\hat{T}_B{}^2{}_{(w_A=w_B=1)}=\left(B_2+B_4\right)^2\hat{E}^{Y/\$2} \tag{4.18}$$

It is clear that the fluctuations in trade balances in the case of the dollar peg are larger than those in the case where both of the monetary authorities adopt the optimal currency basket as shown in equation (4.13) and (4.14). Therefore, the monetary authorities should adopt the optimal currency basket peg rather than the dollar peg.

Why did the monetary authorities *de facto* peg their home currencies to the U.S.

dollar? A possible reason is that the monetary authorities might have any other objectives than we supposed in the above model, for example a political prestige to assure investors (not exporters or importers). Another reason is that the monetary authorities of one county cannot adopt an optimal exchange rate policy because their loss increases if the monetary authorities of country A alone adopt the basket while other countries keep pegging their home currencies to the US dollar.

(3) Coordination failure

Next, we consider how the monetary authorities of one country should behave, given that the monetary authorities of the other country adopt the dollar peg. For example, suppose that the monetary authorities of country A adopt the above optimal currency basket peg ($w_A = w_A^*$) while the monetary authorities of country B adopt the dollar peg ($w_B = 1$). Fluctuations in trade balances for country A are obtained in this case as follows:

$$\hat{T}_{A}{}^{2}{}_{(w_A=w_A^*, w_B=1)} = \left\{ \frac{(A_1+A_2)(B_1-B_4)-(A_1-A_4)(B_1+B_2)}{(A_1+A_2)(B_3+B_4)-(A_3+A_4)(B_1+B_2)}(A_3+A_4) \right\}^2 \hat{E}^{Y/\$2} \tag{4.19}$$

When the monetary authorities of country A have options to adopt the dollar peg ($w_A = 1$) or the optimal currency basket peg ($w_A = w_A^*$), given that the monetary authorities of country B adopt the dollar peg ($w_B = 1$), the monetary authorities of country A compare fluctuations in trade balances between the two options. The monetary authorities of country A compare equation (4.19) with equation (4.17).

If fluctuations in trade balance in the case of adopting the dollar peg (equation (4.17)) are less than those in the case of adopting the optimal currency basket peg (equation (4.19)), the monetary authorities of country A prefer the dollar peg to the optimal currency basket peg.

Also, the monetary authorities of country B adopt the above optimal currency basket peg ($w_B = w_B^*$) while the monetary authorities of country B adopt the dollar peg ($w_A = 1$). Fluctuations in trade balances for country A are obtained in this case as follows:

$$\hat{T}_{B}{}^{2}{}_{(w_A=1, w_B=w_B^*)} = \left\{ \frac{(A_3-A_2)(B_3+B_4)-(A_3+A_4)(B_3-B_2)}{(A_1+A_2)(B_3+B_4)-(A_3+A_4)(B_1+B_2)}(B_1+B_2) \right\}^2 \hat{E}^{Y/\$2} \tag{4.20}$$

The monetary authorities of country B compare fluctuations in trade balances between the two options (equations (4.18) and (4.20)). If fluctuations in trade balances in the case of adopting the dollar peg (equation (4.18)) are less than those in the case of adopting the optimal currency basket peg (equation (4.20)), the monetary authorities of country B select the dollar peg rather than the optimal currency basket peg.

Thus, both of the monetary authorities should keep pegging their home currencies to the dollar if their trade balances fluctuate more widely in the case of the optimal currency basket peg than in the case of the dollar peg. At this time, they face in a coordination failure that they are forced to select the dollar peg even though the optimal currency basket peg is to minimize the fluctuations in trade balances if they adopt the optimal currency basket peg at the same time. Only if both of the monetary authorities coordinated to select the optimal currency basket peg at the same time, they peg their home currencies to the optimal currency basket.

