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Comparison of static and dynamic analyses on exchange rate regimes in East Asia

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Comparison of Static and Dynamic Analyses on Exchange Rate Regimes in East Asia

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and Tamon Asonuma

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Abstract

This paper compares three methods of analyzing exchange rate regimes in East Asia: static analysis, conventional dynamic analysis, and dynamic transition analysis. First we provide quantitative results that both estimated parameters for Thailand and time intervals are applied symmetrically across the three approaches. Our comparable simulation results illustrate how these three analyses are mutually related. Comparisons across the three methods demonstrate limitations of the static and conventional dynamic analyses where exchange rate regimes remain unchanged over the analysis horizon. Moreover, we emphasize three advantages of the dynamic transition analysis over the static and conventional dynamic analyses in that shifts from the current regime to alternative regimes are contrasted with a benchmark case of maintaining the current regime over the analysis horizon.

JEL Classification: F33, F41, F42

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1. INTRODUCTION

Since the onset of the 1997–1998 Asian financial crisis, the optimal exchange rate regime in East Asia has been the center of policy debate. Prior to the crisis, most East Asian economies adopted a de facto dollar peg regime and enjoyed the advantage of no fluctuations in the dollar exchange rate, while suffering some losses associated with exogenous dollar–yen rate fluctuations through the yen rate movement. On the contrary, in the aftermath of the crisis, some economists argued the need for exchange rate flexibility and the East Asian economies’ policy autonomy to react to exogenous shocks (Ito and Park 2003; Kawai 2004). In fact, some East Asian economies deviated from a de facto dollar peg and increased flexibility in exchange rate movements for adjustment of external imbalances.

In the policy debate, we have witnessed three main approaches of theoretical analyses on the desirable exchange rate regime in East Asia. First, immediately after the crisis, the static analysis initiated by Ito, Ogawa, and Sasaki (1998) garnered attention from both academic researchers and policymakers. Their analysis relies on the loss over the short horizon, that is, one quarter, and compares the optimality among a dollar peg, a basket peg, and a floating regime under free capital mobility.¹ Next, the analysis has been extended to cover the longer horizon, 10 years or over the infinite horizon as in Yoshino, Kaji, and Suzuki (2002) and Shioji (2006a; 2006b). Over the horizon, the monetary authorities are assumed to maintain the same exchange rate regimes. The main rationale of the ‘conventional’ dynamic analysis is to consider whether the exchange rate regime, which is desirable in the short run, still remains optimal over the longer horizon.

Lastly, most recently Yoshino, Kaji, and Asonuma (2014; 2015a) proposed the dynamic transition analysis. They consider shifts in exchange rate regimes, that is, shifts from a dollar peg to a basket peg or a floating regime over the same time intervals set in the conventional dynamic analysis together with maintaining a dollar peg.

As acknowledged in the literature, the three approaches of analyses broaden the scope of policy discussion. However, a detailed comparison of the three approaches has not been considered yet. This is because these analyses use different country samples including exogenous shocks, objective functions of the monetary authorities, and most importantly, different length of time periods. One main question—not yet discussed by the literature of exchange rate policy in East Asia—is which approach of theoretical analysis is the most appropriate for East Asian economies, particularly in the post-Asian financial crisis period?

This paper compares the three approaches and provides some implications on the appropriate analysis methods in three aspects. First, we consider how the three analyses are mutually related and complementary. Second, most importantly, we explain the limitations of the static and conventional dynamic analyses. Finally, we explore how the dynamic transition analysis overcomes these drawbacks in the static and conventional dynamic analyses.

Our main implications on the three aspects are the following. On the first issue, we provide simulation results for the three approaches using the same parameters

¹ See also Ogawa and Ito (2002), Yoshino, Kaji, and Suzuki (2004), and Yoshino, Kaji, and Asonuma (2004).

estimated for Thailand and time intervals. The quantitative results are comparable across these approaches. We show that the conventional dynamic analysis is a repetition of the static analysis. In particular, the loss over the longer horizon in the conventional dynamic analysis is a multiple of a one-period loss in the static analysis. Moreover, cumulative losses under the desired regimes after the shifts in the dynamic transition analysis correspond to those under the regimes in the conventional dynamic analysis.

On the second issue, we demonstrate some drawbacks of the static and conventional dynamic analyses. Firstly, most importantly, neither of them has considered shifts in exchange rate regimes. Secondly, these analyses have not reflected either the current exchange rate regime or capital account restrictions. Lastly, the analyses lack discussion on how adjustments should be implemented.

Finally, we explain three main advantages in the dynamic transition analysis. Firstly, we compare shifts from the current regime to alternative regimes with the benchmark of maintaining the current regime, a dollar peg. Secondly, we explore how capital controls are relaxed in order to reach the desired regimes under free capital mobility. This coincides with where the People's Republic of China (PRC) and Malaysia stood in the aftermath of the Asian financial crisis. Thirdly, in the analysis we consider two adjustment options for exchange rate regimes and for capital account restrictions.

The rest of the paper is structured as follows. First, we provide an overview of the development of exchange rate regimes and capital account management in the Association of Southeast Asian Nations' member states, the People's Republic of China, Japan, and the Republic of Korea (ASEAN+3) in the post-Asian financial crisis period. In Section 3, we initiate our discussion from the static analysis of exchange rate regimes in the literature. Then our discussion stretches to the conventional dynamic analysis in the literature in Section 4. Section 5 explains the limitations of both static and conventional dynamic analyses on exchange rate regimes. In contrast to previous methods, Section 6 discusses the merits of the dynamic transition analysis in exchange rate regimes in East Asia. Lastly, Section 7 concludes and summarizes our discussion.

1.1 Literature Review

Several previous studies analyze the desirable exchange rate regime in East Asia in the static context. Ito, Ogawa, and Sasaki (1998) and Ogawa and Ito (2002) find that a basket peg is desirable in a general equilibrium model that does not involve capital movements. Similarly, Yoshino, Kaji, and Suzuki (2004) and Yoshino, Kaji, and Asonuma (2004) confirm the optimality of a basket peg in a general equilibrium model with capital movements across economies.² On the contrary, Adams and Semblat (2004) and Sussangkarn and Vichyanond (2007) argue the advantages of a floating regime with inflation targeting. For an empirical analysis, McKibbin and Lee (2004) investigate which exchange rate the East Asian economies should peg to using several

² Bird and Rajan (2002) argue that pegging against a more diversified basket composed of currencies would have enabled the Southeast Asian economies to better deal with 'the third currency phenomenon,' which contributed to the crisis. Similarly, Devereux (2003) also explores the role of the exchange rate regime in small open economies focusing on the cases of Hong Kong, China and Singapore.

shocks involving country specific (asymmetric) shocks and regional (symmetric) shocks.³

The other stream of literature discusses the dynamic analysis of exchange rate regimes in the region. In the analysis, monetary authorities are assumed to maintain the current exchange rate regime over the long horizon. Yoshino, Kaji, and Suzuki (2002) show that a basket peg attains the lowest cumulative loss among three exchange rate regime options. Shioji (2006a; 2006b) confirms the superiority of a basket peg to a dollar peg in a dynamic model with two invoicing schemes of firms: producer currency pricing and vehicle currency pricing. Moreover, Yoshino, Kaji, and Asonuma (2012) contrast a basket peg with a floating regime using specified instrument rules.⁴

Lastly, the recent literature conducts an analysis of the dynamic transition of exchange rate regimes. Yoshino, Kaji, and Asonuma (2014; 2015a) explore the appropriate transition policy for East Asian economies that currently adopt a dollar peg with strict capital controls.

