Dynamic Effect of Change in Exchange Rate System -From the Fixed Exchange Rate Regime to the Basket-peg or Floating Regime

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Abstract

We attempt to compute dynamic effect of shifts of exchange rate system from the dollar-peg to the basket-peg or floating and obtain transition paths for the shifts, based on a stochastic dynamic small open-economy model. We find that countries are better off shifting to the basket-peg or floating regime than maintaining the dollar-peg regime, in the long-run perspective. Furthermore, because of welfare costs associated with volatility in nominal interest rates, the longer transition period of adjustments, the more benefits a country would gain from suddenly shifting to the basket-peg from the dollar-peg regime rather than with adjusting gradually. Finally, focusing on sudden shift to target regimes, our numerical analysis using Thai data shows that countries will be better off shifting to the basket-peg rather than floating.

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JEL Classification Codes: F33, F41
Key words: Exchange rate regime, basket-peg, floating regime, transition path

1 Introduction

doublespacing One of the two major culprits of the 1997-98 Asian financial crisis was the adoption of the *de facto* dollar-peg by some countries in East Asia[1]. The other was the discrepancy in maturity between lending and borrowing by financial institutions in East Asian economies. Financial institutions in Thailand, Indonesia and Korea borrowed in short-term from abroad and lent to domestic firms in long-term. Sudden withdrawal of funds to abroad made East Asian banks vulnerable to the crisis[2].

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[1]Ito, Ogawa and Sasaki (1998) and Ogawa and Ito (2000) both emphasize the point and advocate adoption of the basket-peg regime in East Asia, in order to avoid being negatively affected by fluctuations in the dollar-yen exchange rate.

[2]On the other hand, McKibbin and Martin (1999) also point out that the primary cause of the East Asia was a fundamental reassessment of the profitability of investments in the region.

Several economists support the desirability of the basket-peg regime in Asia. For example, Kawai (2004), Ito and Park (2003), Yoshino, Kaji, and Suzuki (2004), and Ogawa and Ito (2002) recommend that East Asian countries embrace the basket-peg regime[3]. The main reason for adopting the basket-peg regime was that for countries with close economic relationships with the European Union, Japan and the United States, exchange rate stabilization vis-a-vis a basket comprising these currencies was beneficial, because it removed the problem of large fluctuations of exchange rates.

Furthermore, Yoshino, Kaji, and Asonuma (2004) insist that together with the basket-peg regime, the floating regime is also one of the options for East Asian countries[4]. Moreover, Adams and Semblat (2004) stress that one of the currency regime options is adopting the floating regime with inflation targeting.

The superiority of the basket-peg or the floating regime relative to the dollar-peg regime has been analyzed in the static context, not in dynamic context. For countries like China and Malaysia on the other hand, there is still a big question of how to get from the current *de facto* fixed exchange rate with the US dollar to other exchange rate regimes. Before adopting the basket-peg or floating regime, these countries need to abandon the *de facto* dollar-peg[5][6]. The shift from the dollar-peg regime to basket-peg regime would undergo either one of two processes: (1) starting with the dollar-peg regime with strict capital control, shifting to the basket-peg regime with loose capital control, and finally reaching the basket-peg regime with no capital control, i.e. gradual adjustment of both degree of capital control and basket weight, or (2) starting with the dollar-peg regime with strict capital control, then suddenly shifting to the basket-peg regime with no capital control by removing capital control, i.e. sudden shift of both capital control and basket weight. On the other hand, the shift to the floating regime would involve the following process: starting with the dollar-peg regime with strict capital control and suddenly shifting to the floating regime by removing capital control. Therefore, it is necessary to analyze the effects of these shifts in the dynamic context.

This paper attempts to compute the dynamic effect of the shifts from the fixed exchange rate regime to the basket-peg regime or the floating regime. We obtain two transition paths from the dollar-peg to the basket-peg regime (gradual adjustment and sudden shift) and one transition path from the dollar-peg to the floating regime (sudden shift).

The major findings are as follows. First, value of the cumulative losses of four policies (three transition policies mentioned above plus maintaining the dollar-peg regime) are obtained theoretically as well as empirically. We find that maintaining the dollar-peg regime is desirable only in the short term, indicating that the country will be better off shifting to either the basket-peg regime or the floating regime in the long-run perspective.

Second, concerning the choices between gradual adjustment (policy (2)) toward the target basket-peg regime or sudden shift to the target basket-peg regime (policy (3)), the longer the transition period of adjustments, the more benefits the country will gain from reaching the target regime at once.

[3]Concerning the composition of the basket, Ogawa and Ito (2002) and Kawai (2004) claim the G-3 (US dollar, Japanese yen, euro) basket, while Yoshino, Kaji and Asonuma (2005a) stress that East Asian countries adopt the basket consisted of both G-3 currencies and also East Asian currencies. Moreover, Yoshino, Kaji, and Asonuma (2005b) discuss the optimal weights and composition of basket currency in East Asia.

[4]However, there is also a drawback in adopting the floating regime; too much fluctuations of the exchange rates affect negatively to the economy as shown in Yoshino, Kaji, and Ibuka (2003).

[5]The Chinese government announced its change in exchange rate system from the dollar-peg system into a managed floating system "with reference to" a currency basket and also with a band (plus and minus 0.3% around the base rate on July 21, 2005. However, observing the reference target, weight on the US dollar is very close to 1, implying that the Chinese government is still adopting the *de facto* dollar-peg regime.

[6]Cheung, Chinn, and Fujii (2007) evaluate whether the renminbi is misaligned, relying upon conventional statistical methods of inference and suggest that the renminbi appears to be undervalued, but not by a stastically significant margin.

Finally, for the comparison between sudden shifts to the basket-peg regime (policy (3)) and to the floating regime (policy (4)), our numerical analysis using Thai data shows that the country will be better off shifting to the basket-peg regime rather than to the floating regime[7].

Needless to say, our analysis can be applied to any small open country considering the shift from the fixed regime to the basket-peg or the floating regime.

The paper is related to two streams of literatures. One of these has debated the desirability of the basket-peg regime in East Asia. Ito, Ogawa and Sasaki (1998) and Ogawa and Ito (2002) analyze the optimality of the basket-peg with general equilibrium model which does not include capital movements. Yoshino, Kaji, and Suzuki (2004) and Yoshino, Kaji, and Asonuma (2004) also claim that it is better for the country to adopt the basket-peg rather than the dollar-peg regime based on general equilibrium model which incorporates capital movements across countries. From other perspectives, Shioji (2006a, 2006b) consider the basket-peg regime under two different invoicing schemes, producer currency pricing and vehicle currency pricing. For empirical analysis, McKibbin and Le (2004) investigate which exchange rate the East Asian countries should peg to using several shocks, which involve country specific (asymmetric) shock, and regional (symmetric) shocks.

On the other hand, the other stream deals with the desirability of the floating regime in the region. Adams and Semblat (2004) insist that one of the currency regime options is adopting the floating regime with inflation targeting. Following the argument, Sussangkarn and Vichyanond (2007) stress that the managed floating plus inflation targeting suits the emerging market environment as in Thailand. Furthermore, Yoshino, Kaji and Asonuma (2004) find out that the floating regime is also the possible regimes for East Asian countries together with the basket-peg regime. Lastly, Kim and Lee (2008) show that the exchange rate flexibility provides greater monetary policy independence based on their empirical findings.

The rest of the paper is organized as follows. Section 2 provides a small open economy model. Section 3 analyzes how the economy reaches the stable equilibrium under four regimes. Section 4 defines three transition policies together with maintaining the current regime. Section focuses on the optimal transition policy which the home country takes. A brief conclusion summarizes the discussion. Appendix C presents simulation results using Thai data to support the theoretical findings[8]. Moreover, Appendix D displays relationship between the optimal weights under the basket-peg regime and the time span.

2 Small Open-economy Model

In this section, we provide a small open economy model. As in Yoshino, Kaji and Suzuki (2002) and Dornbusch (1976), we conduct a dynamic analysis with small open general equilibrium model. Though our equilibrium conditions are not based on optimal behaviors of households and firms, our equilibrium conditions are quite the same with ones in Yoshino, Kaji, and Asonuma (2008) which are derived from optimal conditions of households and firms. There are three countries in this model: China, the US, and Japan. We assume China as home country and the US and Japan as the rest of the world (ROW), since the paper analyzes the effect of the changes from the fixed exchange rate regime to the basket-peg or the floating regime. The yen-dollar exchange rate is exogenous to China.

[7] Moreover, Yoshino, Kaji, and Asonuma (2008) analyze the comparison between the basket-peg and floating regime by implementing some instrument rules. Our numerical analysis shows that in the case of Thailand, applying basket weight rule under the baslet-peg regime will lead to smaller cumulative loss than applying interest rate rule or money supply rule under the floating regime.

[8] It is apparent that the optimal basket weight obtained from our numerical analysis is different with one mentioned in Ogawa and Shimizu (2006), which is calculated based on shares in regional GDP measured at PPP and their trade volume shares (sum of the exports and imports).

[Insert Figure 1 here]

[Insert Table 1 here]

Note: all the variables except interest rates and exchange rates are defined in natural log.

We assume that domestic and foreign assets are imperfect substitutes whereas US assets and Japanese assets are perfect substitutes for domestic investors. Thus equation of interest parity condition is

$$i_{t+1} - i_t = -\lambda \left[i_t - \left\{ i_t^* + e_{t+1}^{R/\$} - e_t^{R/\$} - \sigma(e_t) \right\} \right] \tag{1}$$

where λ denotes the adjustment speed of domestic interest rate, which also expresses the degree of capital control. If λ approaches to 0, it implies that domestic interest rate does not respond to change in foreign interest rate. It means that domestic interest rate is exogenous and totally independent. We regard it as a case of strict capital control. On the other hand, if λ approaches to 1, it implies that domestic interest rate responds completely to change in foreign interest rate, which we consider it as a case without capital control. Furthermore, $\sigma(e_t)$ denotes a risk premium. It depends on the renminbi-dollar exchange rate. Depreciation of home currency will increase stock of foreign assets held by domestic investors, and will decrease domestic interest rate. If $\lambda = 1$, equation (1) can be rewritten as

$$i_{t+1} = i_t^* + e_{t+1}^{R/\$} - e_t^{R/\$} - \sigma(e_t) \tag{1'}$$

As we mention later in Section 3.1., under the dollar-peg with capital control, equation (1) will not hold.

Equilibrium condition for money market is

$$m_t - p_t = -\epsilon i_{t+1} + \phi \left(y_t - \bar{y} \right) \tag{2}$$

Assume that demand for goods depends on real exchange rates, real interest rate and exchange rate risks shown as

$$y_t - \bar{y} = \delta \left(e_t^{R/\$} + p^* - p_t \right) + \theta \left(e_t^{R/yen} + p^{yen} - p_t \right) - \rho \left\{ i_{t+1} - \left(p_{t+1}^e - p_t^e \right) \right\} - \tau \Delta e^{R/\$} - \varsigma \Delta e^{R/yen} \tag{3}$$

where the term $\left(p_{t+1}^e - p_t^e \right)$ shows expected rate of inflation. Δe expresses the renminbi-dollar exchange rate risk and Δe^{yen} denotes the renminbi-yen exchange rate risk.

Since one of three exchange rates is not independent, the renminbi-yen rate can be expressed as

$$e_t^{R/yen} = e_t^{R/\$} + e_t^{\$/yen} \tag{4}$$

The inflation rate depends on total productivity, excess demand for goods, the real renminbi-dollar rate, and expected rate of inflation, shown as

$$p_{t+1} - p_t = -\alpha_t + \psi \left(y_t - \bar{y} \right) + \eta \left(e_t^{R/\$} + p^* - p_t \right) + \left(p_{t+1}^e - p_t^e \right) + \chi \Delta e^{R/\$} \tag{5}$$

where the first term on right-hand side shows the total productivity of home country and last term denotes the renminbi-dollar exchange rate risk. We assume aggregate production depends on total productivity, imported materials from the US, and inflation rate. We assume that China imports materials from the US, exports final goods to Japan and the US.

Among variables, α_t, $\bar{y}$, p^*, p^{yen}, $e_t^{\$/yen}$, $\Delta e^{R/\$}$, and $\Delta e^{R/yen}$ are common exogenous variables under any exchange rate regimes. We assume that all exogenous variables except $e_t^{\$/yen}$, p_{t+1}^e, and p_t^e are constant (=0) in the analysis below. All the coefficients above are positive.

3 Exchange rate regimes

In this section, we derive the long-term equilibrium together with equilibrium values at period t. We consider four cases;

(A) Dollar-peg regime with strict capital control,
(B) Basket-peg regime with weak capital control,
(C) Basket-peg regime without capital control and,
(D) Floating regime without capital control

At first, we start our analysis from case (A) which China adopts the fixed exchange rate with the US dollar and restricts capital movements. Second, we consider case (B) where China embraces the basket-peg regime with loose capital control. This assumption reflects a transition period from the fixed exchange rate with capital control to the basket-peg regime with weak capital control, which a basket is composed of the renminbi-dollar and the renminbi-yen rate. Thirdly, we analyze case (C) where China adopts the basket-peg regime without capital control. Lastly we contemplate case (D) where China adopts the floating regime without capital control.