5. Empirical analysis

(1) Analytical method

Trade balances cannot be expressed in forms of logarithm because they sometimes have negative figures. We divide trade balances into exports and imports. Thus, we express rate of changes in trade balances as follows:

$$\hat{T}_A = \frac{Ex_A}{T_A}\hat{E}x_A - \frac{Im_A}{T_A}\hat{I}m_A \qquad (5.1)$$

$$\hat{T}_B = \frac{Ex_B}{T_B}\hat{E}x_B - \frac{Im_B}{T_B}\hat{I}m_B \qquad (5.2)$$

where $\hat{E}x$: rate of changes in export values in terms of the US dollar, $\hat{I}m$: rate of changes in import values in terms of the US dollar.

We regress not rate of changes in trade balances $\hat{T}$ but rates of changes in export and import values $\hat{E}x$ and $\hat{I}m$ of countries A and B on the exchange rates because we cannot take a logarithm of negative trade balances. Moreover, we face in a singularity problem when we use exchange rates of home currencies and other ASIAN currencies in terms of the Japanese yen and the US dollar. We regress them on exchange rates of home currencies in terms of the Japanese yen, the US dollar, and the other ASIAN currencies in order to avoid the singularity problem.

$$\begin{aligned}\hat{E}x_A &= A_1^{Ex}\hat{E}^{A/Y} + A_2^{Ex}\hat{E}^{A/\$} + A_3^{Ex}\hat{E}^{B/Y} + A_4^{Ex}\hat{E}^{B/\$} \\ &= a_1^{Ex}\hat{E}^{A/Y} + a_2^{Ex}\hat{E}^{A/\$} + a_3^{Ex}\hat{E}^{A/B}\end{aligned} \qquad (5.3)$$

$$\begin{aligned}\hat{I}m_A &= A_1^{Im}\hat{E}^{A/Y} + A_2^{Im}\hat{E}^{A/\$} + A_3^{Im}\hat{E}^{B/Y} + A_4^{Im}\hat{E}^{B/\$} \\ &= a_1^{Im}\hat{E}^{A/Y} + a_2^{Im}\hat{E}^{A/\$} + a_3^{Im}\hat{E}^{A/B}\end{aligned} \qquad (5.4)$$

$$\begin{aligned}\hat{E}x_B &= B_1^{Ex}\hat{E}^{A/Y} + B_2^{Ex}\hat{E}^{A/\$} + B_3^{Ex}\hat{E}^{B/Y} + B_4^{Ex}\hat{E}^{B/\$} \\ &= b_1^{Ex}\hat{E}^{A/Y} + b_2^{Ex}\hat{E}^{A/\$} + b_3^{Ex}\hat{E}^{A/B}\end{aligned} \qquad (5.5)$$

$$\begin{aligned}\hat{I}m_B &= B_1^{Im}\hat{E}^{A/Y} + B_2^{Im}\hat{E}^{A/\$} + B_3^{Im}\hat{E}^{B/Y} + B_4^{Im}\hat{E}^{B/\$} \\ &= b_1^{Im}\hat{E}^{A/Y} + b_2^{Im}\hat{E}^{A/\$} + b_3^{Im}\hat{E}^{A/B}\end{aligned} \qquad (5.6)$$

where $a_1^i \equiv A_1^i + A_3^i$, $a_2^i \equiv A_2^i + A_4^i$, $a_3^i \equiv -(A_3^i + A_4^i)$, $b_1^i \equiv B_1^i + B_3^i$, $b_2^i \equiv B_2^i + B_4^i$, $b_3^i \equiv -(B_3^i + B_4^i)$ for $i = Ex and\ Im$.