³ Ogawa and Shimizu (2006) investigate the extent to which a common currency basket peg would stabilize effective exchange rates of East Asian currencies. In contrast, Kim and Lee (2008) show that exchange rate flexibility provides greater monetary policy independence based on their empirical findings.

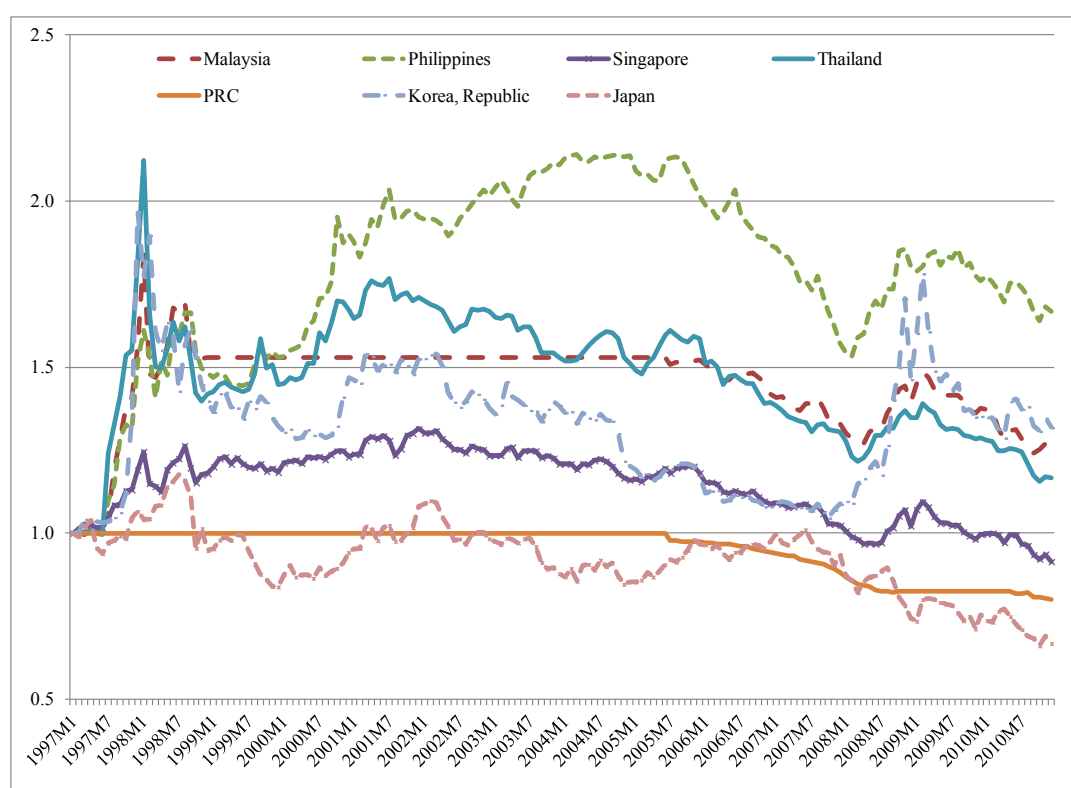
⁴ Yoshino, Kaji, and Asonuma (forthcoming-a) explore whether actual policies that have been implemented by East Asian economies after the Asian financial crisis follow or deviate from theoretically 'desirable' policies over the medium and long term.

2. RECENT DEVELOPMENT OF EXCHANGE RATES AND REGIMES IN ASEAN+3

This section provides an overview of the exchange rate movements of ASEAN+3 currencies and de jure and de facto exchange rate regimes adopted by the ASEAN+3 economies in the post-Asian financial crisis period.⁵

Figure 1: Nominal Exchange Rates of ASEAN+3 Currencies against the Dollar

(Jan. 1997=1.0, excluding Indonesia)



ASEAN+3 = Association of Southeast Asian Nations, plus People's Republic of China, Japan, and the Republic of Korea; PRC = People's Republic of China.

Note: Figure including Indonesia is reported in Appendix A1.

Source: International Monetary Fund, International Financial Statistics.

Figure 1 displays movements of exchange rates of selected ASEAN+3 currencies against the dollar, normalized to pre-crisis levels (January 1997). Two patterns emerge

⁵ According to IMF (2009; 2011), de jure exchange rate arrangements are those which the authorities officially announced. On the contrary, Ilzetzi, Reinhart, and Rogoff (2011) define alternative classifications of exchange rate arrangements based on market-determined exchange rates. Their de facto classifications enable us to assess precisely underlying monetary policy and the ability of the economy to adjust external imbalances.

from the data. First, most ASEAN+3 currencies experienced a sharp depreciation during the Asian financial crisis (1997M7–1998M12). These economies deviated from a de facto dollar peg and allowed the exchange rate determined at the appropriate level supported by macroeconomic fundamentals. Two currencies, the yen and the yuan, are exceptional among these currencies and had been steady around the pre-crisis level.

Second, the PRC and Malaysia departed from a de facto dollar peg in July 2005 and preceded the gradual appreciation trend.⁶ Their deviation from a dollar peg reflects increased demands of exchange rate flexibility for external balance adjustments. Following their appreciation trend, some other currencies, in particular the Philippine peso, the Singapore dollar, and the Thai baht, similarly experienced a gradual appreciation.

Table 1 summarizes the recent transition of de jure exchange rate regimes of ASEAN+3 over 1999–2008.⁷ It is noteworthy that most economies in ASEAN+3, except Japan, have experienced shifts from one regime to others in the post-Asian financial crisis period, at least small degrees of change. Among them, we see two patterns of regime change: one is a deviation from a conventional pegged arrangement associated with an increase in the flexibility of the exchange rate as in the PRC and Malaysia. The other is a departure from a managed floating regime owing to a reduction in interventions as in Indonesia and Thailand.

Table 1: Transition of De Jure Exchange Rate Regimes in ASEAN+3

Economy	1999 ^{1/}	2002 ^{1/}	2005 ^{1/}	2008 ^{2/}
Indonesia	Independently floating	Managed floating with no pre-announced path for the exchange rate	Managed floating with no pre-determined path for the exchange rate	Floating
Malaysia	Conventional pegged arrangement	Conventional pegged arrangement	Managed floating with no pre-determined path for the exchange rate	Floating ^{3/}
Philippines	Independently floating	Independently floating	Independently floating	Floating
Singapore	Managed floating with no pre-determined path for the exchange rate	Managed floating with no pre-announced path for the exchange rate	Managed floating with no pre-determined path for the exchange rate	Floating ^{4/}
Thailand	Independently floating	Managed floating with no pre-announced path for the exchange rate	Managed floating with no pre-determined path for the exchange rate	Floating
People's Republic of China	Conventional pegged arrangement	Conventional pegged arrangement	Conventional pegged arrangement	Stabilized arrangement
Japan	Independently floating	Independently floating	Independently floating	Free floating ^{5/}
Republic of Korea	Independently floating	Independently floating	Independently floating	Free floating ^{5/}

⁶ Ma and McCauley (2011) find that in 2 years from mid-2006 to mid-2008, the yuan strengthened gradually against trading partners' currencies within a narrow band.

⁷ IMF (2009) explains that by Article IV, Section 2(a) of the IMF's Articles of Agreement and Paragraph 16 of the 2007 Surveillance Decision No. 13919-(07/51), each member is required to notify the IMF of the exchange arrangements it intends to apply and to notify the IMF promptly of any changes in its exchange arrangements.