3.1 Dollar-peg regime with strict capital control (A)

Under the dollar-peg regime, the renminbi-dollar rate ($e_t^{R/\$}$) becomes exogenous ($e_t^{R/\$} = \bar{e}^{R/\$}$). Thus, expectation of the exchange rate will be the same with current exchange rate. Furthermore, in this case, money supply (m_t) becomes endogenous, implying that the monetary authority adjusts money supply by intervening to foreign exchange market in order to maintain the US dollar rate constant. Thus, impacts of foreign market intervention have been taken into account in this case. Since the monetary authority restricts domestic residents' holding foreign assets, equation (1) does not exit. Domestic interest rate (i_{t+1}) is policy instrument (exogenous) in this case.

As the renminbi-dollar rate is fixed, from equation (4),

$$e_t^{R/yen} = e_t^{\$/yen} \tag{4'}$$

Substitute equation (4') into equation (3), we can obtain,

$$y_t - \bar{y} = \delta\left(-p_t\right) + \theta\left(e_t^{\$/yen} - p_t\right) - \rho\left\{i_{t+1} - \left(p_{t+1}^e - p_t^e\right)\right\} - \varsigma\Delta e^{R/yen} \tag{3'}$$

Endogenous variables in this case are m_t, y_t, and p_t. Solving equation (2), (3'), and (5) for the price level and money supply, following semi-reduced form equations are obtained:

$$p_{t+1} - p_t = -\alpha_t - \left[\psi(\delta+\theta) + \eta\right] p_t + \psi\theta e_t^{\$/yen} + (1+\psi\rho)\left(p_{t+1}^e - p_t^e\right) - \psi\varsigma\Delta e^{R/yen} - \psi\rho i_{t+1} \tag{6}$$

$$m_t = \left[1 - \phi(\delta+\theta) + \eta\right] p_t + \phi\theta e_t^{\$/yen} + \phi\rho\left(p_{t+1}^e - p_t^e\right) - \phi\varsigma\Delta e^{R/yen} - (\epsilon + \phi\rho)\, i_{t+1} \tag{7}$$

Long-run equilibrium value for the price level and money supply under the dollar-peg regime are[9]

[9] We assume that $p_{t+1}^e = p_t^e$, and $\Delta e^{\$/yen} = 0$ at the long-rum equilibrium.

$$\bar{p}_A = \frac{1}{D}\left[\psi\theta\bar{e}^{\$/yen} - \psi\rho\bar{i} - \bar{\alpha}\right] \tag{8}$$

$$\bar{m}_A = \left[\frac{1-\phi(\delta+\theta)}{D}\psi\theta + \phi\theta\right]\bar{e}^{\$/yen} - \frac{1-\phi(\delta+\theta)}{D}\bar{\alpha} - \left[\frac{1-\phi(\delta+\theta)}{D}\psi\rho + (\epsilon+\phi\rho)\right]\bar{\imath} \tag{9}$$

where $D = \psi(\delta+\theta)+\eta$.

We define that $\hat{X}_t = X_t - \bar{X}$ expresses the deviation from the long-run equilibrium value. We assume the dollar-yen rate moves from its initial equilibrium value (= 0) to $\hat{e}_t^{\$/yen}$ at time t and remains at the new equilibrium after time $t+1$ ($=\hat{e}_t^{\$/yen}$). As the price level is sticky in the short run, $p_0 = 0$ at time 0. We assume the initial equilibrium values $\bar{p}_0 = \bar{e}_0 = 0$. New equilibrium value after the dollar-yen rate change is

$$\bar{p}'_A = \frac{1}{D}\left[\psi\theta\hat{e}_t^{\$/yen} + (1+\psi\rho)\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) - \psi\varsigma\Delta\hat{e}_t^{yen} - \psi\rho i_{t+1}\right] \tag{10}$$

where we assume that total productivity will not be affected by exchange rate change i.e. $\hat{\alpha}_t = 0$.

Difference equation (6) can be solved as

$$(p_t - \bar{p}'_A) = -\frac{1}{D}\left[\psi\theta\hat{e}_t^{\$/yen} + (1+\psi\rho)\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) - \psi\varsigma\Delta\hat{e}^{R/yen} - \psi\rho i_{t+1}\right]\{1-\psi(\delta+\theta)-\eta\}^t \tag{11}$$

We solve for rational expectation and acquire expressions for $y_t - \bar{y}'_A$ and $p_t - \bar{p}'_A$ such as[10]

$$(y_t - \bar{y}'_A) = A_1(t)\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}^{R/yen} + A_3(t)i_{t+1} \tag{12}$$

$$(p_t - \bar{p}'_A) = A^p_1(t)\hat{e}_t^{\$/yen} + A^p_2(t)\Delta\hat{e}^{R/yen} + A^p_3(t)i_{t+1} \tag{12a}$$

Furthermore, we denote deviation of output and the price level from the new long-run equilibrium value under the basket-peg regime without capital control (C) as[11]

$$\begin{aligned}(y_t - \bar{\bar{y}}'_A) &= (y_t - \bar{y}'_A) + (\bar{y}'_A - \bar{\bar{y}}'_A) \\ &= \left\{A_1(t) + A'_1(t)\right\}\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}^{R/yen} + A'_2(t)\Delta\hat{e}^{R/\$} + A_3(t)i_{t+1}\end{aligned} \tag{12'}$$

$$\begin{aligned}(p_t - \bar{\bar{p}}'_A) &= (p_t - \bar{p}'_A) + (\bar{p}'_A - \bar{\bar{p}}'_A) \\ &= \left\{A^p_1(t) + A'^p_1(t)\right\}\hat{e}_t^{\$/yen} + A^p_2(t)\Delta\hat{e}^{R/yen} + +A'^p_2(t)\Delta\hat{e}^{R/\$} + A^p_3(t)i_{t+1}\end{aligned} \tag{12'a}$$

Note that $\bar{\bar{y}}'_A \equiv \bar{y}'_C$ and $\bar{\bar{p}}'_A \equiv \bar{p}'_C$ which are defined in Section 3.3. One shortcoming of the dollar-peg regime with capital control is that capital inflow is restricted which leads to lower level of long-run equilibrium value compared with one under the basket-peg regime without capital control.

[10] We show how to solve for rational expectation and derive equation (12) in Appendix A.1. Expression $A_1(t)$, $A_2(t)$, $A^p_1(t)$, and $A^p_2(t)$, are shown in Appendix A.1.

[11] Details of are shown in Appendix A.1.

3.2 Basket-peg regime with weak capital control (B)

As the basket-peg is one type of fixed exchange rate regimes, endogenous variables are the same as under the dollar peg regime. In this case, the monetary authority adjusts money supply by intervening to foreign exchange market in order to maintain the value of basket. Thus, impacts of foreign market intervention have been considered in this case as well. As mentioned above, basket is a weighted average of the renminbi-dollar rate and the renminbi-yen rate. We have equation (1) together with basket equation, which is

$$\upsilon e_t^{R/\$} + (1-\upsilon) e_t^{R/yen} = \Gamma \tag{13}$$

where Γ is the value of basket. From this equation and equation (4), we can obtain

$$e_t^{R/\$} = -(1-\upsilon) e_t^{\$/yen} \tag{13a}$$

$$e_t^{R/yen} = \upsilon e_t^{\$/yen} \tag{13b}$$

Substituting equation (13a) and (13b), we acquire

$$y_t - \bar{y} = -(\delta+\theta)p_t + \{-\delta(1-\upsilon)+\theta\upsilon\} e_t^{\$/yen} - \rho i_{t+1} + \rho\left(p_{t+1}^e - p_t^e\right) - \tau \Delta e^{R/\$} - \varsigma \Delta e^{R/yen} \tag{3''}$$

Solving equation (1), (3"), and (5) for the price level and interest rate, following semi-reduced form equations are obtained:

$$\begin{aligned} p_{t+1} - p_t \;=\;& -\alpha_t + \{\psi(\delta+\theta)+\eta\} p_t + \left[\psi\{\theta\upsilon - \delta(1-\upsilon) - \rho\lambda(1+\sigma)(1-\upsilon)\} - \eta(1-\upsilon)\right] e_t^{\$/yen} \\ & \psi\rho\lambda(1-\upsilon) e_{t+1}^{\$/yen} + (1+\psi\rho)\left(p_{t+1}^e - p_t^e\right) - (\psi\tau - \chi)\Delta e^{R/\$} - \psi\varsigma\Delta e^{R/yen} \end{aligned} \tag{14}$$

$$i_{t+1} - i_t = -\lambda i_t - \lambda(1-\upsilon) e_{t+1}^{\$/yen} + \lambda(1+\sigma)(1-\upsilon) e_t^{\$/yen} \tag{15}$$

Long-run equilibrium value is derived as

$$\bar{p}_B = \frac{\psi\{\theta\upsilon - \delta(1-\upsilon) + \rho\sigma(1-\upsilon)(2\lambda-1) + \eta(1-\upsilon)\}}{\psi(\delta+\theta)+\eta} \bar{e}^{\$/yen} - \frac{1}{\psi(\delta+\theta)+\eta} \bar{\alpha} \tag{16}$$

$$\bar{\imath}_B = (1-\upsilon)\sigma \bar{e}_t^{\$/yen} \tag{17}$$

As in Section 3.1, we assume the same exogenous dollar-yen rate change. New equilibrium value after the dollar-yen rate change is

$$\bar{p}_B' = \frac{1}{D}\left\{ \begin{array}{c} \left[\psi\{\theta\upsilon - \delta(1-\upsilon) - \rho\lambda(1+\sigma)(1-\upsilon)\} - \eta(1-\upsilon)\right] \hat{e}_t^{\$/yen} \\ +(1+\psi\rho)\left(\hat{p}_{t+1}^e - \hat{p}_t^e\right) - (\psi\tau-\chi)\Delta\hat{e}^{R/\$} - \psi\varsigma\Delta\hat{e}^{R/yen} \end{array} \right\} \tag{18}$$

$$\bar{\imath}_B' = (1-\upsilon)\sigma \hat{e}_t^{\$/yen} \tag{19}$$

where $D = \psi(\delta+\theta)+\eta$.

Difference equations (14) and (15) can be solved as follows;

$$\left(p_t - \bar{p}'_B\right) = -\frac{1}{D}\left[\begin{array}{c} \left[\psi\left\{\theta\upsilon - \delta(1-\upsilon) - \rho\lambda(1+\sigma)(1-\upsilon)\right\} - \eta(1-\upsilon)\right]\hat{e}_t^{\$/yen} \\ +(1+\psi\rho)\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) - (\psi\tau - \chi)\,\Delta\hat{e}^{R/\$} - \psi\varsigma\Delta\hat{e}^{R/yen} \end{array}\right]\left\{1 - \psi(\delta+\theta) - \eta\right\}^t \tag{20}$$

$$(i_t - \bar{\imath}'_B) = -(1-\upsilon)\sigma\,(1-\lambda)^t\,\hat{e}_t^{\$/yen} \tag{21}$$

We solve for rational expectation and obtain expressions for $y_t - \bar{y}'_B$ and $p_t - \bar{p}'_B$ such as[12]

$$(y_t - \bar{y}'_B) = B_1(t)\upsilon\hat{e}_t^{\$/yen} + B_2(t)\hat{e}_t^{\$/yen} + B_3(t)\hat{z}_t \tag{22}$$

$$(p_t - \bar{p}'_B) = B^p_1(t)\upsilon\hat{e}_t^{\$/yen} + B^p_2(t)\hat{e}_t^{\$/yen} + B^p_3(t)\hat{z}_t \tag{22a}$$

where $B_3(t)\hat{z}_t$ is comprised of $\Delta\hat{e}^{R/\$}$ and $\Delta\hat{e}^{R/yen}$ terms.

3.3 Basket-peg regime without capital control (C)

Similar to Section 3.2, we have same equation (13a) and (13b) in this case. Since we assume perfect capital mobility, we have equation (1') with $\lambda = 1$. Substituting equation (13a) and (13b), we have same equation (3").