We compare equations (5.1) to (5.6) with equations (4.1) and (4.2). We can obtain the following relationship as for coefficients on the exchange rates:

$$a_i = \frac{Ex_A}{T_A}a_i^{Ex} - \frac{Im_A}{T_A}a_i^{Im} \quad for i = 1 to\ 4 \qquad (5.7)$$

$$b_i = \frac{Ex_A}{T_A}b_i^{Ex} - \frac{Im_A}{T_A}b_i^{Im} \quad for\ i = 1\ to\ 4 \qquad (5.8)$$

(2) Regression Results

Table 2 shows results of estimating equations (5.3) to (5.6). Country A is Thailand and country B is weighted average of the other Asian (NIES and ASEAN 4) countries whose data are available: Korea, Hong Kong, Singapore, Indonesia, Malaysia and Philippines. Regression method is OLS. We think it would be better to include some lags in the equations in order to avoid J curve effects. But we couldn’t do so because, for lack of quarterly or monthly GDP data of some countries, we use annual data and number of sample is not enough.

Estimation results of (5.3) and (5.5) in Table 2 are export equations, which include GDP of United States, Japan and B country (weighted average of Asian countries) as independent variables. Estimation results of (5.4) and (5.6) in Table 2 are import equations, which include GDP of A country (Thailand) as independent variable.

The coefficients of a_1^{IM}, a_2^{IM}, b_1^{EX} are positive and significant. However, the other coefficients are not significant. One of the causes is why we omitted lagged independent variables such as exchange rates.

As for the coefficients of GDP data, GDP of both A and B countries are positive and significant but USGDP and JPGDP are not significant and signs of some of them are negative.

(3) Calculation optimal weights

We use the regression results on coefficients on the exchange rates in both exports and imports equations to calculate optimal weights of the analyzed countries according to equations (4.13). We can convert the estimated coefficients on the exchange rates in both the exports and imports equations to a_i and b_i for $i = 1 \, to \, 3$. (Table 3 is summary table for a_i and b_i for $i = 1 \, to \, 3$.) Moreover, we rewrite an optimal weight on the exchange rate against the US dollar in terms of a_i and b_i (for $i = 1 \, to \, 3$) as following:

$$w_A^* = \frac{(A_1 + A_3)(B_3 + B_4) - (A_3 + A_4)(B_1 + B_3)}{(A_1 + A_2)(B_3 + B_4) - (A_3 + A_4)(B_1 + B_2)} = \frac{a_3 b_1 - a_1 b_3}{a_3(b_1 + b_2 + b_3) - (a_1 + a_2 + a_3) b_3} \qquad (5.9)$$

Table 4 shows optimal weight on the exchange rate against the US dollar for Thailand. The optimal weight is 22.2% and it is much lower than the actual weight they had been taking.

(4) Stability of equilibrium

We check stability of equilibrium by comparing inequality equations (4.15) and (4.16). Table 5 shows comparisons of values of $\left| \frac{A_1 + A_2}{A_3 + A_4} \right|$ with $\left| \frac{B_1 + B_2}{B_3 + B_4} \right|$. The equilibrium is stable if $\left| \frac{A_1 + A_2}{A_3 + A_4} \right| > \left| \frac{B_1 + B_2}{B_3 + B_4} \right|$. On one hand, the equilibrium is unstable otherwise.[4]

Table 5 shows that the condition for stable equilibrium is satisfied in the case of Thailand.

(5) Possibility of coordination failure

We compare equation (4.17) with equation (4.19). Equation (4.17) represents fluctuations in trade balances under the assumption that all the monetary authorities adopt the dollar peg. Equation (4.19) represents fluctuations in trade balances under the assumption that the monetary authorities of one country adopt its optimal currency basket peg while the monetary authorities of the other countries. If fluctuations in trade balances in equation (4.19) are larger than those in equation (4.17), the monetary authorities should not adopt the optimal currency basket peg. Thus, they face in coordination failure.