ASEAN+3 = Association of Southeast Asian Nations, plus the People's Republic of China, Japan, and the Republic of Korea.

Notes:^{1/} The categories of exchange rate arrangements over 1999–2007 are: (1) hard pegs comprising (i) exchange arrangements with no separate legal tender and (ii) currency board arrangement; (2) soft pegs consisting of (i) conventional pegged arrangements, (ii) pegged exchange rates within horizontal bands, (iii) crawling pegs, (iv) crawling band; and (3) floating regimes, under which the exchange rate is market determined and characterized as (i) independently floating or (ii) managed floating with no pre-announced path for the exchange rate.

^{2/} The categories of exchange rate arrangements over 2008–2010 are (1) hard pegs comprising (i) exchange arrangements with no separate legal tender and (ii) currency board arrangement; (2) soft pegs consisting of (i) conventional pegged arrangements, (ii) pegged exchange rates within horizontal bands, (iii) crawling pegs, (iv) stabilized arrangements, and (v) crawl-like arrangements; and (3) floating regimes, under which the exchange rate is market determined and characterized as (i) floating or (ii) free floating; and a residual category, other managed arrangements.

^{3/} The ringgit is managed with reference to a currency basket. The composition of the basket is not disclosed. Effective 2 February 2009, the classification of the de facto exchange rate arrangement has been changed from managed floating with no predetermined path for the exchange rate to floating, retroactively to 30 April 2008, due to the revision of the classification methodology.

^{4/} The Singapore dollar is allowed to fluctuate within a targeted policy band and is managed against a basket of currencies of the country's major trading partners and competitors. The various currencies are assigned weights in accordance with the importance of the economy to Singapore's trade relations with the world. The exchange rate policy is announced every 6 months in the Monetary Policy Statement, typically in terms of changes to the slope of the policy band. The US dollar is the intervention currency.

^{5/} According to IMF (2009), a floating exchange rate is largely market determined, without an ascertainable or predictable path for the rate. In particular, an exchange rate that satisfies the statistical criteria for a stabilized or a crawl-like arrangement will be classified as such unless it is clear that the stability of the exchange rate is not the result of official actions. Foreign exchange market intervention may be either direct or indirect, and serves to moderate the rate of change and prevent undue fluctuations in the exchange rate. Furthermore, this floating exchange rate can be classified as free floating if intervention occurs only exceptionally, aims to address disorderly market conditions, and if the authorities have provided information or data confirming that intervention has been limited to at most three instances in the previous 6 months, each lasting no more than 3 business days.

Source: IMF (2011).

Table 2 summarizes key capital account measures in the Republic of Korea, Malaysia, and Thailand. Following the spillover from the Asian financial crisis, the Malaysian authorities immediately eliminated offshore ringgit activities and limited portfolio capital outflows. Later, the authorities reversed their strategy, gradually relaxing restrictions on portfolio outflows and offshore transactions. The Republic of Korea moved to the stage of capital outflow liberalization after the country recovered from the Asian financial crisis. Limits on outward investments were relaxed further and resulted in the elimination of most of the controls by 2007. Lastly, Thai authorities restricted baht deposits for nonresidents. In 2006, they also introduced an unremunerated reserve requirement (URR) of 30% on capital inflows.

Table 2: Summary of Capital Account Management Measures, 1998–2010

Economy	Period	Major Policy Measures
Republic of Korea	2001–2008	Outflow Liberalization <ul style="list-style-type: none"> • Elimination of limits on deposits • Relaxation of limit on lending to nonresidents
Malaysia	1998–2001	Outflows Controls <ul style="list-style-type: none"> • Controls on transfers of funds from ringgit-denominated accounts for nonresidents • Removal of the partial/complete exit levy on repatriation of principals
	1998–2008	Ringgit Transactions <ul style="list-style-type: none"> • Prohibition of offshore transactions of ringgit • Licensing both lending in ringgit to foreign companies onshore and foreign banks' activity
Thailand	2006–2008	Unremunerated Reserve Requirement (URR) <ul style="list-style-type: none"> • Introduction of a 1-year URR for capital inflows • Elimination of the URR
	2003–2008	Inflow Controls <ul style="list-style-type: none"> • Limits on short-term borrowing from nonresidents and investments on government debt securities
	2002–2008	Outflow Liberalization <ul style="list-style-type: none"> • Relaxation of limits on residents' investments in foreign affiliates and lending abroad

Sources: Ariyoshi et al. (2000); Baba and Kokenyne (2011); International Monetary Fund (2014); Kawai and Takagi (2004); Meesok et al. (2001).

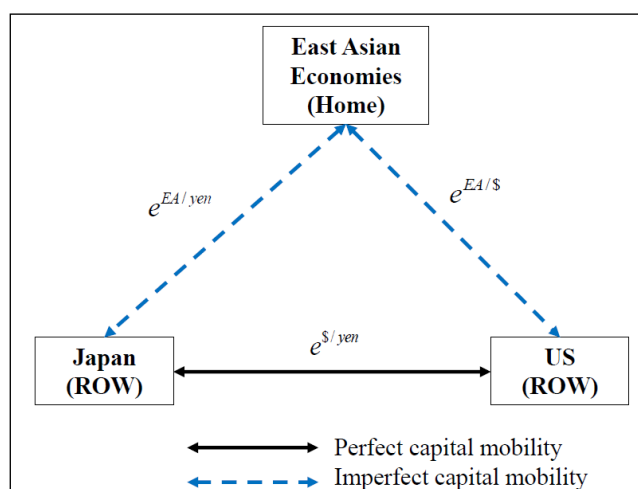
3. STATIC ANALYSIS OF EXCHANGE RATE REGIMES

We initiate our discussion from the static analysis of exchange rate regimes in the literature. Ito, Ogawa, and Sasaki (1998) and Yoshino, Kaji, and Suzuki (2004) find that a basket peg is superior to a dollar regime for small open economies in East Asia.⁸

Our discussion centers on a small open economy model where the rest of the world is divided into two countries (Figure 2). In this case, East Asian economies are treated as the home economy and Japan and the United States (US) as the rest of the world (ROW). Once again the yen–dollar rate remains exogenous to East Asian economies. Domestic and foreign assets are imperfect substitutes whereas US assets and Japanese assets are perfect substitutes for domestic investors. Appendix A2 discusses the details of the model. Moreover, in order to have our calibration results comparable across sections, the simulation exercises for each analysis use the same set of estimated parameters and shocks over the same time horizons for Thailand.⁹

⁸ Ito, Ogawa, and Sasaki (1998) consider the optimal basket peg regime under a partial equilibrium model that do not involve capital movements, while Yoshino, Kaji, and Suzuki (2004) explore the same issue under a general equilibrium model with capital movements across economies. The optimality of a basket peg is also confirmed in two interdependent economies in Ogawa and Ito (2002) and Yoshino, Kaji, and Asonuma (2004).

⁹ Estimated parameter values are reported in Appendix A3.

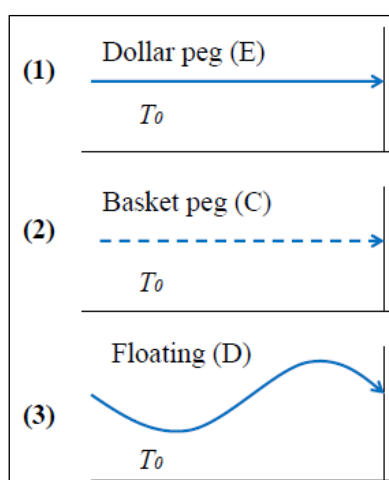
Figure 2: Small Open Economy with the Rest of the World

ROW =rest of world; US = United States.