Solving equation (2), (3"), and (5) for the price level and money supply, following semi-reduced form equations are obtained:

$$\begin{aligned} p_{t+1} - p_t \;\;=\;\; & -\alpha_t - \left\{\psi(\delta+\theta) + \eta\right\}p_t + \left[\psi\left\{\theta\upsilon - \delta(1-\upsilon) - \rho(1+\sigma)(1-\upsilon)\right\} - \eta(1-\upsilon)\right]e_t^{\$/yen} \\ & +\psi\rho(1-\upsilon)e_{t+1}^{\$/yen} + (1+\psi\rho)\left(p^e_{t+1} - p^e_t\right) - (\psi\tau - \chi)\,\Delta e^{R/\$} - \psi\varsigma\Delta e^{R/yen} \end{aligned} \tag{23}$$

$$\begin{aligned} m_t \;\;=\;\; & \left[1 - \phi(\delta+\theta)\right]p_t + (\epsilon + \phi\rho)\,(1-\upsilon)e_{t+1}^{\$/yen} + \phi\rho\left(p^e_{t+1} - p^e_t\right) - \phi\varsigma\Delta e^{R/yen} - \phi\tau\Delta e^{R/\$} \\ & +\left[\phi\left\{-\delta(1-\upsilon) + \theta\upsilon\right\} - (\epsilon + \phi\rho)\,(1-\upsilon)(1+\sigma)\right]e_t^{\$/yen} \end{aligned} \tag{24}$$

Long-run equilibrium value is derived as

$$\bar{p}_C = \frac{\psi\left\{\theta\upsilon - \delta(1-\upsilon) - \rho\sigma(1-\upsilon)\right\} - \eta(1-\upsilon)}{\psi(\delta+\theta) + \eta}\bar{e}^{\$/yen} - \frac{1}{\psi(\delta+\theta) + \eta}\bar{\alpha} \tag{25}$$

$$\bar{m}_C = \left[1 - \phi(\delta+\theta)\right]\bar{p} + \left[\phi\left\{-\delta(1-\upsilon) + \theta\upsilon\right\} - \sigma\,(\epsilon + \phi\rho)\,(1-\upsilon)\right]\bar{e}^{\$/yen} \tag{26}$$

As in Section 3.1, we assume the same exogenous dollar-yen rate change. New equilibrium value after the dollar-yen rate change is

$$\bar{p}'_C = \frac{1}{D}\left\{\begin{array}{c} \left[\psi\left\{\theta\upsilon - \delta(1-\upsilon) - \rho(1+\sigma)(1-\upsilon)\right\} - \eta(1-\upsilon)\right]\hat{e}_t^{\$/yen} \\ +(1+\psi\rho)\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) - (\psi\tau - \chi)\,\Delta\hat{e}^{R/\$} - \psi\varsigma\Delta\hat{e}^{R/yen} \end{array}\right\} \tag{27}$$

$$\begin{aligned} \bar{m}_C \;\;=\;\; & \left[1 - \phi(\delta+\theta)\right]\bar{p}' + \left[\phi\left\{-\delta(1-\upsilon) + \theta\upsilon\right\} - \sigma\,(\epsilon + \phi\rho)\,(1-\upsilon)\right]\hat{e}^{\$/yen} \\ & +\phi\rho\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) - \phi\varsigma\Delta\hat{e}^{R/yen} - \phi\tau\Delta\hat{e}^{R/\$} \end{aligned} \tag{28}$$

[12] We show how to solve for rational expectation and derive equation (19) in Appendix A.2. Expression $B_1(t)$, $B_2(t)$, $B_3(t)$, $B^p_1(t)$, $B^p_2(t)$, and $B^p_3(t)$ are shown in Appendix A.2.

where $D = \psi(\delta+\theta)+\eta$.

Difference equation (23) can be solved as follows;

$$p_t - \bar{p}' = \frac{-1}{D}\left[\begin{array}{c} \left[\psi\left\{\theta\upsilon-\delta(1-\upsilon)-\rho(1+\sigma)(1-\upsilon)\right\}-\eta(1-\upsilon)\right]\hat{e}_t^{\$/yen} \\ +(1+\psi\rho)\left(\hat{p}_{t+1}^e-\hat{p}_t^e\right)-(\psi\tau-\chi)\Delta\hat{e}^{R/\$}-\psi\varsigma\Delta\hat{e}^{R/yen}\end{array}\right]\left\{1-\psi(\delta+\theta)-\eta\right\}^t \quad (29)$$

We solve for rational expectation to obtain expressions for $y_t - \bar{y}'_C$ and $p_t - \bar{p}'_C$ such as[13]

$$\left(y_t - \bar{y}'_C\right) = C_1(t)\upsilon\hat{e}_t^{\$/yen} + C_2(t)\hat{e}_t^{\$/yen} + C_3(t)\hat{z}_t \quad (30)$$

$$\left(p_t - \bar{p}'_C\right) = C_1^p(t)\upsilon\hat{e}_t^{\$/yen} + C_2^p(t)\hat{e}_t^{\$/yen} + C_3^p(t)\hat{z}_t \quad (30a)$$

3.4 Floating regime with no capital control (D)

Under the floating regime, money supply (m_t) becomes exogenous. From equation (1') to (5), we derive following two difference equations.

$$e_{t+1}^{R/\$} - e_t^{R/\$} = f_1 e_t^{R/\$} + f_2 p_t - \frac{\phi}{\epsilon+\phi\rho}\left[\begin{array}{c}\theta e_t^{\$/yen}+\rho\left(p_{t+1}^e-p_t^e\right)\\ -\tau\Delta e^{R/\$}-\varsigma\Delta e^{R/yen}\end{array}\right] - \frac{1}{\epsilon+\phi\rho}m_t \quad (31)$$

$$\begin{aligned} p_{t+1}-p_t &= f_3 e_t^{R/\$} + f_4 p_t + \frac{\psi\rho}{\epsilon+\phi\rho}m_t + \left[\frac{\psi\rho^2\phi}{\epsilon+\phi\rho}+1+\psi\rho\right]\left(p_{t+1}^e-p_t^e\right)-\alpha_t \quad (32)\\ &\quad +\frac{\psi\epsilon\theta}{\epsilon+\phi\rho}e_t^{\$/yen}+\left(\chi-\psi\tau\left(1+\frac{\phi\rho}{\epsilon+\phi\rho}\right)\right)\Delta e^{R/\$}-\psi\varsigma\left(1+\frac{\phi\rho}{\epsilon+\phi\rho}\right)\Delta e^{R/yen}\end{aligned}$$

where $f_1 = \left[\sigma+\frac{\phi(\delta+\theta)}{\epsilon+\phi\rho}\right]$, $f_2 = \left[\frac{1+\phi(\delta+\theta)}{\epsilon+\phi\rho}\right]$, $f_3 = \left[\eta+\frac{\epsilon[\psi(\delta+\theta)+\eta]}{\epsilon+\phi\rho}\right]$, and $f_4 = \left[-\eta-\frac{\psi(\delta+\theta)(\epsilon+2\phi\rho)}{\epsilon+\phi\rho}\right]$.

Long-run equilibrium value is derived as

$$\bar{e}_D^{R/\$} = -\frac{f_4+\psi\rho f_2}{E(\epsilon+\phi\rho)}\bar{m} - \frac{\phi\theta f_4+\psi\theta\epsilon f_2}{E(\epsilon+\phi\rho)}\bar{e}^{\$/yen} + \frac{f_2}{E}\bar{\alpha} \quad (33)$$

$$\bar{p}_D = \frac{f_3+\psi\rho f_1}{E(\epsilon+\phi\rho)}\bar{m} + \frac{\phi\theta f_3+\psi\theta\epsilon f_1}{E(\epsilon+\phi\rho)}\bar{e}^{\$/yen} - \frac{f_1}{E}\bar{\alpha} \quad (34)$$

where $E = f_2 f_3 - f_1 f_4$.

Under some assumptions mentioned in Appendix B, this system satisfies saddle path stability. After solving for characteristic roots of difference equations, we obtain a following saddle path[14].

$$e_t^{R/\$} - \bar{e}_D^{R/\$} = \kappa(p_t - \bar{p}_D) \quad (35)$$

where $\kappa = \frac{\omega_2-1-f_4}{f_3}$, and $\omega_2 = \frac{1}{2}(2+f_1+f_4) - \frac{1}{2}\sqrt{(2+f_1+f_4)^2-4(1+f_1+f_4+E)}$

As in Section 3.1, we assume the same exogenous dollar-yen rate change. New equilibrium value after the dollar-yen rate change is[15]

$$\bar{p}'_D = \frac{f_3+\psi\rho f_1}{E(\epsilon+\phi\rho)}m_t + \frac{\phi\theta f_3+\psi\theta\epsilon f_1}{E(\epsilon+\phi\rho)}\hat{e}^{\$/yen} + g_1\left(p_{t+1}^e-p_t^e\right) + g_2\Delta e^{R/\$} + g_3\Delta e^{R/yen} \quad (36)$$

[13] We show how to solve for rational expectation and derive equation (30) in Appendix A.3. Expression $C_1(t)$, $C_2(t)$, $C_3(t)$, $C_1^p(t)$, $C_2^p(t)$, and $C_3^p(t)$ are shown in Appendix A.3.

[14] We show that this system satisfies the saddle path stability in Appendix B.

[15] Details of expression are shown in Appendix A.4.

$$\bar{e}'_D = -\frac{f_4 + \psi\rho f_2}{E(\epsilon + \phi\rho)} m_t - \frac{\phi\theta f_4 + \psi\theta\epsilon f_2}{E(\epsilon + \phi\rho)} \hat{e}_t^{\$/yen} + g'_1 \left(p^e_{t+1} - p^e_t \right) + g'_2 \Delta e^{R/\$} + g'_3 \Delta e^{R/yen} \tag{37}$$

A new saddle path is

$$e_t^{R/\$} - \bar{e}_D^{\prime R/\$} = \kappa(p_t - \bar{p}'_D) \tag{38}$$

Assuming that agents have perfect foresight and can always be on the saddle path, the economy can jump on this new saddle path. Taking into account that the price is sticky in the short-run, *i.e.* $p_0 = 0$, the exchange rate at time 0 is

$$e_0^{R/\$} = \bar{e}_D^{\prime R/\$} - \kappa \bar{p}'_D \tag{39}$$

which shows that the exchange rate undershoots its new equilibrium value. Thus,

$$p_t - \bar{p}'_D = -\omega_2^t \bar{p}'_D \tag{40}$$

$$e_t^{R/\$} - \bar{e}_D^{\prime R/\$} = -\kappa \omega_2^t \bar{p}'_D \tag{41}$$

Substituting those expressions into equation (3) and solving for rational expectation yield expressions, for $y_t - \bar{y}'_D$ and $p_t - \bar{p}'_D$[16]

$$(y_t - \bar{y}'_D) = D_1(t) \hat{e}_t^{\$/yen} + D_2(t) \hat{z}_t + D_3(t) m_t \tag{42}$$

$$(p_t - \bar{p}'_D) = D_1^p(t) \hat{e}_t^{\$/yen} + D_2^p(t) \hat{z}_t + D_3^p(t) m_t \tag{42a}$$

4 Transition path to other exchange rate regimes

In this section, we define four transition policies. Based on the results of static analysis shown by Yoshino, Kaji and Suzuki (2004)[17], we regard the stable desirable regimes are either the basket-peg regime without capital control (C) or the floating regime without capital control (D). We consider following three transition paths to the target regimes plus maintaining current regime such as the dollar-peg regime with capital control (A).

(1) Maintaining the dollar-peg (with strict capital control) ((A)- (A)- (A))

(2) Gradual shift from the dollar-peg to the basket-peg without capital control (gradual adjustment of both capital controls and basket weight) ((A)- (B)- (C))

(3) Sudden shift from the dollar-peg to the basket-peg without capital control (sudden removal of capital control and sudden shift of basket weights) ((A)- (C) – (C))

(4) Sudden shift from the dollar-peg to the floating regime (sudden removal of capital control and sudden increase of flexibility in exchange rate) ((A) – (D) – (D))

[Insert Figure 2]

[16] We show how to solve for rational expectation and derive equation (42) in Appendix A.4.

[17] Yoshino, Kaji, and Suzuki (2004) shows that for small open economy like Thailand, it would be desirable to adopt basket-peg or floating rather than dollar-peg under static analysis. Furthermore, Yoshino, Kaji, and Asonuma (2004) confirms that this statement is also true under two-country general equilibrium model.

The first policy is sustaining the dollar-peg regime. The monetary authority restricts capital control and fixes a weight on the dollar rate to 1. Next, the second one is that it includes the transition period (B), which reflects the adjustment period of capital control and basket weights. It starts from the dollar-peg regime and undergoes the transition period (B) and finally arrives at the basket-peg regime without capital control (C).

The third is that it does not includes the transition period (B), so therefore, the monetary authority shifts from the dollar-peg regime to the basket-peg regime without transition period, implying the economy will jump to the target basket-peg regime. Finally, the last one is that the monetary authority shifts from the dollar-peg to the floating regime without transition period, implying the economy will suddenly jump to the floating regime. We assume that time interval for initial dollar-peg regime is T_0. Furthermore, we regard the transition period as T_1 and the time interval after the authority reach the target regime as T_2. We assume that discount factor is β. Figure 2 displays the four policies respectively. Throughout this section, we suppose that the monetary authority aims to minimize output fluctuation[18].

4.1 Maintaining the dollar-peg regime

In this subsection, we derive the cumulative loss for maintaining the dollar-peg regime. The country keeps the dollar-peg regime for the entire time period $T_0+T_1+T_2$. The cumulative loss for sustaining the dollar-peg for T_1+T_2 after the initial dollar-peg period T_0 and optimal interest rate are expressed as follows[19].

$$\begin{aligned} L_1\left(i^*, T_1+T_2\right) &\equiv \sum_{t=1}^{T_0} \beta^{t-1}(y_t-\bar{y}_A')^2 + \sum_{t=T_a+1}^{T_0+T_1+T_2} \beta^{t-1}(y_t-\bar{\bar{y}}_A')^2 \qquad (43) \\ &= \sum_{t=1}^{T_0} \beta^{t-1}(y_t-\bar{y}_A')^2 + \sum_{t=T_a+1}^{T_0+T_1+T_2} \beta^{t-1}\left[\begin{array}{c} \{A_1(t)+A_1'(t)\}\,\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}^{R/yen} \\ +A_2'(t)\Delta\hat{e}^{R/\$} + A_3(t)i^* \end{array}\right]^2 \end{aligned}$$

$$i^* = \arg\min \sum_{t=1}^{T_0+T_1+T_2} \beta^{t-1}(y_t-\bar{y}_A')^2 \qquad (43')$$

where $(y_t-\bar{y}_A') = \left[A_1(t)\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}^{R/yen} + A_3(t)i^*\right]$. Note that i^* is chosen to minimize the cumulative loss in term of deviation from its stable equilibrium value under the dollar-peg regime.