We compare coefficients on $\hat{E}^{Y/\$2}$ between equations (4.17) and (4.19) in Table 6.[5]

---

[4] We represent $\left| \frac{A_1 + A_2}{A_3 + A_4} \right|$ and $\left| \frac{B_1 + B_2}{B_3 + B_4} \right|$ in terms of a_i and b_i (for $i = 1 \, to \, 3$) as following:

$\left| \frac{A_1 + A_2}{A_3 + A_4} \right| = \left| \frac{a_1 + a_2 + a_3}{-a_3} \right|$ and $\left| \frac{B_1 + B_2}{B_3 + B_4} \right| = \left| \frac{b_1 + b_2 + b_3}{-b_3} \right|$.

[5] We can rewrite coefficients on $\hat{E}^{Y/\$2}$ of equations (4.17) and (4.19) in terms of a_i and b_i (for $i = 1 \, to \, 3$) as following:

$$\left(A_2 + A_4\right)^2 = a_2{}^2$$

$$\left\{ \frac{(A_1 + A_2)(B_1 - B_4) - (A_1 - A_4)(B_1 + B_2)}{(A_1 + A_2)(B_3 + B_4) - (A_3 + A_4)(B_1 + B_2)} (A_3 + A_4) \right\}^2 = \left\{ \frac{(a_1 + a_2 + a_3)(b_1 + b_3) - (a_1 + a_3)(b_1 + b_2 + b_3)}{(a_1 + a_2 + a_3) b_3 - a_3 (b_1 + b_2 + b_3)} a_3 \right\}^2$$

Table 6 shows that equation (4.17) is larger than equation (4.19). It means that the monetary authorities of Thailand could have adopted the optimal currency basket peg and they did not face in coordination failure.

6. Conclusion

This paper considered the question of choosing the exchange rate regime for emerging market economies that export goods to the U.S., Japan, and neighboring countries. The exchange rate regime should be chosen on the basis of minimizing the fluctuation of the trade balance, as the yen-dollar exchange rate fluctuates.

We can draw some policy implications from these conclusions. First, if the Asian region that relies on exports to Japan, the U.S., and other regions, wants to avoid a boom and bust cycle due to under- and over-valued exchange rates, the real effective exchange rate must be managed. In particular, the basket currency regime is helpful. Second, the choice of the exchange rate regime (or weights in the basket) may depend on your neighboring country's choice of the regime. There may be coordination failure. Given the dollar peg of the neighboring country, the choice is the dollar peg, and the neighboring country decides the choice in the same manner. However, both countries would be better off to move to a basket currency regime with more weights on the yen, if the decisions are made simultaneously. Third, in order to help the calculation of such a basket tailored to each country, it may be helpful to calculate and publish the typical currency basket unit for the region. Such a currency unit (say, Asian Currency Unit, or ACU) has weights on the U.S. dollar, the yen, and the euro. Each Asian country manages its own currency within the reasonable band around the ACU, then the coordination failure may be avoided. Calculation of such a currency unit and simulations of the trade balances under the basket system is left for future work.

Although this paper simplifies many aspects of the real world, the essential points, we believe, are very relevant to the real world. Asian countries will benefit from coordination with each other in choosing the exchange rate regime.

References

Bénassy-Quéré, Agnès (1999) "Optimal Pegs for East Asian Currencies," *Journal of the Japanese and International Economies*, vol. 13, 44-60.

Bhandari, Jagdeep S. (1985) "Experiments with the optimal currency composite," *Southern Economic Journal*, vol. 51, no. 3 (January): 711-730.

Eichengreen, Barry (1999) *Toward a New International Financial Architecture: A Practical Post-Asia Agenda.* Washington, D.C., Institute for International Economics.

Flanders, M. June and Asher Tishler (1981) "The role of elasticity optimism in choosing an optimal currency basket with applications to Israel," *Journal of International Economics*, vol. 11, 395-406.

Flanders, M. June and Helpman, Elhanan (1979) "An Optimal Exchange Rate Peg in a World of General Floating," Review of Economic Studies," *The Review of Economic Studies* (July): 533-542.