Source: Yoshino, Kaji, and Asonuma (2004; 2015a).

Yoshino, Kaji, and Suzuki (2004) compare three main possible exchange rate regimes for East Asian economies (Figure 3). The first one is a dollar peg under free capital mobility. The monetary authorities maintain the dollar exchange rate constant at fixed value and all capital account restrictions are removed completely.

The second option is a basket peg under free capital mobility. Instead of maintaining the fixed rate against the dollar as in the previous option, the monetary authorities maintain the value of basket constant and adjust the weights on currencies inside the basket to achieve their policy goal. The last option is a floating regime under perfect capital mobility. In this case, the monetary authorities allow the exchange rate completely determined at the market and implement its optimal monetary policy through its policy instrument, that is, money supply.

Figure 3: Policy Options in Static Analysis

Source: Yoshino, Kaji, and Suzuki (2004).

Time period is assumed as follows: $T_0 = 1$. By nature, the static analysis compares losses at given point of time, i.e., over one period. Therefore, the loss function for the authorities aiming to stabilize output fluctuation is defined as¹⁰

$$L(T_0) = (y_{T_0} - \bar{y}')^2 \quad (1)$$

Note that a reduced form $y_t - \bar{y}'$ varies depending on the exchange rate regimes. Obviously, this corresponds to a one-period loss included in the cumulative loss function in dynamic analysis shown in equation (2) in Section 4 and equation (3) in Section 6. We assume both exchange rates and exchange rate risks as exogenous shocks and use the actual data for the period Q1 1993–Q1 2006 for Thailand, respectively.

One important implication of Ito, Ogawa, and Sasaki (1998) and Yoshino, Kaji, and Suzuki (2004) emerges from Table 3 which reports simulation results for static analysis (over one period) in the case of Thailand: the country is better off adopting a basket peg than a dollar peg. A basket peg allows the monetary authorities to mitigate the negative impacts of the exogenous dollar–yen exchange rate fluctuation by choosing the optimal weights on exchange rate against the dollar and allowing both the dollar rate and the yen rate fluctuate in opposite directions. This results in a smaller one-period loss under a basket peg (policy 2) than that under a dollar peg (policy 1). On the contrary, the superiority between a basket peg and a floating regime hinges on instrument rules and size and type of exogenous shocks.

Table 3: Static Analysis—Case of Thailand (1 period): Output Stability

	Policy (1)	Policy (2)	Policy (3)
Stable Regime	Dollar peg (E)	Basket peg (C)	Floating (D)
Capital Account Restrictions	No	No	No
Instrument Value	-	$v^* = 0.57$	$m^* = 0.26$
One-period Loss (value)	0.00047	0.00006	0.00011
One-period Loss (% of \bar{y}^2) ^{1/}	1.02	0.13	0.24

Note: ^{1/} We calculate the value of \bar{y}^2 and obtain $\bar{y}^2 = 0.046$.

Source: Authors' computations.

¹⁰ In the case that the authorities stabilize price level, the cumulative is defined as

$$L(T_0) = (p_{T_0} - \bar{p}')^2$$

(1a)

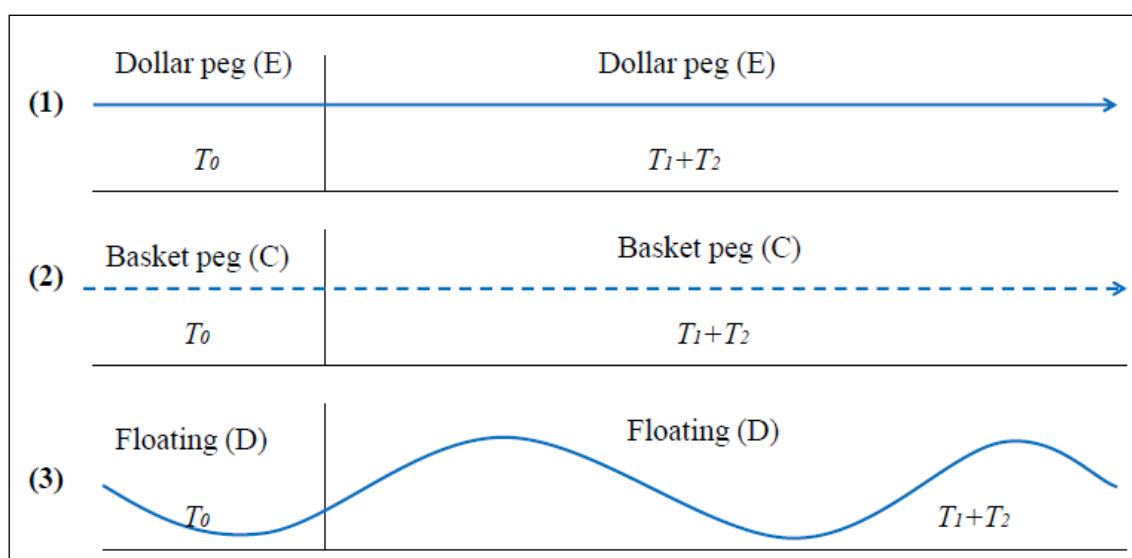
4. CONVENTIONAL DYNAMIC ANALYSIS

Some papers extend the static analysis and explore the desirability of a basket peg over the longer horizon, say 10 years or infinite horizon. Yoshino, Kaji, and Suzuki (2002) and Shioji (2006a) find that it is desirable for the East Asian economies to adopt a basket peg even over the longer horizon relative to a dollar peg. Yoshino, Kaji, and Asonuma (2012) show the relative superiority of a basket peg to a floating regime with specified instrument rules.

In line with the static analysis, the same three exchange rate regimes are considered as candidates for East Asian economies as in Yoshino, Kaji, and Suzuki (2002) (Figure 4). The first one is a dollar peg under free capital mobility (policy 1). The monetary authorities maintain the dollar exchange rate constant at fixed value and all capital account restrictions are removed completely. The second one is a basket peg under free capital mobility (policy 2). The authorities adjust weights on the currencies included in the basket to mitigate the negative impact of exogenous shocks as policy instruments. In this case, the value of the basket is kept constant. Finally, the last one is a floating regime under perfect capital mobility (policy 3). The monetary authorities do not intervene in the foreign exchange rate market to influence exchange rate directly, but leave exchange rates completely determined at the market and implement their optimal monetary policy through policy instruments.

In the analysis, the monetary authorities are maintaining the current exchange rate regimes, which they initiate at the start (T_0) over the long horizon ($T_1 + T_2$). Obviously, the initial period (T_0) in the dynamic analysis corresponds to one period in the static analysis (T_0). It indicates that the dynamic analysis is a continuous repetition of the static analysis.

Figure 4: Policy Options in Conventional Dynamic Analysis



Source: Yoshino, Kaji, and Suzuki (2002) and authors' consideration.

We consider the case of the monetary authority aiming to minimize output fluctuations and its cumulative loss function is shown as:¹¹

$$L(T_0, T_1, T_2) = \sum_{t=1}^{T_0+T_1+T_2} \beta^{t-1} (y_t - \bar{y}')^2 \quad (2)$$

Note that a reduced form $y_t - \bar{y}'$ varies depending on the exchange rate regimes (policies) as in the previous section.