4.2 Gradual adjustment to the basket-peg with no capital control

In this subsection, we first define the cumulative loss for policy (2) with transition period. Then we derive the optimal weight of basket which the monetary authority sets as a goal under the basket-peg regime without capital control.

[18] We also derive the cumulative loss for stabilization of the price level in footnotes

[19] The cumulative loss evaluated in term of deviation of the price level from the steady state level is shown as follows;

$$L_1^p\left(i_p^*, T_1+T_2\right) = \sum_{t=1}^{T_0} \beta^{t-1}(p_t-\bar{p}_A')^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}(p_t-\bar{\bar{p}}_A')^2 \qquad (43a)$$

where

$$i_p^* = \arg\min \sum_{t=1}^{T_0+T_1+T_2} \beta^{t-1}(p_t-\bar{p}_A')^2$$

First, we express the optimal basket weight as υ^* assuming that $0 \leq \upsilon^* \leq 1$. As we mentioned above, the monetary authority starts with adopting the dollar-peg regime with capital control (A), indicating that basket weight is equal to 1. Then it shifts to the basket-peg regime and gradually loose the degree of capital control under regime (B). At the same time, the monetary authority decreases its weight by $\frac{1-\upsilon^*}{T_1}$ each period during the transition period in order to arrive at υ^* when it reaches the basket-peg regime without capital control. Once the monetary authority adopts the target basket-peg regime, it maintains the optimal basket weight (υ^*). The cumulative loss of transition policy (2) with optimal basket weight υ^*, transition period T_1, and target regime period T_2, and can be expressed as[20]

$$\begin{aligned} L_2(\upsilon^*, T_1, T_2) &= \sum_{t=1}^{T_0} \beta^{t-1}(y_t - \bar{y}'_A)^2 + \sum_{t=T_a+1}^{T_0+T_1} \beta^{t-1}(y_t - \bar{y}'_B)^2 + \sum_{t=T_a+T_1+1}^{T_0+T_1+T_2} \beta^{t-1}(y_t - \bar{y}'_C)^2 \\ &= \sum_{t=1}^{T_0} \beta^{t-1}(y_t - \bar{y}'_A)^2 + \sum_{t=T_a+1}^{T_0+T_1} \beta^{t-1}\left[B_1(t)\upsilon(t)\hat{e}_t^{\$/yen} + B_2(t)\hat{e}_t^{\$/yen} + B_3(t)\hat{z}_t\right]^2 \\ &\quad + \sum_{t=T_0+T_1+1}^{T_0+T_1+T_2} \beta^{t-1}\left[C_1(t)\upsilon^*\hat{e}_t^{\$/yen} + C_2(t)\hat{e}_t^{\$/yen} + C_3(t)\hat{z}_t\right]^2 \end{aligned} \tag{44}$$

where $(y_t - \bar{y}'_A) = \left[A_1(t)\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}^{R/yen} + A_3(t)i^*\right]$ and $\upsilon(t) = 1 - \frac{1-\upsilon^*}{T_1}(t - T_0)$. Note that the second and the third terms on right-hand side of equation (44) show losses under transition periods and losses under the basket-peg regime (C) respectively.

We differentiate the cumulative loss $L_2(\upsilon^*, T_1, T_2)$ respect to υ^* and obtain the optimal basket weight as

$$\upsilon^* = -\frac{1}{H_1}\left[\begin{array}{c} \sum_{t=T_0+T_1+1}^{T_0+T_1+T_2} \beta^{t-1} C_1(t)\hat{e}_t^{\$/yen}\left(C_2(t)\hat{e}_t^{\$/yen} + C_3(t)\hat{z}_t\right) \\ + \sum_{t=T_0+1}^{T_0+T_1} \beta^{t-1} B_1(t)\hat{e}_t^{\$/yen}\left(\frac{t-T_0}{T_1}\right)\left\{B_1(t)\hat{e}_t^{\$/yen}\left(\frac{t-T_A}{T_1}\right) + B_2(t)\hat{e}_t^{\$/yen} + B_3(t)\hat{z}_t\right\} \end{array}\right] \tag{45}$$

where $H_1 = \left[\sum_{t=T_0+1}^{T_0+T_1} \beta^{t-1}\left\{B_1(t)\hat{e}_t^{\$/yen}\left(\frac{t-T_0}{T_1}\right)\right\}^2 + \sum_{t=T_0+T_1+1}^{T_0+T_1+T_2} \beta^{t-1}\left(C_1(t)\hat{e}_t^{\$/yen}\right)^2\right]$

4.3 Sudden shift to the basket-peg with no capital control

In this sub-section, we first define the cumulative loss for transition policy (3) with sudden shift. Then, we calculate the optimal basket weight under the target basket-peg, which is different from the one derived in section 4.2.

[20] The cumulative loss evaluated in term of deviation of the price level from its steady-state level is defined as follows;

$$\begin{aligned} L_2^p(\upsilon_p^*, T_1, T_2) &= \sum_{t=1}^{T_0} \beta^{t-1}(p_t - \bar{p}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1} \beta^{t-1}(p_t - \bar{p}'_B)^2 + \sum_{t=T_0+T_1+1}^{T_0+T_1+T_2} \beta^{t-1}(p_t - \bar{p}'_C)^2 \\ &= \sum_{t=1}^{T_0} \beta^{t-1}(p_t - \bar{p}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1} \beta^{t-1}\left[B_1^p(t)\upsilon(t)\hat{e}_t^{\$/yen} + B_2^p(t)\hat{e}_t^{\$/yen} + B_3^p(t)\hat{z}_t\right]^2 \\ &\quad + \sum_{t=T_0+T_1+1}^{T_0+T_1+T_2} \beta^{t-1}\left[C_1^p(t)\upsilon_p^*\hat{e}_t^{\$/yen} + C_2^p(t)\hat{e}_t^{\$/yen} + C_3^p(t)\hat{z}_t\right]^2 \end{aligned} \tag{44a}$$

where $(p_t - \bar{p}'_A) = \left[A_1^p(t)\hat{e}_t^{\$/yen} + A_2^p(t)\Delta\hat{e}^{R/yen} + A_3^p(t)i_p^*\right]$, $\upsilon_p(t) = 1 - \frac{1-\upsilon_p^*}{T_1}(t - T_0)$ and υ_p^* is optimal basket weight for the transition policy of stabilizing the price level.

First of all, we denote the optimal basket weight as υ^{**} under the target basket-peg regime. As we mentioned above, the monetary authority starts with the dollar-peg regime with capital control (A) implying that basket weight is fixed at 1, and suddenly shifts to the basket-peg regime implementing the optimal weight (υ^{**}) with no capital control (C). The cumulative loss for policy (3) with optimal basket weight υ^{**} and target regime period $T_1 + T_2$ is shown as follows[21],

$$\begin{aligned} L_3\left(\upsilon^{**}, T_1+T_2\right) &= \sum_{t=1}^{T_0} \beta^{t-1}(y_t - \bar{y}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}(y_t - \bar{y}'_C)^2 \\ &= \sum_{t=1}^{T_0} \beta^{t-1}(y_t - \bar{y}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}\left[C_1(t)\upsilon^{**}\hat{e}_t^{\$/yen} + C_2(t)\hat{e}_t^{\$/yen} + C_3(t)\hat{z}_t\right]^2 \end{aligned} \tag{46}$$

where $(y_t - \bar{y}'_A) = \left[A_1(t)\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}^{R/yen} + A_3(t)i^*\right]$ and note that impacts of exchange rate volatility after the shift are included in the second terms on the right-hand side of equation (46).

We differentiate the cumulative loss $L_3\left(\upsilon^{**}, T_1+T_2\right)$ respect to υ^{**} and acquire the optimal weight as

$$\upsilon^{**} = -\frac{1}{H_2}\left[\sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}C_1(t)\hat{e}_t^{\$/yen}\left(C_2(t)\hat{e}_t^{\$/yen} + C_3(t)\hat{z}_t\right)\right] \tag{47}$$

where $H_2 = \left[\sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}\left(C_1(t)\hat{e}_t^{\$/yen}\right)^2\right]$

Comparing with the basket weight obtained in section 4.2., υ^{**} is different from υ^* as long as $T_1 \neq 0$. This is because υ^{**} is the weight which minimizes the loss under the basket-peg regime without capital control while υ^* is the weight which minimizes sum of discounted losses under transition period and target basket-peg regime period.

4.4 Sudden shift from dollar-peg to the floating regime

Lastly, we calculate the cumulative loss for policy (4) which the monetary authority shifts from the dollar-peg regime to the floating regime (D) without transition period. We assume the optimal money supply under the floating regime as m^*. The monetary authority starts with adopting the dollar-peg regime with capital control (A) implying that weight is fixed at 1, and suddenly it jumps to the floating regime without capital control. The cumulative loss under policy (4) with target regime

[21] The cumulative loss for stabilizing the price level is shown as follows;

$$\begin{aligned} L_3\left(\upsilon^{**}, T_1+T_2\right) &= \sum_{t=1}^{T_0} \beta^{t-1}(p_t - \bar{p}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}(p_t - \bar{p}'_C)^2 \\ &= \sum_{t=1}^{T_0} \beta^{t-1}(p_t - \bar{p}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}\left[C_1^p(t)\upsilon_p^{**}\hat{e}_t^{\$/yen} + C_2^p(t)\hat{e}_t^{\$/yen} + C_3^p(t)\hat{z}_t\right]^2 \end{aligned} \tag{46a}$$

where $(p_t - \bar{p}'_A) = \left[A_1^p(t)\hat{e}_t^{\$/yen} + A_2^p(t)\Delta\hat{e}^{R/yen} + A_3^p(t)i_p^*\right]$ and υ_p^{**} is the optimal weight for stabilizing the price level.

period $T_1 + T_2$ and optimal money supply m^* is shown as follows[22],

$$
\begin{aligned}
L_4(m^*, T_1 + T_2) &= \sum_{t=1}^{T_0} \beta^{t-1}(y_t - \bar{y}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}(y_t - \bar{y}'_D)^2 \quad (48) \\
&= \sum_{t=1}^{T_0} \beta^{t-1}(y_t - \bar{y}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}\left[D_1(t)\hat{e}_t^{\$/yen} + D_2(t)\hat{z}_t + D_3(t)m^*\right]^2
\end{aligned}
$$

where $(y_t - \bar{y}'_A) = \left[A_1(t)\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}^{R/yen} + A_3(t)i^*\right]$ and note that impacts of exchange rate volatility associated with the shift are included in the second term on the right-hand side of equation (48).

We differentiate the cumulative loss $L_4(m^*, T_1 + T_2)$ respect to m^* and obtain the optimal money supply, such as

$$
m^* = \frac{-1}{H_3}\left[\sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1} D_3(t)\left(D_1(t)\hat{e}_t^{\$/yen} + D_2(t)\hat{z}_t\right)\right] \quad (49)
$$

where $H_3 = \left[\sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}\left(D_3(t)\right)^2\right]$

5 Comparison of cumulative losses

In this section, we focus on the optimal policy for the monetary authority to stabilize output fluctuation[23]. We have two main goals throughout this section. One is to contemplate whether maintaining the dollar-peg regime is optimal for the monetary authority in the long-term perspective and the other is to discuss the optimal policy, given that it is not desirable to maintain the dollar-peg in the long-run. In order to do so, at first step, we reflect implications from static analysis in this dynamic model. Next, we compare the current policy (policy (1)), with other transition policies to target basket-peg regime or floating regime.

Based on the results that the dollar-peg is not preferable in the long-run, at the second step, we examine the optimal policy for the monetary authority among three policies. For the case study, we provide simulation results using Thai data to support theoretical findings in Appendix C.

5.1 Implications from static analysis

First of all, we reflect the some implications from static analysis in this subsection. Using static small open general equilibrium model, Yoshino, Kaji, and Suzuki (2004) show that it is not optimal for

[22] The cumulative loss for stabilizing the price level is defined as follows;

$$
\begin{aligned}
L_4^p(m_p^*, T_1 + T_2) &= \sum_{t=1}^{T_0} \beta^{t-1}(p_t - \bar{p}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}(p_t - \bar{p}'_D)^2 \quad (48a) \\
&= \sum_{t=1}^{T_0} \beta^{t-1}(p_t - \bar{p}'_A)^2 + \sum_{t=T_0+1}^{T_0+T_1+T_2} \beta^{t-1}\left[D_1^p(t)\hat{e}_t^{\$/yen} + D_2^p(t)\hat{z}_t + D_3^p(t)m_p^*\right]^2
\end{aligned}
$$

where $(p_t - \bar{p}'_A) = \left[A_1^p(t)\hat{e}_t^{\$/yen} + A_2^p(t)\Delta\hat{e}^{R/yen} + A_3^p(t)i^*\right]$ and m_p^* is optimal money supply for stabilizing the price level.