Ito, Takatoshi, Eiji Ogawa, and Yuri N. Sasaki, (1998) "How did the Dollar Peg Fail in Asia?" *Journal of the Japanese and International Economies*, vol. 12, 256-304.

Lipschitz, Leslie and V. Sundararajan (1980) "The optimal basket in a world of generalized floating," *IMF Staff Papers*, vol. 27, no. 1, 80-100.

Marston, Richard C. (1990) "Pricing to market in Japanese manufacturing," *Journal of International Economics*, vol. 29, no. 3/4, 217-236.

Ohno, Ken-ichi (1989) "Export pricing behavior in manufacturing: A U.S.-Japan comparison," *IMF Staff Papers*, vol. 36, no. 3, 550-579.

Turnovsky, Stephen J. (1982). "A Determination of the Optimal Currency Basket," *Journal of International Economics*, vol. 12: 333-354.

Table 1: Export shares by destination				
Exports from	to Japan	to US	to NIEs4+ASEAN4	To EU4
Korea	19.5	19.8	10.8	9.0
Singapore	17.6	16.9	32.0	10.5
Indonesia	23.4	11.3	32.8	15.1
Thailand	25.7	13.8	21.5	9.6
Malaysia	22.0	16.8	34.1	10.4
Philippines	20.5	17.5	24.7	10.4
China	20.4	11.5	35.3	9.7

Notes:

All data are from 1997, except Indonesia exports to Taiwan, and Philippine exports to Taiwan, 1996.

EU4=Germany, France, UK, Italy

ASEAN4=Indonesia, Thailand, Malaysia, Philippines

NIEs4=Korea, Taiwan, Hong Kong, Singapore

Source: Economic Planning Agency, Asian Economies 1999.

Table 2: Regression Results

Equation (5.3)

	Coef.	T-value	Significant
C	0.053	0.487	0.637
a_1^{EX}	0.017	0.016	0.988
a_2^{EX}	0.543	0.387	0.707
a_3^{EX}	0.217	0.198	0.847
USGDP	-1.651	-1.335	0.211
JPGDP	0.229	0.217	0.833
B-GDP	1.451	1.773	0.107
R-bar Sq.	0.484		

Equation (5.4)

	Coef.	T-value	Significant
C	-0.436	-3.057	0.01
a_1^{IM}	0.473	1.81	0.095
a_2^{IM}	4.489	3.246	0.007
a_3^{IM}	-0.367	-0.51	0.619
A-GDP	4.397	4.259	0.001
R-bar Sq.	0.648		

Equation (5.5)

	Coef.	T-value	Significant
C	-0.083	-0.837	0.422
b_1^{EX}	1.425	1.923	0.083
b_2^{EX}	-0.076	-0.079	0.939
b_3^{EX}	0.637	1.53	0.157
USGDP	0.966	1.202	0.257
JPGDP	-1.166	-1.628	0.135
A-GDP	1.524	2.536	0.03
R-bar Sq.	0.547		

Equation (5.6)

	Coef.	T-value	Significant
C	-0.056	-0.776	0.453
b_1^{IM}	0.056	0.403	0.694
b_2^{IM}	0.762	1.26	0.232
b_3^{IM}	-0.511	-0.707	0.493
B-GDP	1.462	2.793	0.016
R-bar Sq.	0.584		

Table 3: Summary table of a_1-a_3 and b_1-b_3

A = Thailand, B = The other countries

a_1	2.264	b_1	-5.322
a_2	19.989	b_2	4.054
a_3	-2.661	b_3	-5.02

Table 4: Optimal weights (W^*_A)

	Optimal weight on US dollar (%)
Thailand	22.2

$$\left|\frac{A_1+A_2}{A_3+A_4}\right| \quad \left|\frac{B_1+B_2}{B_3+B_4}\right|$$

Table 5: Stability

Thailand	7.36	1.25	Stable

Table 6: Coordination failure

	Equation (4.17)	Equation (4.19)
Thailand	399.6	22.5