We consider the cumulative losses over 37 quarters (almost 9 years) to make them comparable with those discussed in Section 6. Thus, the time period is specified as follows: $T_0 = 1$, $T_1 = 18$, and $T_2 = 18$. A discount rate is set to $\beta = 0.99$, corresponding to the inverse of an annual interest rate of 4%. Obviously, cumulative losses for three policies comprise the loss in the initial period (T_0) and discounted losses over the longer horizon ($T_1 + T_2$). A one-period loss in the static analysis corresponding to one in the initial period is a fraction of cumulative losses in the current dynamic analysis.

Table 4 demonstrates one notable implication in the case of Thailand found in the dynamic analysis such as in Yoshino, Kaji, and Suzuki (2002) and Shioji (2006a); a basket peg is more desirable than a dollar peg over the long horizon, say over 10 years. As explained in the static analysis, the monetary authorities benefit from choosing the optimal weights on exchange rate against the dollar to react to exogenous shocks negatively affecting the economy, that is, the dollar–yen exchange rate. This results in a smaller cumulative loss under a basket peg than under a dollar peg. One remarkable drawback under a dollar peg is that the exogenous dollar–yen exchange rate fluctuations directly influence the economy through the yen rate, though the dollar exchange rate is kept fixed.

On comparison between a basket peg and a floating regime, a basket peg is found to be superior over the longer horizon for Thailand. This is because a basket peg enables the authorities to successfully minimize the negative influence of exchange rate fluctuations on the economy, while a floating regime leaves exchange rate fluctuations regardless of the size of fluctuations. The current finding is in line with Yoshino, Kaji, and Asonuma (2012) who show a more comprehensive comparison between a basket peg and a floating regime using specified instrument rules and several exogenous shocks in the cases of Singapore and Thailand.¹²

¹¹ In the case that the authorities stabilize price level, the cumulative is defined as

$$L^P(T_1, T_2) = \sum_{t=1}^{T_0+T_1+T_2} \beta^{t-1} (p_t - \bar{p}')^2 \quad (2a)$$

¹² They find the relative superiority of the basket weight rule under a basket peg when compared to the interest rate rule or money supply rule under a floating regime in both Singapore and Thailand where the exchange rate variances are moderate (around 5%). One of the main reasons for the relative superiority of the basket weight rule is that by committing to the basket weight rule, the monetary authority can effectively use exchange rate channels to stabilize output gap and inflation rate, which are missing under the interest rate rule or money supply rule.

Table 4: Dynamic Analysis—Case of Thailand (37 periods): Output Stability

	Policy (1)	Policy (2)	Policy (3)
Stable Regime	Dollar peg (E)	Basket peg (C)	Floating (D)
Capita Account Restrictions	No	No	No
Instrument Value	-	$v^{**} = 0.57$	$m^{*} = 0.008$
Cumulative Loss (value)	0.0069	0.0027	0.0035
Cumulative Loss (% of \bar{y}^2) ^{1/}	15.0	5.9	7.6

Note: ^{1/} We calculate the value of \bar{y}^2 and obtain $\bar{y}^2 = 0.046$.

Source: Authors' computations.

5. LIMITATIONS OF STATIC AND CONVENTIONAL DYNAMIC ANALYSES

Both static and traditional dynamic analyses are appropriate for consideration of the desirable exchange rate regime in the future compared with the status quo, that is, a dollar peg that most East Asian economies adopted at the onset of the Asian financial crisis.

However, the scope that the monetary authorities can apply these static and conventional dynamic analyses is limited and strictly specified. These analyses have four drawbacks when they are applied to East Asian economies in the post-Asian financial crisis period.

First, most importantly, these analyses have not taken into consideration shifts in exchange rate regimes or costs associated with shifts. As discussed in Section 2, the majority of East Asian economies officially announced a departure from a de facto dollar peg at the onset of the Asian financial crisis and experienced several switches in exchange rate regimes in the aftermath of the crisis. Obviously, shifts to different regimes entail costs for the monetary authorities.

Second, related to the first point, these analyses have not reflected where East Asian economies stand currently, that is, the status quo regime. Commonly, they start from desirable regimes that are different from the current regime and there is no detailed discussion on how the economy has reached the desirable regime. However, in reality, a departure from one exchange rate regime generates substantial costs, which sometimes make economies hesitant to shift from the regime.

Third, all the exchange rate regimes in the static and dynamic analyses are under free capital mobility, not under strict or loose capital controls.¹³ Their model set-ups contradict the recent development of capital account restrictions in East Asian economies reported in Section 2; Malaysia and Thailand implemented capital account restrictions suddenly and relaxed gradually afterwards. Moreover, the PRC is currently imposing restrictive measures on capital accounts.¹⁴ Changes in capital account measures, in particular removal of capital controls need to be considered in the context of exchange rate regimes since exchange rates and interest rates are significantly influenced by any changes in capital account measures.

Lastly, in addition to the fact that shifts in exchange rate regimes have not been explored yet, the analyses have not focused on how adjustments should be implemented. In particular, monetary authorities choose between gradual and rapid adjustments.¹⁵ On the one hand, the entire transition process of increasing flexibility in exchange rates includes several intermediate exchange rate regimes where exchange rates are allowed to fluctuate more than under the previous regime. On the other hand, the monetary authorities could also suddenly abandon a fixed regime and adopt a free-floating regime, leaving the exchange rate determined at the market.

These drawbacks in the static and conventional dynamic analyses call for a need to develop an alternative dynamic analysis, which suits the East Asian economies, particularly in the post-Asian financial crisis period.

6. DYNAMIC TRANSITION ANALYSIS

To overcome the above-mentioned limitations of the static and conventional dynamic analyses, Yoshino, Kaji, and Asonuma (2015a) introduce a new dynamic transition analysis of exchange rate regimes. The proposed analysis has three major advantages. Firstly, it compares shifts from the current regime to alternative regimes with the benchmark of maintaining the current regime, a dollar peg. Both benefits and costs associated with shifts in exchange rate regimes are taken into consideration. Secondly, it explores how capital controls are relaxed in order to reach the desired regimes under free capital mobility. A dollar peg regime with strict capital controls is assumed to be the status quo. This precisely corresponds to where the PRC and Malaysia stood in the aftermath of the Asian financial crisis as reported in Section 2. Thirdly, in the analysis, the monetary authorities have two adjustment options for exchange rate regimes and for capital account restrictions respectively; gradual and sudden adjustments.

Possible options for the monetary authorities besides maintaining the current regime (policy 1) are shifts to a basket peg or a floating regime (Figure 5). For the shift to a basket peg, there are two possible processes an economy can take; one is starting with a dollar peg with strict capital controls, shifting to a basket peg with loose capital

¹³ Yoshino, Kaji, and Ibuka (2003) analyze the effectiveness of capital controls and fixed exchange rates in the case of Malaysia.

¹⁴ Ma and McCauley (2007) argue that the PRC's capital controls remain substantially finding even after its announcement of the PRC's deviation from a dollar peg in July 2005. Yongding (2013) summarizes the evolution of capital controls in the PRC, including recent rapid capital account liberalization since 2009.