[23] Discussion concerning stabilizing the price lecel is also provided in the footnotes.

small open economy to adopt the dollar-peg compared with the basket-peg or the floating regimes[24]. In other words, value of the loss under the dollar-peg is higher than ones under the basket-peg or the floating regime at the steady state.

We can express these implications by using one-period losses in this model as follows[25];

$$(y_t - \overline{\overline{y}}'_A) > (y_t - \overline{y}'_C) \tag{50}$$

$$(y_t - \overline{\overline{y}}'_A) > (y_t - \overline{y}'_D) \tag{51}$$

Note that these results hold under regimes which has been maintained for several periods.

5.2 Comparison of policy (1) and other transition policies

In this subsection, we discuss the desirability of the dollar-peg in the long-term by comparing policy (1) and other transition policies to the basket-peg or the floating regime. We start with contrast between maintaining the dollar-peg (policy (1)) and sudden shift to the basket-peg regime without capital control (policy (3)). We define threshold time period T_C^* such that

$$L_1(i^*, T_C^*) = L_3\left(v^{**}, T_C^*\right)$$

expressing the time interval under which cumulative loss of maintaining the dollar-peg is equal to one of shift to the basket-peg. Taking into account that equation (50) holds under the target regime period[26], we obtain following statements;

$$L_1(i^*, t) < L_3\left(v^{**}, t\right) \quad if\ t < T_C^*$$

$$L_1(i^*, t) > L_3\left(v^{**}, t\right) \quad if\ t > T_C^*$$

It means that if t is shorter than the threshold time period T_C^*, then the cumulative loss of maintaining the dollar-peg is smaller than one of transition policy to the basket-peg. This could happen only if the exchange rate volatility affects negatively to the economy[27]. On the other hand, if t is longer than the threshold time period T_C^*, then the cumulative loss of maintaining the dollar-peg regime is higher than one of transition policy to the basket-peg regime. In other words, longer the

[24] Furthermore, Yoshino, Kaji, and Asonuma (2004) derive the same implications under static two-country general equilibrium model.

[25] Similarly, we can express these implications by using one-period losses in term of the deviation of the price level from the steady state as follows;

$$(p_t - \overline{\overline{p}}'_A) > (p_t - \overline{p}'_C) \tag{50a}$$

$$(p_t - \overline{\overline{p}}'_A) > (p_t - \overline{p}'_D) \tag{51a}$$

[26] For the price level stability, the similar statements will be satisfied;

$$L_1^p(i^*, t) < L_3^p\left(v_p^{**}, t\right) \quad if\ t < T_C^{*p}$$

$$L_1^p(i^*, t) > L_3^p\left(v_p^{**}, t\right) \quad if\ t > T_C^{*p}$$

where

$$L_1^p(i^*, T_C^{*p}) = L_3^p\left(v_p^{**}, T_C^{*p}\right)$$

[27] As we explain in section 4.3, effect of exchange rate volatility due to the shift is included in the expression of cumulative loss of policy (3). Therefore, at the short-horizon, loss of sustaining the current regime is smaller than the one of policy (3) because the monetary authority can avoid negative effect of exchange rate volatility.

time period of adopting the basket-peg, the more benefits the country can obtain from shifting to basket-peg regime as shown in equation (50).

Next, we contrast the losses under maintaining the dollar-peg (policy (1)) and shift to the floating regime (policy (4)). Similarly, we define threshold time period T_D^* such that

$$L_1(i^*, T_D^*) = L_4\left(m^*, T_D^*\right)$$

denoting time interval under which cumulative loss of maintaining the dollar-peg is equal to one of shift to the floating regime. Reflecting that equation (51) holds under target regime period after the shift, following conditions hold[28];

$$L_1(i^*, t) < L_4\left(m^*, t\right) \qquad if \;\; t < T_D^*$$

$$L_1(i^*, t) > L_4\left(m^*, t\right) \qquad if \;\; t > T_D^*$$

These imply that longer the period of adopting the floating regime, the more benefits the country can obtain from shifting to the floating regime as shown in equation (51).

Summarizing the results mentioned above, maintaining the dollar-peg regime is desirable only in the short-term, i.e. $t < Min\left[T_C^*, T_D^*\right]$ [29]. As the target time period gets longer, the country can obtain more benefits from shifting to either the basket-peg or the floating regime.

5.3 Comparison among transition policies

At the second step, we examine the optimal policy among three transition policies. There are costs and benefits for three transition policies (2), (3), and (4), as shown in Table 2. For components of costs, estimates based on numerical analysis are provided in Table 3.

[Insert Table 2 here]

[Insert Table 3 here]

Moreover, these benefits and costs are taken into account by evaluating the cumulative losses expressed by equation (44), (46), and (48). By comparing the cumulative losses, we can analyze the optimal transition policy given that the monetary authority prefers to deviate from the dollar-peg regime.

We start from comparing between gradual adjustment to the basket-peg (policy (2)) and sudden shift to the basket-peg (policy (3)). Given time period T_0, and T_2,we define T_1^* such that

$$L_2\left(v^*, T_1^*, T_2\right) = L_3\left(v^{**}, T_1^* + T_2\right)$$

[28] For the price level stability, the similar conditions will be satisfied;

$$L_1^p(i^*, t) < L_4^p\left(m^*, t\right) \quad if \; t < T_D^{*p}$$

$$L_1^p(i^*, t) > L_4^p\left(m^*, t\right) \quad if \; t > T_D^{*p}$$

where

$$L_1^p(i^*, T_D^{*p}) = L_4^p\left(m^*, T_D^{*p}\right)$$

[29] For the case of the price stability, $t < Min\left[T_C^{*p}, T_D^{*p}\right]$

reflecting the time interval for transition period under which cumulative loss of gradual adjustment policy is equal to one of sudden shift policy to basket-peg. Based on the fact that terms in $L_3(\upsilon^{**}, T_1 + T_2)$ includes high volatility of exchange rate and interest rate due to the shift, it is apparent that following results will hold[30];

$$L_2(\upsilon^*, T_1, T_2) < L_3(\upsilon^{**}, T_1 + T_2) \quad if \;\; T_1 < T_1^*$$

$$L_2(\upsilon^*, T_1, T_2) > L_3(\upsilon^{**}, T_1 + T_2) \quad if \;\; T_1 > T_1^*$$

It implies that longer the transition period of adjustment, more benefits the country can gain from reaching the target regime suddenly. On the other hand, as long as interval for transition period is in the certain range, $T_1 < T_1^*$, the monetary authority will gain benefits from avoiding large fluctuations of exchange rates.

Next, we consider the contrast between policy (3) and policy (4). We can not obtain explicit theoretical conditions for optimality between policy (3) and policy (4). Instead of theoretical analysis, we rely on our numerical analysis using Thai data which is explained in Appendix C.

It shows that it is optimal for the country to take a sudden shift to the basket-peg rather than to the floating regime, given the country implements money supply rule under floating regime. Table 4 presents values of optimal instruments and cumulative losses for four policies aimed to stabilize output and the price level respectively. Our numerical analysis indicates that values of cumulative loss with sudden shift to the basket-peg regime is smaller than one with sudden shift to the floating regime for stabilizing output. It reflects that the country will be better off choosing sudden shift to the basket-peg regime. Moreover, Yoshino, Kaji, and Asonuma (2008) insist that the country will be better off implementing basket weight rule under basket peg regime compared with adopting interest rate rule or money supply rule under the floating regime. Focusing on the basket-peg regime, Appendix D discusses relationship between optimal weights and time span for transition period and target regime period.

[Insert Table 4 here]

Summarizing the results in this subsection, concerning with optimality between policy (2) and policy (3), the longer the transition period of adjustments, more benefits the monetary authority will gain from reaching the basket-peg regime at once. For the contrast between policy (3) and policy (4), from the numerical analysis, we find that it is optimal for the country to shift suddenly to the basket-peg regime rather than the floating regime, given the country adopts money supply rule under floating regime. As for the case study, we provide the numerical analysis using Thai data in Appendix C to support the theoretical findings mentioned above.

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[30] For the case of the price level stability, the similar statements will hold as follows;

$$L_2^p(\upsilon_p^*, T_1, T_2) < L_3^p(\upsilon_p^{**}, T_1 + T_2) \quad if \;\; T_1 < T_1^{*p}$$

$$L_2^p(\upsilon_p^*, T_1, T_2) > L_3^p(\upsilon_p^{**}, T_1 + T_2) \quad if \;\; T_1 > T_1^{*p}$$

where

$$L_2^p(\upsilon_p^*, T_1^{*p}, T_2) = L_3^p(\upsilon_p^{**}, T_1^{*p} + T_2)$$

6 Conclusion

There is broad debate on desirable exchange regimes for East Asian countries. The dollar-peg which the most of East Asian country adopted before the Asian currency crisis, is blamed as one of the culprits of the crisis. Several economists advocate desirability of the basket-peg regimes in Asia. The main reason for adopting the basket-peg regime was that for countries with close economic relationships with the United States, Japan and the European Union, exchange rate stabilization vis-a-vis a basket comprising these currencies was beneficial, because it removed the problem of large fluctuations of exchange rates. Furthermore, Yoshino, Kaji, and Asonuma (2004) show that together with the basket-peg regime, the floating regime is also one of the options for East Asian countries.

The states which the previous research analyzes are those that an East Asian country reaches, once it has adopted the basket-peg or the floating. For countries like China and Malaysia, which currently adopts the *de facto* dollar-peg on the other hand, there is still a big question of how to get there.

This paper attempts to compute the dynamic effect of changing from the fixed exchange rate regime to the stable basket peg regime or the stable floating regime. We obtain two transition paths from the dollar-peg to the basket-peg regime (gradual adjustment of basket weight, or sudden shift) and one transition path from the dollar-peg to the floating regime.

The major findings are as follows. First, value of cumulative losses of four policies (three transition policies mentioned above plus maintaining the dollar-peg regime) are obtained theoretically as well as empirically. We find that maintaining the dollar-peg regime is desirable only in the short term, implying that the country will be better off shifting to either the basket-peg regime or the floating regime.

Second, concerning the optimality between gradual adjustment (policy (2)) toward stable basket-peg regime or sudden shift to the stable basket-peg regime (policy (3)), the longer the transition period of adjustments, the more benefits the country will gain from reaching stable regime at once.

Finally, for the choice between a sudden shift to the basket-peg regime (policy (3)) and to the floating regime (policy (4)), our numerical analysis using Thai data shows that the country will be better off shifting to the basket-peg regime rather than the floating regime.

However, our analysis is still limited to middle-term perspective compared with one based on longer time span such as 20 years or more. There is some possibility that the country might be better off adopting the floating regime in longer time horizons (more than 20 years or so). If so, a question concerning how the country shifts from the basket-peg regime to the floating regime remains as a future research topic.

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A Solving for rational expectation

A.1 Dollar-peg regime (A)

Substituting equation (11) into equation (3'), we obtain following equation such as

$$y_t - \bar{y}'_A = \frac{-(\delta+\theta)}{D}\left[\begin{array}{c}\psi\theta\hat{e}_t^{\$/yen} + (1+\psi\rho)\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) \\ -\psi\varsigma\Delta\hat{e}^{R/yen} - \hat{\alpha}_t - \psi\rho i_{t+1}\end{array}\right]\left[1 - \{1 - \psi(\delta+\theta) - \eta\}^t\right]$$
$$+\theta\hat{e}_t^{\$/yen} + \rho\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) - \varsigma\Delta\hat{e}^{R/yen} - \rho i_{t+1} \quad \text{(A1)}$$

We take the expectation of both sides of equation (11)[31] and solve for $\hat{p}^e_{t+1}$.

$$\hat{p}^e_{t+1} = a_1\hat{e}_t^{\$/yen} + a_2\hat{p}^e_t \quad \text{(A2)}$$

Then we substitute for $\hat{p}^e_{t+1}$ in equation (11) and obtain expression for $\hat{p}^e_t$ such that

$$\hat{p}^e_t = a_3\hat{e}_t^{\$/yen} \quad \text{(A3)}$$

Substituting equation (A2) and (A3) into equation (A1) and (11) respectively, we obtain

$$y_t - \bar{y}'_A = A_1(t)\hat{e}_t^{\$/yen} + A_2(t)\Delta\hat{e}_t^{R/yen} + A_3(t)i_{t+1} \quad (12)$$

$$p_t - \bar{p}'_A = A^p_1(t)\hat{e}_t^{\$/yen} + A^p_2(t)\Delta\hat{e}_t^{R/.yen} + A^p_3(t)i_{t+1} \quad \text{(12a)}$$

$A_1(t) = -\frac{(\delta+\theta)[\psi\theta+(1+\psi\rho)(a_1+a_2a_3-a_2)]}{D}\left[1 - \{1 - \psi(\delta+\theta) - \eta\}^t\right] + \theta + \rho(a_1 + a_2a_3 - a_2)$,

$A_2(t) = -\frac{\psi\zeta(\delta+\theta)}{D}\left\{1 - \{1 - \psi(\delta+\theta) - \eta\}^t\right\} - \varsigma$,
$A_3(t) = \frac{\psi\rho(\delta+\theta)}{D}\left\{1 - \{1 - \psi(\delta+\theta) - \eta\}^t\right\} - \rho$,
$A^p_1(t) = -\frac{[\psi\theta+(1+\psi\rho)(a_1+a_2a_3-a_2)]}{D}\{1 - \psi(\delta+\theta) - \eta\}^t$,
$A^p_2(t) = -\frac{\psi\zeta}{D}\{1 - \psi(\delta+\theta) - \eta\}^t$, and $A^p_3(t) = \frac{\psi\rho}{D}\{1 - \psi(\delta+\theta) - \eta\}^t$

A.2 Basket-peg regime with weak capital control (B)

Substituting equation (20) into equation (3"), we obtain following equation such as

$$y_t - \bar{y}'_B = \frac{-(\delta+\theta)}{D}\left[\begin{array}{c}\bar{G}\hat{e}_t^{\$/yen} + (1+\psi\rho)\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right) \\ -(\psi\tau - \chi)\Delta\hat{e}^{R/\$} - \psi\varsigma\Delta\hat{e}^{R/yen}\end{array}\right]\left[1 - \{1 - \psi(\delta+\theta) - \eta\}^t\right] \quad \text{(A4)}$$
$$+\{-\delta(1-\upsilon) + \theta\upsilon\}\hat{e}_t^{\$/yen} - \rho\left[1 - (1-\lambda)^t\right](1-\upsilon)\sigma\hat{e}_t^{\$/yen} + \rho\left(\hat{p}^e_{t+1} - \hat{p}^e_t\right)$$
$$-\tau\Delta\hat{e}^{R/\$} - \varsigma\Delta\hat{e}^{R/yen}$$

where $\bar{G} = [\psi\{\theta\upsilon - \delta(1-\upsilon) - \rho\lambda(1+\sigma)(1-\upsilon)\} - \eta(1-\upsilon)]$

We take the expectation of both sides of equation (20) and solve for $\hat{p}^e_{t+1}$.

[31] We assume that exchange rate risk terms are mean zero, implying $E(\Delta^{R/\$}) = 0$ and $E(\Delta^{R/yen}) = 0$.

$$\hat{p}^e_{t+1} = (b_1\upsilon + b'_1)\hat{e}^{\$/yen}_t + b_2\hat{p}^e_t \tag{A5}$$

Then we substitute for $\hat{p}^e_{t+1}$ in equation (20) and obtain expression for $\hat{p}^e_t$ such that

$$\hat{p}^e_t = (b_3\upsilon + b'_3)\hat{e}^{\$/yen}_t \tag{A6}$$

Substituting equation (A5) and (A6) into equation (A4) and (20), we obtain

$$(y_t - \bar{y}'_B) = B_1(t)\upsilon\hat{e}^{\$/yen}_t + B_2(t)\hat{e}^{\$/yen}_t + B_3(t)\hat{z}_t \tag{22}$$

$$(p_t - \bar{p}'_B) = B^p_1(t)\upsilon\hat{e}^{\$/yen}_t + B^p_2(t)\hat{e}^{\$/yen}_t + B^p_3(t)\hat{z}_t \tag{22a}$$

where $B_1(t) = \frac{-(\delta+\theta)}{D}\left[\left\{\begin{array}{l}\eta + \psi\{\theta+\delta+\rho\lambda(1+\sigma)\}\\ +(1+\psi\rho)(b_1+b_2b_3-b_3)\end{array}\right\}\left[1-\{1-\psi(\delta+\theta)-\eta\}^t\right]\right] + (\delta+\theta) + \rho\sigma\left[1-(1-\lambda)^t\right] + \rho(b_1+b_2b_3-b_3)$,

$B_2(t) = \frac{-(\delta+\theta)}{D}\left[\left\{\begin{array}{l}-\eta + \psi\{-\delta-\rho\lambda(1+\sigma)\}\\ +(1+\psi\rho)(b'_1+b_2b'_3-b'_3)\end{array}\right\}\left[1-\{1-\psi(\delta+\theta)-\eta\}^t\right]\right] - \delta - \rho\sigma\left[1-(1-\lambda)^t\right] + \rho(b'_1+b_2b'_3-b'_3)$,

$B_3(t)\hat{z}_t = \frac{(\delta+\theta)}{D}\left\{(\psi\tau-\chi)\Delta\hat{e}^{R/\$} + \psi\zeta\Delta\hat{e}^{R/yen}\right\}\left[1-\{1-\psi(\delta+\theta)-\eta\}^t\right] - \tau\Delta\hat{e}^{R/\$} - \varsigma\Delta\hat{e}^{R/yen}$,

$B^p_1(t) = \frac{-1}{D}\left\{\begin{array}{l}\eta + \psi\{\theta+\delta+\rho\lambda(1+\sigma)\}\\ +(1+\psi\rho)(b_1+b_2b_3-b_3)\end{array}\right\}\{1-\psi(\delta+\theta)-\eta\}^t$,

$B^p_2(t) = \frac{-1}{D}\left\{\begin{array}{l}-\eta + \psi\{-\delta-\rho\lambda(1+\sigma)\}\\ +(1+\psi\rho)(b_1+b_2b_3-b_3)\end{array}\right\}\{1-\psi(\delta+\theta)-\eta\}^t$, and

$B^p_3(t)\hat{z}_t = \frac{-1}{D}\left\{-(\psi\tau-\chi)\Delta\hat{e}^{R/\$} - \psi\zeta\Delta\hat{e}^{R/yen}\right\}\{1-\psi(\delta+\theta)-\eta\}^t$

A.3 Basket-peg regime with no capital control (C)

We follow the same calculation as in Section A.2 to obtain equation (30). Substituting equation (29) into equation (3"), we obtain following equation such as

$$\begin{aligned}(y_t - \bar{y}'_C) \quad = \quad & -\frac{(\delta+\theta)}{D}\left[\begin{array}{l}\bar{G}'\hat{e}^{\$/yen}_t + (1+\psi\rho)\left(\hat{p}^e_{t+1}-\hat{p}^e_t\right)\\ -(\psi\tau-\chi)\Delta\hat{e}^{R/\$} - \psi\varsigma\Delta\hat{e}^{R/yen}\end{array}\right]\left[1-\{1-\psi(\delta+\theta)-\eta\}^t\right] \\ & + \{-\delta(1-\upsilon)+\theta\upsilon-\rho(1+\sigma)(1-\upsilon)\}\hat{e}^{\$/yen}_t + \rho\left(\hat{p}^e_{t+1}-\hat{p}^e_t\right) - \tau\Delta\hat{e}^{R/\$} - \varsigma\Delta\hat{e}^{R/yen}\end{aligned} \tag{A7}$$

where $\bar{G}' = [\psi\{\theta\upsilon - \delta(1-\upsilon) - \rho(1+\sigma)(1-\upsilon)\} - \eta(1-\upsilon)]$.

We take the expectation of both sides of equation (29) and solve for $\hat{p}^e_{t+1}$.

$$\hat{p}^e_{t+1} = (c_1\upsilon + c'_1)\hat{e}^{\$/yen}_t + c_2\hat{p}^e_t \tag{A8}$$

Then we substitute for $\hat{p}^e_{t+1}$ in equation (29) and obtain expression for $\hat{p}^e_t$ such that

$$\hat{p}^e_t = (c_3\upsilon + c'_3)\hat{e}^{\$/yen}_t$$

Substituting equation (A8) and (A9) into equation (A7) and (29), we obtain

$$(y_t - \bar{y}'_C) = C_1(t)\upsilon\hat{e}^{\$/yen}_t + C_2(t)\hat{e}^{\$/yen}_t + C_3(t)\hat{z}_t \tag{30}$$

$$(p_t - \bar{p}'_C) = C_1^p(t)v\hat{e}_t^{\$/yen} + C_2^p(t)\hat{e}_t^{\$/yen} + C_3^p(t)\hat{z}_t \tag{30a}$$

$$\begin{aligned}
C_1(t) &= \tfrac{-(\delta+\theta)}{D}\left[\left\{\begin{array}{c}\eta+\psi\left(\rho\sigma+\rho+\delta+\theta\right)\\ +\left(1+\psi\rho\right)\left(c_1+c_2c_3-c_3\right)\end{array}\right\}\left[\begin{array}{c}1-\\ \{1-\psi(\delta+\theta)-\eta\}^t\end{array}\right]\right]+\left\{\begin{array}{c}(\delta+\theta)+\rho(1+\sigma)\\ +\rho(c_1+c_2c_3-c_3)\end{array}\right\},\\
C_2(t) &= \tfrac{-(\delta+\theta)}{D}\left[\left\{\begin{array}{c}-\eta-\psi\left(\rho\sigma+\rho+\delta\right)\\ +\left(1+\psi\rho\right)\left(c_1'+c_2c_3'-c_3'\right)\end{array}\right\}\left[\begin{array}{c}1-\\ \{1-\psi(\delta+\theta)-\eta\}^t\end{array}\right]\right]+\left\{\begin{array}{c}-\theta-\rho(1+\sigma)\theta\\ +\rho(c_1'+c_2'c_3'-c_3')\end{array}\right\},\\
C_3(t)\hat{z}_t &= \tfrac{(\delta+\theta)}{D}\left\{\begin{array}{c}\left(\psi\tau-\chi\right)\Delta\hat{e}^{R/\$}+\\ \psi\zeta\Delta\hat{e}^{R/yen}\end{array}\right\}\left[1-\{1-\psi(\delta+\theta)-\eta\}^t\right]-\tau\Delta\hat{e}^{R/\$}-\varsigma\Delta\hat{e}^{R/yen},\\
C_1^p(t) &= \tfrac{-1}{D}\left[\left\{\begin{array}{c}\eta+\psi\left(\rho\sigma+\rho+\delta+\theta\right)\\ +\left(1+\psi\rho\right)\left(c_1+c_2c_3-c_3\right)\end{array}\right\}\{1-\psi(\delta+\theta)-\eta\}^t\right],\\
C_2^p(t) &= \tfrac{-1}{D}\left[\left\{\begin{array}{c}-\eta-\psi\left(\rho\sigma+\rho+\delta\right)\\ +\left(1+\psi\rho\right)\left(c_1'+c_2c_3'-c_3'\right)\end{array}\right\}\{1-\psi(\delta+\theta)-\eta\}^t\right], \text{ and}\\
C_3^p(t)\hat{z}_t &= \tfrac{(\delta+\theta)}{D}\left\{\begin{array}{c}\left(\psi\tau-\chi\right)\Delta\hat{e}^{R/\$}+\\ \psi\zeta\Delta\hat{e}^{R/yen}\end{array}\right\}\{1-\psi(\delta+\theta)-\eta\}^t.
\end{aligned}$$

A.4 Floating regime without capital control (D)

New equilibrium value after the dollar-yen rate change is

$$\bar{p}'_D = \frac{f_3+\psi\rho f_1}{E(\epsilon+\phi\rho)}m_t + \frac{\phi\theta f_3+\psi\theta\epsilon f_1}{E(\epsilon+\phi\rho)}\hat{e}^{\$/yen} + g_1\left(p_{t+1}^e - p_t^e\right) + g_2\Delta e^{R/\$} + g_3\Delta e^{R/yen} \tag{36}$$

$$\bar{e}_D'^{R/\$} = -\frac{f_4+\psi\rho f_2}{E(\epsilon+\phi\rho)}m_t - \frac{\phi\theta f_4+\psi\theta\epsilon f_2}{E(\epsilon+\phi\rho)}\hat{e}_t^{\$/yen} + g_1'\left(p_{t+1}^e - p_t^e\right) + g_2'\Delta e^{R/\$} + g_3'\Delta e^{R/yen} \tag{37}$$

where $g_1 = \frac{\phi\rho f_3+\left(1+\rho\psi\left(1+\frac{\phi\rho}{(\epsilon+\phi\rho)}\right)\right)f_1}{E(\epsilon+\phi\rho)}$, $g_2 = \frac{-\phi\tau f_3+\left(\chi-\psi\tau\left(1+\frac{\phi\rho}{(\epsilon+\phi\rho)}\right)\right)f_1}{E(\epsilon+\phi\rho)}$, $g_3 = \frac{\phi\varsigma f_3-\left(\psi\varsigma\left(1+\frac{\phi\rho}{(\epsilon+\phi\rho)}\right)\right)f_1}{E(\epsilon+\phi\rho)}$, $g_1' = -\frac{\phi\rho f_4+\left(1+\rho\psi\rho\psi\left(1+\frac{\phi\rho}{(\epsilon+\phi\rho)}\right)\right)f_2}{E(\epsilon+\phi\rho)}$, $g_2' = -\frac{-\phi\tau f_4+\left(\chi-\psi\tau\left(1+\frac{\phi\rho}{(\epsilon+\phi\rho)}\right)\right)f_2}{E(\epsilon+\phi\rho)}$, $g_3' = \frac{-\phi\varsigma f_4-\left(\psi\varsigma\left(1+\frac{\phi\rho}{(\epsilon+\phi\rho)}\right)\right)f_2}{E(\epsilon+\phi\rho)}$