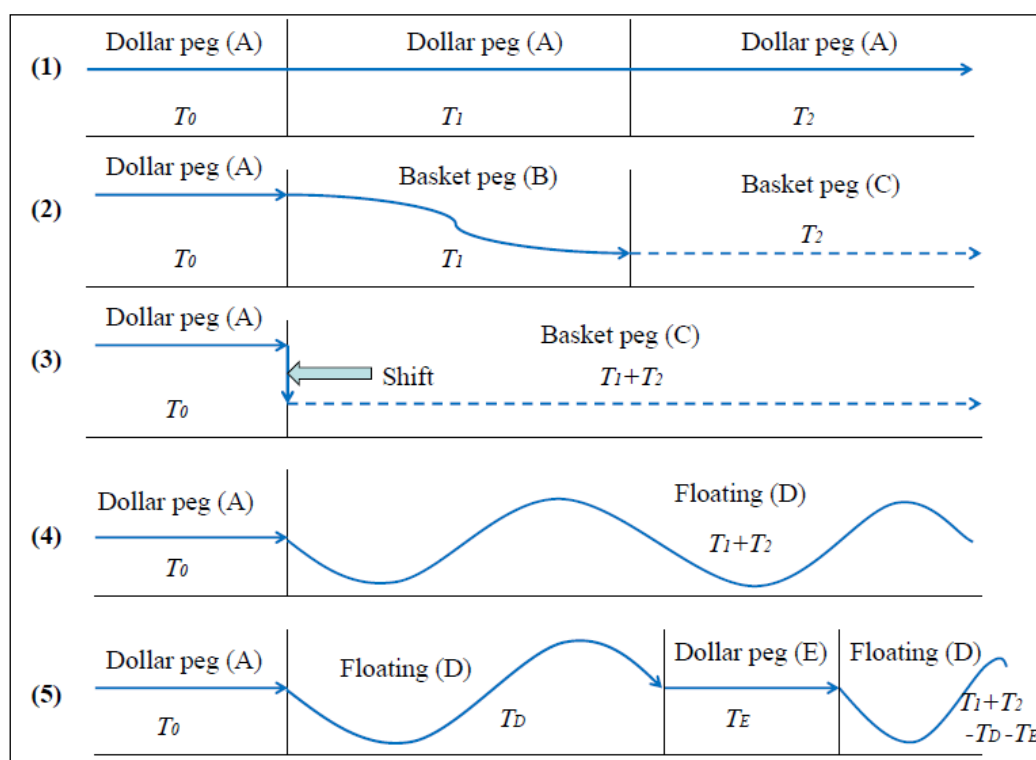
¹⁵ Yoshino, Kaji, and Asonuma (forthcoming-b) not only explore benefits and costs for both gradual and sudden adjustments of exchange rate regimes, but also describe country experiences that have benefited from these two adjustments.

control, and finally reaching a basket peg with no capital control (policy 2). This corresponds to gradual adjustments of both degrees of capital controls and basket weight. The other is starting with a dollar peg with strict capital control, and then suddenly shifting to a basket peg without capital controls by removing capital controls, which is the sudden shift of both capital controls and basket weight.

On the contrary, the shift to a floating regime also involves one of these two processes; one is starting with a dollar peg with strict capital controls and suddenly jumping to a free floating regime by removing capital controls (policy 4). The other is starting with a dollar peg with strict capital controls and suddenly shifting to a managed floating regime by removing capital controls (policy 5). Under a managed floating regime, the monetary authorities intervene in foreign exchange markets when the exchange rate deviates substantially from the desired bands within a certain width.

The desired exchange rate regimes, which the monetary authorities reach after completion of shifts, correspond to those in the conventional dynamic analysis. In contrast, the exchange rate regime in the initial period (T_0) is a dollar peg with strict capital control, symmetric across all transition policies. It suggests that the current analysis includes a subset of the conventional dynamic analysis (the interval T_2) and a fraction symmetric across transition policies (initial period).

Figure 5: Policies toward Stable Regimes



Source: Yoshino, Kaji, and Asonuma (2015a).

Identical to one in Section 4, the monetary authorities continue to stabilize output fluctuations over longer horizons with its cumulative loss function defined as:¹⁶

$$L(T_0, T_1, T_2) = \sum_{t=1}^{T_0+T_1+T_2} \beta^{t-1} (y_t - \bar{y}')^2 \quad (3)$$

Note that a reduced form $y_t - \bar{y}'$ varies depending on the exchange rate regimes (policies). Cumulative losses are also computed over 37 quarters using a discount rate of $\beta = 0.99$, identical to the inverse of an annual interest rate of 4%. Time period is specified as follows: $T_0 = 1$, $T_1 = 18$, and $T_2 = 18$. Cumulative losses for three policies comprise the loss in the initial period (T_0) and discounted losses over longer horizon ($T_1 + T_2$). The former corresponds to one under a dollar peg regime in static analysis and is symmetric across transitional policies. The latter includes a fraction of cumulative losses in the conventional dynamic analysis.

Tables 5 and 6 report simulation results using data from Thailand and the PRC.¹⁷ First, both the PRC and Thailand are better off shifting to either a basket peg or a floating regime over the long horizon, that is, 37 quarters. Benefits under the desired regime outweigh costs associated with the shifts from the current regime. Sticking to a dollar peg is found to be optimal solution only over the short period.

Second, focusing on shifts to a desirable basket peg, the optimal choice of adjustment policy depends on length of the transition period. If the transition period becomes shorter, the monetary authorities opt to take a gradual adjustment (policy 2). Otherwise, they choose a sudden adjustment (policy 3). This is because benefits they receive from reaching the desired regime at once get smaller as the transition period becomes shorter. Under the current length of transition period (18 quarters), both the PRC and Thailand find it desirable to take a gradual adjustment.

Third, on the choice between sudden shifts to a basket peg or a floating regime, the monetary authority's decision hinges on the magnitude of exchange rate fluctuations. Under the environment where exchange rate fluctuates remarkably, the cumulative losses are smaller under the shift to a basket peg. Clearly, volatility in exchange rate expectation by the private sector is much smaller if the private sector anticipates that the monetary authorities opt for the gradual adjustment. This is found to be one of benefits together with smaller negative impacts on trade and capital inflows. Cases of both the PRC and Thailand fit in this category.

Lastly, the shift to a managed floating regime sometimes provides a better outcome for the monetary authorities than a free-floating regime, while not better than a basket peg. Intervening in foreign exchange rate markets for a certain period is costly for the monetary authorities since during the interventions they lose the monetary policy autonomy.

¹⁶ In the case that the authorities stabilize price level, the cumulative is defined as

$$L^P(T_0, T_1, T_2) = \sum_{t=1}^{T_0+T_1+T_2} \beta^{t-1} (p_t - \bar{p}')^2 \quad (3a)$$

¹⁷ Similar to the Thai case, we use the actual data of exchange rate and exchange rate risks for the period Q1 1999–Q4 2010 for the PRC.

Table 5: Comparison of Five Transitional Policies for Thailand—Output Stability

	Policy (1)	Policy (2)	Policy (3)	Policy (4)	Policy (5) ($T_E=3$) ^{2/}
Stable Regime	Dollar peg	Basket peg	Basket peg	Floating	Managed Floating
Adjustment	-	Gradual	Sudden	Sudden	Sudden
Instrument Value	$i^* = 0.003$	$v^* = 0.68$	$v^{**} = 0.62$	$m^* = 0.082$	$m^{**} = 0.082$
Cumulative Loss (value)	0.0069	0.0006	0.0026	0.0052	0.0053
Cumulative Loss (% of \bar{y}^2) ^{1/}	15.0	1.3	5.7	11.3	11.5

Note: ^{1/} We calculate the value of \bar{y}^2 and obtain $\bar{y}^2 = 0.046$. ^{2/} If $T_E=5$, cumulative loss is 3.54 ($m^{**} = 0.082$).