Substituting equation (40) and (41) into equation (3), we obtain following equation such as

$$\begin{aligned}(y_t - \bar{y}'_D) &= H\bar{p}' + (\delta+\theta)h_1\bar{e}'^{R/\$} + \frac{\rho}{(\epsilon+\phi\rho)}m_t \\ &\quad +\theta h_2\hat{e}_t^{\$/yen} + \rho h_2\left(\hat{p}_{t+1}^e - \hat{p}_t^e\right) - \tau h_2\Delta\hat{e}^{R/\$} - \varsigma h_2\Delta\hat{e}^{R/yen}\end{aligned} \tag{A10}$$

where $H = \left[-(\delta+\theta)(1-\omega_2^t) + \frac{1+\phi(\delta+\theta)}{(\epsilon+\phi\rho)} - (\delta+\theta)h_1\kappa\omega_2^t\right]$, $h_1 = 1 - \frac{\phi\rho}{(\epsilon+\phi\rho)}$, and $h_2 = 1 + \frac{\phi\rho}{(\epsilon+\phi\rho)}$. We take the expectation of both sides of equation (40) and solve for $\hat{p}_{t+1}^e$.

$$\hat{p}_{t+1}^e = d_1\hat{e}_t^{\$/yen} + d_2\hat{p}_t^e \tag{A11}$$

Then we substitute for $\hat{p}_{t+1}^e$ into equation (40) and obtain expression for $\hat{p}_t^e$ such that

$$\hat{p}_t^e = d_3\hat{e}_t^{\$/yen} \tag{A12}$$

Substituting equation (A12) and (A11) into equation (A10) and (40), we obtain

$$(y_t - \bar{y}'_D) = D_1(t)\hat{e}_t^{\$/yen} + D_2(t)\hat{z}_t + D_3(t)m_t \tag{42}$$

$$(p_t - \bar{p}'_D) = D_1^p(t)\hat{e}_t^{\$/yen} + D_2^p(t)\hat{z}_t + D_3^p(t)m_t \tag{42a}$$

$D_1(t) = H\frac{\phi\theta f_3+\psi\epsilon\theta f_1}{E(\epsilon+\phi\rho)} - (\delta+\theta)\frac{\phi\theta f_4+\psi\epsilon\theta f_2}{E(\epsilon+\phi\rho)}h_1 + [Hg_1 + h_1 g_1'(\delta+\theta) + \rho h_2](d_1 + d_2 d_3 - d_3) + h_2\theta$
$D_2(t)\hat{z}_t = \{g_2 H + h_1 g_2'(\delta+\theta) - \tau h_2\}\Delta\hat{e}^{R/\$} + \{g_3 H + h_1 g_3'(\delta+\theta) - \zeta h_2\}\Delta\hat{e}^{R/yen}$,
$D_3(t) = H\frac{f_3+\psi\rho f_1}{E(\epsilon+\phi\rho)} - (\delta+\theta)h_1\frac{f_4+\psi\rho f_2}{E(\epsilon+\phi\rho)} + \frac{\rho}{(\epsilon+\phi\rho)}$,
$D_1^p(t) = -\omega_2^t\left[\frac{\phi\theta f_3+\psi\theta\epsilon f_1}{E(\epsilon+\phi\rho)}\hat{e}^{\$/yen} + g_1(d_1 + d_2 d_3 - d_3)\right]$,
$D_2^p(t) = -\omega_2^t\left[g_2\Delta\hat{e}^{R/\$} + g_3\Delta\hat{e}^{R/yen}\right]$ and $D_3^p(t) = -\omega_2^t\left(\frac{f_3+\psi\rho f_1}{E(\epsilon+\phi\rho)}\right)$.

B Saddle path stability under floating regime

Characteristic roots of difference equations (31) and (32) can be derived by solving equation below.

$$\omega^2 - (2 + f_1 + f_4)\,\omega + (1 + f_1 + f_4 + E) = 0 \tag{A13}$$

Solving this equation,

$$\omega_1, \omega_2 = \frac{1}{2}(2 + f_1 + f_4) \pm \frac{1}{2}\sqrt{(2 + f_1 + f_4)^2 - 4(1 + f_1 + f_4 + E)} \tag{A14}$$

Now we assume some assumptions to satisfy saddle path stability, such as
(a) $(2 + f_1 + f_4)^2 - 4(1 + f_1 + f_4 + E) > 0$,
(b) $1 + f_1 + f_4 + E > 0$, and
(c) $(2 + f_1 + f_4) - \sqrt{(2 + f_1 + f_4)^2 - 4(1 + f_1 + f_4 + E)} < 2$

First, under (a) $(2 + f_1 + f_4)^2 - 4(1 + f_1 + f_4 + E) > 0$, both ω_1, ω_2 are real and distinct. It is easily found that $\omega_1 > 1$. Now under (b) $1 + f_1 + f_4 + E > 0$,

$$\omega_1\omega_2 = 1 + f_1 + f_4 + E > 0$$

therefore, $\omega_2 > 0$. Lastly under (c) $(2 + f_1 + f_4) - \sqrt{(2 + f_1 + f_4)^2 - 4(1 + f_1 + f_4 + E)} < 2$, it simply implies $\omega_2 < 1$.

The system is described by the unique stable saddle path. We can express the solution for the original variables as

$$e_t^{R/\$} - \bar{e}_D^{R/\$} = \kappa(p_0 - \bar{p})\omega_2^t \tag{A15}$$

$$p_t - \bar{p}_D = (p_0 - \bar{p})\omega_2^t \tag{A16}$$

From the equations above, the saddle path is

$$e_t^{R/\$} - \bar{e}_D^{R/\$} = \kappa(p_t - \bar{p}_D) \tag{A17}$$

where

$$\kappa = \frac{\omega_2 - 1 - f_4}{f_3}$$

C Simulation results using Thai data

In this Appendix C, we present simulation result using Thai data. There are two reasons we use Thai data; (1) based on the fact that China had been adopting the fixed regime until 2nd Quarter of 2005 and has adopted the *de facto* crowling-peg after that, therefore there is no sample periods of the floating regime, and (2) we have enough sample periods for fixed regime and floating regime for Thailand reflecting that Thailand had fixed exchange rate against the US dollar, but had shifted to floating regime in 3rd Quarter of 1997.

We use Thai quarterly data from the International Monetary Fund (IMF) International Financial Statistics (IFS)[32]. Taking into account that Thailand had adopted the dollar-peg, but has floated since 3rd Quarter of 1997, we estimate with following sample periods (1) 1st Quarter of 1993 - 2nd Quarter of 1997 for the dollar-peg, and (2) 3rd Quarter of 1997 - 1st Quarter of 2006 for the floating regime. Most variables except interest rates are denominated in natural log.

Procedure of simulations has been broken down to 4 steps. First, we apply the unit root tests as well as co-integration tests of variables used in the model. Second, based on the results of unit root and co-integration tests, we estimate equations mentioned in Section 2. Third, by using the estimated coefficients, we assess values of optimal instruments and cumulative losses for four policies. Lastly comparison among the transition policies is discussed.

C.1 Unit root test and Co-integration tests

This subsection explains results of unit root and co-integration tests. First, we apply Dicky-Fuller General Least Square (DF-GLS) unit root tests. Results of unit root test are presented in Table 5. Based on 10% significance critical value, half of variables has a unit root. Second, based on outcome of the unit root tests, we examine Johansen co-integration test for four equations as indicated in Table 6. Reflecting 10% significance critical value, we do not find any co-integration relationships among four equations.

[Insert Table 5 here]

[Insert Table 6 here]

C.2 Estimation with Thai Data

In this subsection, we estimate macroeconomic model mentioned in Section 2 using Thai data. We use the Instrumental Variable (IV) method to estimate equations simultaneously. We estimate based on two sample periods: (1) 1st Quarter of 1993 - 2nd Quarter of 1997 for the dollar-peg and (2) 3rd Quarter of 1997 - 1st Quarter of 2006 for the floating regime. Table 8 shows the estimation results. The first column of Table 7 shows the explanatory variables. The second column indicates the estimated coefficients under the fixed regime (basket-peg regime) period, and the third column shows ones under the floating regime period. Values inside parentheses denote t-values of coefficients. One and two asterisks on t-values indicate 1% and 5% significance respectively. Concerning with exchange risks, we use variance of monthly exchange rate data as proxy. For variables which have an unit root, we take the first order difference in order to satisfy stationary property. A dummy variable is used to exclude effects of large exchange rate fluctuation during the Asian currency crisis period from 3rd Quarter of 1997 to 2nd Quarter of 1998.

[32] We will provide data as well as methods of calculation upon requests.

[Insert Table 7 here]

C.3 Initial impacts and total impacts of the shock

With the estimated coefficients, we calculate the initial impacts and total impacts by one-unit by one-unit exogenous dollar-yen shock on endogenous variables under four regimes, as presented in Table 8.

[Insert Table 8 here]

C.4 Simulation using the estimated coefficients

Similarly, we compute the optimal values of instruments and values of cumulative losses according to the transition policies. For the dollar-yen exchange rate, the dollar-baht exchange rate risk, and the yen-baht exchange rate risk, we use the actual quarterly data from 4th Quarter of 1996 to 2nd Quarter of 2006. As we define exogenous shocks as deviation from the long-run values, we use deviation from the H-P filtered trend value for each exogenous shock. We assume time period for the dollar-peg as 1 quarter ($T_0 = 1$), interval for transition period as 18 quarters ($T_1 = 18$), and periods for target regime as 18 ($T_2 = 18$) quarters. Table 9 reports values of cumulative losses and optimal instruments of four policies stabilizing output and the price level respectively.

[Insert Table 9 here]

From two tables above, we can confirm the theoretical findings in Section 5. First, among the four policies, maintaining dollar-peg (policy (1)) leads to highest losses in both cases of stabilizing output and the price level. It implies that the country will be better off shifting to the target basket-peg regime or floating regime. Second, comparing the transition policies to the basket-peg regime, it is optimal for the country to adopt gradual adjustment rather than sudden shift in both cases of stabilizing output and the price level. This is because interval of transition periods is not long enough for the country to gain benefits of shifting suddenly to the target regime. Moreover, the optimal weights of policy (2) and policy (3) are different as explained in Section 4.2 and 4.3.

Lastly, comparing shifting to the basket-peg with shifting to the floating, the latter leads to higher losses showing that the country will be better off shifting to the target basket-peg regime. However as we mentioned in Section 5.3, the desirability of shifting to the stable basket-peg or floating regime depends on which instruments the monetary authority adopts and how instrument rules are effective under the regime. In the case of Thailand, it is not optimal to shift to the floating regime with using money supply as instruments compared with shifting to the basket-peg regime with using basket weights as instruments.

D Optimal weights and time span

In Appendix C.4, we have derived optimal weights and values of cumulative losses given the fixed time span ($T_0 = 1$, $T_1 = 18$, and $T_2 = 18$). In this section, we focus on the relationship between the optimal weights under basket-peg and time span.

First, we consider the case of gradual adjustment to the basket-peg regime (policy (2)). Generally speaking, optimal weight of basket is increasing respect to both the period for transition period and the period for stable regime.

[Insert Figure 3]

Next, we consider the case of sudden shift to the basket-peg regime (policy (3)). Once again, the optimal weight of basket is increasing respect to the total time period.

[Insert Figure 4]

From both cases, we can infer the optimal time span given the target basket weight. For example, the long-run desirable basket weight is 0.6. In the case of gradual adjustment to the basket-peg regime, the monetary authority would prefer to set $T_1 = 19$ if that the target basket-peg regime period is $T_2 = 16$. On the other hand, it would set 34 quarters for the total span period in the case of sudden shift to the basket-peg regime.

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E Figure legends

Figure 1: The model

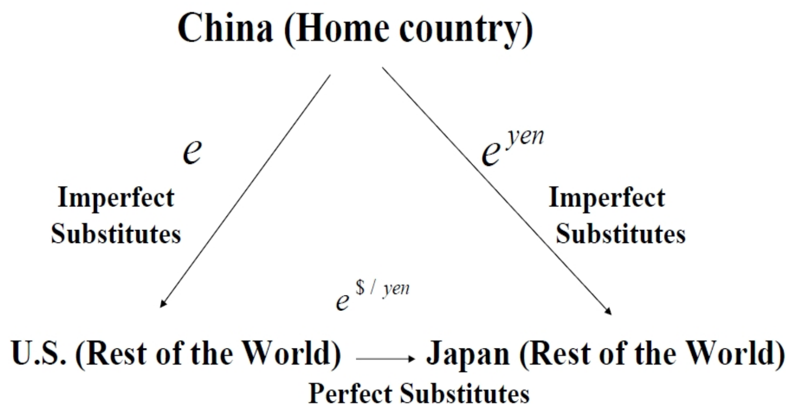


Figure 2: Four policies toward stable regimes

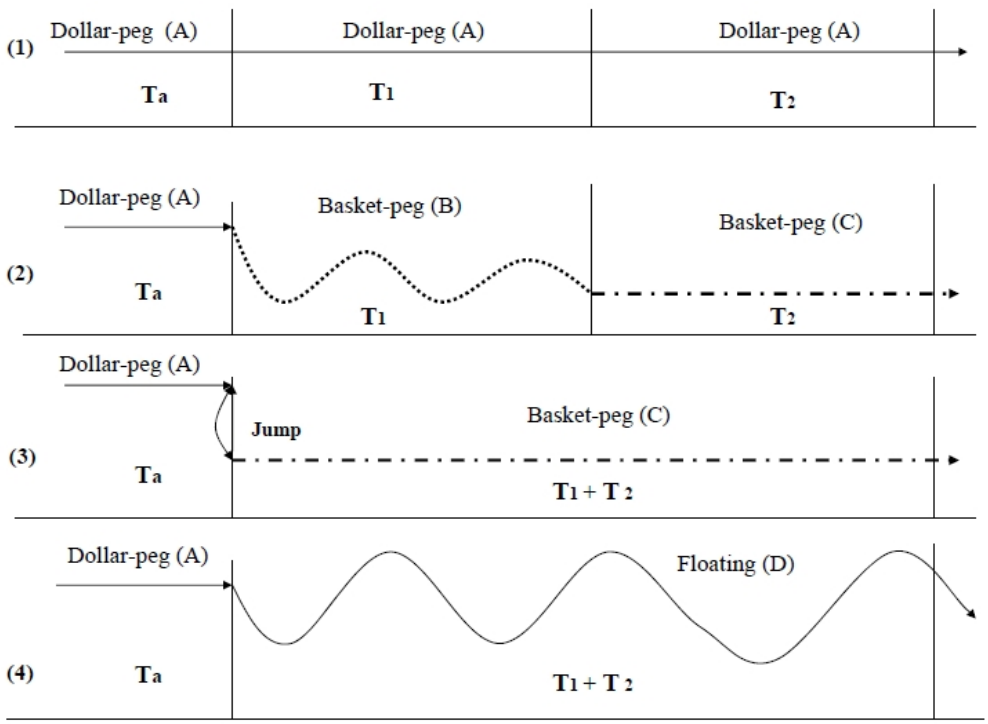


Figure 3: Optimal weight and time span under policy (2)

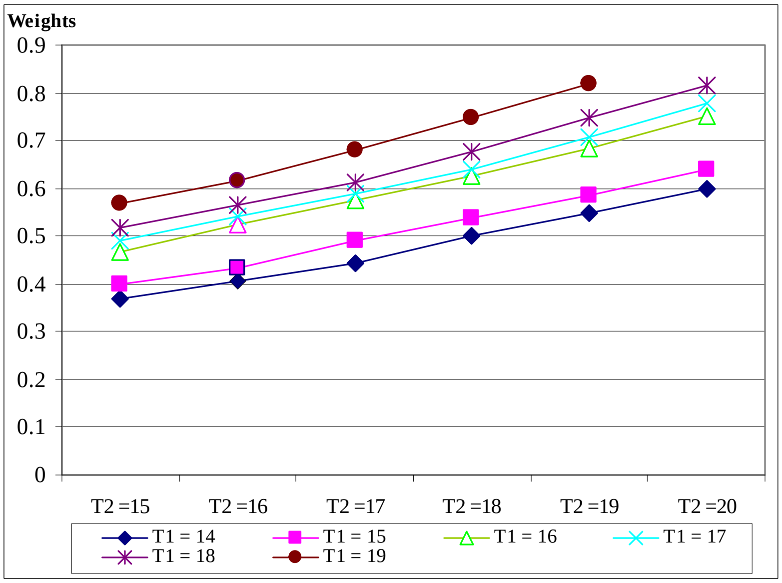
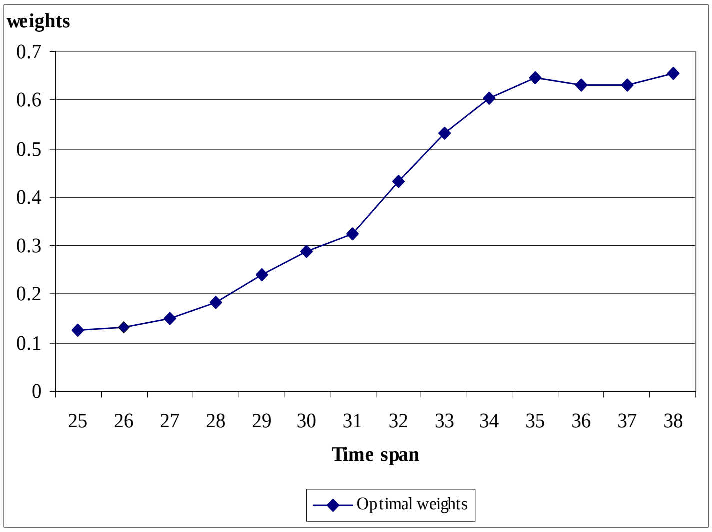


Figure 4: Optimal weight and time span under policy (3)



F Tables

Table 1: Table of notation:

m	stock of money supply
p	domestic price level
p^e	the expected domestic price level
p^*	the price level in the US
p^{yen}	the price level in Japan
i	domestic interest rate
i^*	US interest rate
y	domestic GDP
$\bar{y}$	potential domestic GDP
e	Chinese renminbi-dollar exchange rate
e^{yen}	Chinese renminbi-yen exchange rate
$e^{\$/yen}$	dollar/yen exchange rate
υ	basket weight on the US dollar rate
α	total productivity of China

Table 2: Costs and benefits of each transition policy

Policy	**Benefits**	**Costs**
(1) Maintaining	a. no volatility of e	a. limited capital inflow
the dollar-peg		
(2) Gradual shift	a. small volatility of i	a. time to reach stable
to basket-peg	b. small volatility of e, e^{yen}	regime
		b. adjustment costs
(3) Sudden shift	a. reaching stable regime at once	a. high volatility of i
to basket-peg	(more benefits of stable regime)	b. high volatility of e, e^{yen}
	b. no adjustment costs	
(4) Sudden shift	a. reaching stable regime at once	a. high volatility of i
to floating	(more benefits of stable regime)	b. high volatility of e, e^{yen}
	b. no adjustment costs	

Table 3: Estimates of the costs under three policies

Policy	**Costs**	**Estimates**	**Sum**
(1) Maintaining	a. limited capital inflow	3.0e-3 *[1]	3.0e-3
dollar-peg			
(2) Gradual shift	a. time to reach stable regime	9.607e-5 *[2]	9.689e-5
to basket-peg	b. adjustment costs	7.9120e-7 *[3]	
(3) Sudden shift	a. high volatility of i	3.4668e-7 *[4]	1.813e-4
to basket-peg	b. high volatility of e, e^{yen}	1.8096e-4 *[5]	
(4) Sudden shift	a. high volatility of i	3.7798e-6 *[4]	5.004e-3
to floating	b. high volatility of e, e^{yen}	0.0050 *[5]	

Note: *[1] the estimate is based on the cumulative loss for time period of total 9 quarters (one initial period and two years).

*[2] the estimate is based on the difference between values of the cumulative loss under transition period of 14 quarters and 18 quarters.

*[3] the estimate of adjustment costs is based on difference between the cumulative losses based on the baseline λ and based on 20% deviation from the baseline λ.

*[4] the estimates of high volatility of i are based on cumulative losses of change in interest rate originally caused by 0.001 unit deviation of $e^{\$/yen}$ shock.

*[5] the estimates of high volatility of e, e^{yen} are based on cumulative losses caused by 0.001 unit deviation of $e^{\$/yen}$ shock.

Table 4: Values of cumulative loss and optimal values of instruments[33]

	Policy (1)	Policy (2)	Policy (3)	Policy (4)
Stable regime	Dollar-peg	Basket-peg	Basket-peg	Floating
Adjustment	-	gradual	sudden	sudden
Instrument value	-	$v^* = 0.68$	$v^{**} = 0.62$	$m^* = 0.0082$
Cumulative loss (value)	0.0069	0.0006	0.0026	0.0052
Cumulative loss (% of $(\bar{y}^2)$*)	15.03	1.31	5.66	11.33

* We calculate the value of $\bar{y}^2$ shown in section 3 and obtain $\bar{y}^2 = 0.0459$

[33] Table 4 is the same with Table A5 in Appendix C.

Table 5: DF-GLS Unit-Root Tests

Variable	Degree	Trend	Lag	DF-GLS Stat.	Resutls
e	level	0	0	-0.905	
	1st dif.	0	0	-6.874	I(1)
e^{yen}	level	0	2	-0.704	
	1st dif.	0	4	-2.086	I(1)
i	level	0	1	-1.053	
	1st dif.	0	1	-3.036	I(1)
i^*	level	0	1	-1.937	
	1st dif.	0	1	-2.530	I(0)
$m - p$	level	0	4	0.537	
	1st dif.	0	4	-1.603	I(1)
$e + p^* - p$	level	0	0	-1.158	
	1st dif.	0	0	-7.029	I(1)
$e^{yen} + p^{yen} - p$	level	0	0	-2.398	I(0)
$e^{\$/yen}$	level	0	0	-2.205	I(0)
Δe	level	0	1	-2.253	I(0)
Δe^{yen}	level	0	2	-3.076	I(0)
$p_{t+1} - p_t$	level	0	3	-1.941	I(0)
p_t	level	0	1	0.386	
	1st dif.	0	0	-3.464	I(1)
$y - \bar{y}$	level	0	2	-1.475	
	1st dif.	0	4	-2.366	I(1)

Table 6: Johansen Co-Integration Test

Equation	Variables	Trend	Hypothesis	Trace Statistics	P-value
Money	$m - p$	Deter.	None	138.195	0.000
demand	i		at most 1	61.325	0.000
	$y - \bar{y}$		at most 2	10.827	0.002
Interest	i	Deter.	None	48.830	0.000
parity	i^*		at most 1	18.654	0.016
	e		at most 2	3.601	0.058
Aggregate	$y - \bar{y}$	Deter.	None	231.864	0.000
demand	$e + p^* - p$		at most 1	133.763	0.000
	$e^{yen} + p^{yen} - p$		at most 2	88.594	0.001
	i		at most 3	54.812	0.010
	$p_{t+1} - p_t$		at most 4	32.547	0.024
	Δe		at most 5	14.405	0.073
	Δe^{yen}		at most 6	5.129	0.024
Aggregate	$p_{t+1} - p_t$	Deter.	None	154.363	0.000
supply	$y - \bar{y}$		at most 1	67.470	0.000
	e		at most 2	26.216	0.001
	Δe		at most 3	5.126	0.022

Table 7: Estimation Results using Thai Data

Coefficients	Fixed (basket-peg)	Floating regime
λ	0.525 (4.569)**	0.523 (2.907)**
σ	0.07 (3.207)**	0.456 (2.735)**
ϵ	0.277 (-0.115)	0.68 (-0.637)
ϕ	2.235 (1.997)*	2.47 (5.502)**
δ	-0.078 (-0.018)	-0.120 (-0.951)
θ	0.034 (0.487)	0.195 (1.352)
ρ	1.015 (-0.618)	-1.11 (1.431)
τ	0.023 (0.647)	-0.089 (-0.977)
ς	-0.029 (-1.370)	0.081 (0.746)
α	0.022 (3.401)**	0.002 (0.789)
ψ	0.016 (0.195)	0.046 (0.875)
η	-0.095 (-3.083)**	-0.006 (-0.284)
χ	0.008 (3.390)**	0.001 (0.607)

Table 8: Impacts of 1% exogenous dollar-yen exchange rate shocks (denominted in term of %)

A. Dollar-peg	$(y_t - \bar{y})$	$(p_t - \bar{p})$	$(m_t - \bar{m})$
initial impact	0.034	0.0005	0.076
total impact	1.3382	0.0496	0.0496
B. Basket-peg (weak capital control)	$(y_t - \bar{y})$	$(p_t - \bar{p})$	$(i_t - \bar{\imath})$
initial impact	0.0486	0.029	0.1864
total impact	-0.7149	-3.0518	0.1864
C. Basket-peg (no capital control)	$(y_t - \bar{y})$	$(p_t - \bar{p})$	$(i_t - \bar{\imath})$
initial impact	0.0502	0.0288	0.3937
total impact	0.7579	0.6877	0.3937
D. Floating	$(y_t - \bar{y})$	$(p_t - \bar{p})$	$(i_t - \bar{\imath})$
initial impact	0.195	0.006	-1.456
total impact	1.508	2.107	-1.456

Table 9: Cumulative losses and optimal values of instruments

	Policy (1)	Policy (2)	Policy (3)	Policy (4)
Stable regime	Dollar-peg	Basket-peg	Basket-peg	Floating
Adjustment	-	gradual	sudden	sudden
Instrument value	-	$v^* = 0.68$	$v^{**} = 0.62$	$m^* = 0.0082$
Cumulative loss (value)	0.0069	0.0006	0.0026	0.0052
Cumulative loss (% of $(\bar{y}^2)$*)	15.03	1.31	5.66	11.33

* We calculate the value of $\bar{y}^2$ shown in section 3 and obtained $\bar{y}^2 = 0.0459$