Sources: Authors' calculations.

Table 6: Comparison of Five Transitional Policies for the People's Republic of China—Output Stability

	Policy (1)	Policy (2)	Policy (3)	Policy (4)	Policy (5) ($T_E=5$) ^{2/}
Stable Regime	Dollar peg	Basket peg	Basket peg	Floating	Managed Floating
Adjustment	-	Gradual	Sudden	Sudden	Sudden
Instrument Value	$i^* = 4.34$	$v^* = 0.58$	$v^{**} = 0.68$	$m^* = 0.016$	$m^{**} = 0.017$
Cumulative Loss (value)	17.04	1.80	1.91	2.67	2.31
Cumulative Loss (% of \bar{y}^2) ^{1/}	23.4	2.4	2.6	3.7	3.2

Notes: ^{1/} We calculate the value of \bar{y}^2 and obtain $\bar{y}^2 = 72.8$. ^{2/} If $T_E=7$, cumulative loss is 3.54 ($m^* = 0.017$).

Source: Authors' calculations.

7. CONCLUSION

Since the start of the Asian financial crisis, the optimal exchange rate regime in East Asia has been discussed under three main approaches of theoretical analyses: static analysis, conventional dynamic analysis, and dynamic transition analysis. Though the three approaches enrich the policy debate, there is not a detailed comparison among the three approaches owing to differences in both economy samples and length of time periods. Therefore, an important policy relevant question remains unanswered: Which approach of theoretical analysis fits well for East Asian economies in the current environment?

This paper attempts to fill the gap in the literature. We consider the link among the three analyses and contrast the static and conventional dynamic analyses with the dynamic transition analysis.

Our main implications are the following. First, based on our simulation results comparable across the three approaches, we find that the conventional dynamic analysis is a repetition of the static analysis. Moreover, the post-shift regime in the dynamic transition analysis corresponds to the regime in the conventional dynamic analysis.

Second, we demonstrate some drawbacks of the static and conventional dynamic analyses. Most importantly, neither of them has considered shifts in exchange rate regimes.

Lastly, our paper emphasizes some advantages in the dynamic transition analysis. First, it compares shifts from the current regime to alternative regimes with the benchmark of maintaining the current regime. Second, it explores how capital controls are relaxed in order to reach the desired regimes under free capital mobility. Third, in the analysis, two adjustment options for exchange rate regimes and for capital account restrictions are considered respectively.

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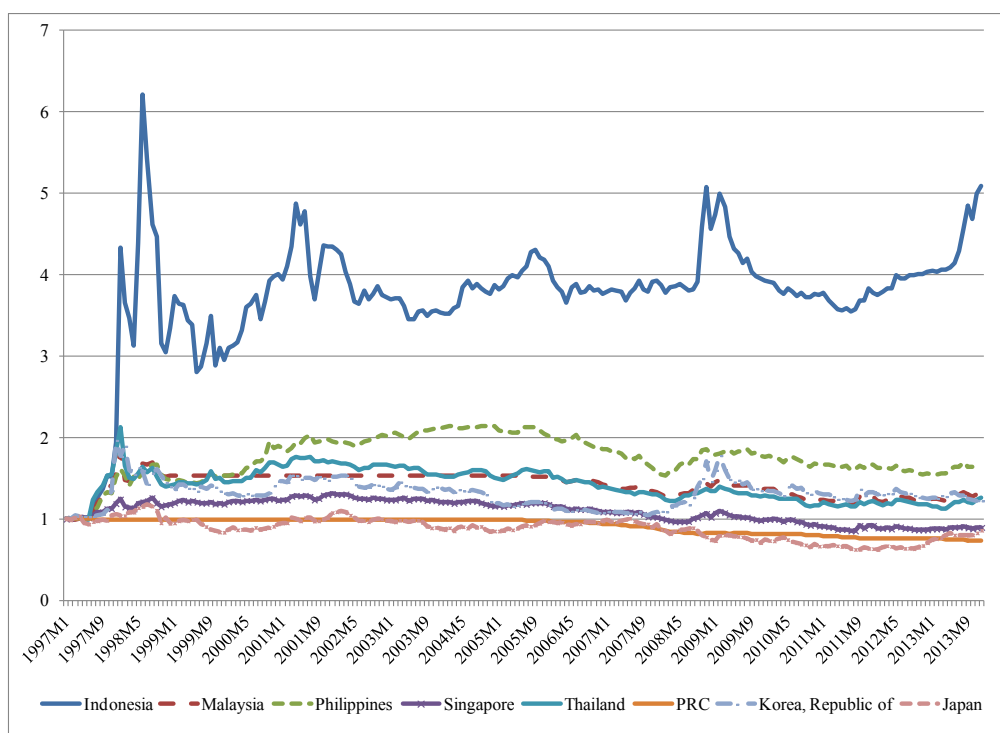
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APPENDIX A1: DE JURE EXCHANGE RATE REGIME AND CAPITAL ACCOUNT MEASURES

Figure A1: Nominal Exchange Rates of ASEAN+3 Currencies against the Dollar



ASEAN+3 = Association of Southeast Asian Nations, plus People's Republic of China, Japan, and Republic of Korea.

Source: International Monetary Fund, International Financial Statistics.

Table A1: Transition of De Facto Exchange Rate Regimes in ASEAN+3^{1/2/}

Economy	1999	2002	2005	2008
Indonesia	Managed floating	Managed floating	De facto crawling band that is narrower than or equal to $\pm 5\%$	De facto crawling band that is narrower than or equal to $\pm 5\%$
Malaysia	Pre announced peg or currency board arrangement	Pre announced peg or currency board arrangement	De facto peg	De facto crawling band that is narrower than or equal to $\pm 5\%$
Philippines	De facto crawling band that is narrower than or equal to $\pm 2\%$	De facto crawling band that is narrower than or equal to $\pm 2\%$	De facto crawling band that is narrower than or equal to $\pm 2\%$	De facto crawling band that is narrower than or equal to $\pm 5\%$
Singapore	Moving band that is narrower than or equal to $\pm 2\%$	Moving band that is narrower than or equal to $\pm 2\%$	Moving band that is narrower than or equal to $\pm 2\%$	Moving band that is narrower than or equal to $\pm 2\%$
Thailand	Moving band that is narrower than or equal to $\pm 2\%$	Moving band that is narrower than or equal to $\pm 2\%$	Moving band that is narrower than or equal to $\pm 2\%$	Moving band that is narrower than or equal to $\pm 2\%$
People's Republic of China	De facto peg	De facto peg	Moving band that is narrower than or equal to $\pm 2\%$	De facto peg
Japan	Free floating	Free floating	Free floating	Free floating
Republic of Korea	Managed floating	Managed floating	Managed floating	Managed floating

Notes: ^{1/} The categories of de facto exchange rate arrangements are (1) no separate legal tender (2) pre-announced peg or currency board arrangement, (3) pre-announced horizontal band that is narrower than or equal to $\pm 2\%$, (4) de facto peg, (5) pre-announced crawling peg, (6) pre-announced crawling band that is narrower than or equal to $\pm 2\%$, (7) de facto crawling peg, (8) de facto crawling band that is narrower than or equal to $\pm 2\%$, (9) pre-announced crawling band that is wider than or equal to $\pm 2\%$, (10) de facto crawling band that is narrower than or equal to $\pm 5\%$, (11) moving band that is narrower than or equal to $\pm 2\%$, (12) managed floating, (13) free floating, (14) free falling, and (15) dual market in which parallel market data is missing.

^{2/} According to Ilzetzki, Reinhart, and Rogoff (2010), if the exchange rate has no drift, it is classified as a *fixed parity*; if a positive drift is present, it is labeled a *crawling peg*; and, if the exchange rate also goes through periods of both appreciation and depreciation it is a *moving peg*. If a band is explicitly announced and the chronologies show a unified exchange market, we label the episode as a *band*. By computing the probability that the monthly exchange rate change remains within a $\pm 2\%$ band over a rolling 5-year period, the regime is classified as a *de facto narrow band*, a *narrow crawling* or a *moving band* over the period through which it remains continuously above 80% threshold.

Source: Ilzetzki, Reinhart, and Rogoff (2010).

**Table A2: Detailed Development in Capital Account Management Measures,
1998–2010**

Economy	Period	Major Policy Measures
Republic of Korea	2001–2008	<p>Outflow Liberalization</p> <p>Limits on deposits abroad were eliminated. The limit on lending to nonresidents was increased and residents' personal capital transfers were liberalized in 2001. The ceiling on commercial credits was increased in 2002. The limit on individuals' foreign direct investment (FDI) was raised to \$3 million and on certain real estate purchases to \$500,000 in 2005. Following a further increase, they were eliminated in March 2006.</p> <p>The rules for the repatriation of proceeds from capital transactions were further eased, and all approval requirements for capital transactions were changed to notification requirements in January 2006. The threshold for prior notification of won-denominated loans to nonresidents was raised to W10 billion in 2006 and to W30 billion in 2007. Real estate purchases and establishment of bank branches abroad were further liberalized during 2007–2008.</p>
Malaysia	1998–2001	<p>Outflows Controls</p> <p>In September 1998, a 12-month waiting period was imposed for nonresidents to convert ringgit proceeds from the sale of Malaysian securities held in external accounts. This restriction excluded FDI flows, repatriation of interest, dividends, fees, commissions, and rental income from portfolio investment. No such restriction existed previously.</p> <p>In February 1999, the 12-month holding period rule for repatriation of portfolio capital was replaced with the imposition of a graduated system of exit levy on the repatriation on the principal of capital investments made prior to 15 February 1999. In September 1999, the two-tier levy system was replaced with a flat 10% levy on repatriation of profits on portfolio investment, irrespective of when the profits were repatriated. The 10% exit levy on profits repatriated after 1 year was abolished in February 2001. Profits repatriated within 1 year remained subject to the 10% levy. In May 2001, the 10% exit levy on the repatriation of portfolio profits was removed completely.</p>
	1998–2008	<p>Ringgit Transactions</p> <p>A requirement was introduced in September 1998 to repatriate all ringgit held offshore, including ringgit deposits in overseas banks, by 1 October 1998; this required approval by Bank Negara Malaysia thereafter. An approval requirement was imposed on transfers of funds between external accounts and for the use of funds other than for permitted purposes (that is, the purchase of ringgit assets). Licensed offshore banks, which had previously been able to trade up to permitted limits, were prohibited from trading in ringgit assets.</p> <p>In September 1999, to provide foreign investors with more flexibility in managing their portfolios and risks, Bank Negara Malaysia relaxed controls on lending in ringgit to foreign stockbroking companies. In April 2004, resident companies with domestic borrowing were allowed to open non-export foreign currency accounts with licensed onshore banks in Malaysia to retain foreign currency receivables other than export proceeds with no limit on the overnight balances.</p> <p>Resident companies without domestic borrowing were allowed to open non-export foreign currency accounts (FCAs) in licensed offshore banks in Labuan up to an overnight limit of \$500,000 or its equivalent. Resident individuals with funds abroad (not converted from ringgit) were allowed to maintain non-export FCAs offshore without any limit imposed on overnight balances. The requirement to submit a monthly statement by resident companies maintaining FCAs with licensed offshore banks in Labuan or overseas banks was abolished in January 2008.</p>
Thailand	2006–2008	<p>Unremunerated Reserve Requirement</p> <p>A 1-year unremunerated reserve requirement (URR) of 30% was put in place for capital inflows, except for FDI and amounts not exceeding \$20,000, on 19</p>

		December 2006. Early repatriation was subject to a refund of only two-thirds of the URR. Equity investments traded on the stock exchange were exempted from the requirement from 22 December 2006. There were additional exemptions in early 2007. Certain investments in property funds and long-term foreign borrowing not exceeding \$1 million were made exempt from the URR in December 2007. The URR was eliminated on 3 March 2008.
2003–2008	Inflow Controls	Short-term baht borrowing from nonresidents was limited to B50 million, and a limit of B300 million was introduced on nonresidents' baht accounts in 2003. Nonresidents' accounts carried no interest except for fixed income accounts with maturities of at least 6 months. Banks were not allowed to issue or sell bills of exchange in baht of any maturity to nonresidents from 15 November 2006. Sell-and-buy-back transactions of debt securities were prohibited and a 3-month holding period on investments in government debt securities was introduced on 4 December 2006; a B50 million limit was placed on banks' borrowing of baht with maturities of less than 6 months from nonresidents. The limit on banks' baht borrowing and baht transactions comparable to borrowing from nonresidents without underlying trade or investment in Thailand was decreased to B10 million on 3 March 2008.
2002–2008	Outflow Liberalization	Investments in employee stock option plans and real estate up to a limit and lending to affiliated companies was allowed in 2002, and an aggregate limit was established on foreign investments of institutional investors in 2003. Foreign companies were allowed to issue baht-denominated bonds subject to approval by the Ministry of Finance in 2006. Significant outflow liberalization started in 2007 with gradual increases in the maximum Thai citizens could invest in foreign affiliates: \$50 million in January 2007 and \$100 million in February 2008. The ceiling on institutional investor foreign portfolio investments was increased to \$50 million in January 2007. In July 2007, the maximum for real estate purchases and other personal remittances abroad was increased to \$1 million and listed companies were allowed to make outward FDI of up to \$100 million. The limits on lending abroad were increased to \$100 million and its scope expanded in February 2008; the maximum on real estate purchases was increased to \$5 million. In March 2008, banks were allowed to lend baht to or engage in comparable transactions, that is, swap with nonresidents up to B300 million, and portfolio investments by resident individuals were allowed through private funds and securities companies.

Sources: Ariyoshi et al. (2000); Baba and Kokenyne (2011); International Monetary Fund (2014); Kawai and Takagi (2004); Meesok et al. (2001).

APPENDIX A2: THEORETICAL MODEL

We assume that domestic and foreign assets are imperfect substitutes, whereas Japanese and US assets are perfect substitutes for domestic investors. An interest parity condition is shown as:

$$i_{t+1} - i_t = -\lambda \left[i_t - \left\{ i_t^{US} + e_{t+1}^{EA/US} - e_t^{EA/US} - \sigma \left(e_t^{EA/US} \right) \right\} \right] \quad (A1)$$

where λ denotes the adjustment speed of the domestic interest rate, which also captures the degree of capital control. If λ is close to 0, it implies that the domestic interest rate does not respond to an interest rate differential. This means that the domestic interest rate is exogenous and totally independent. We regard this as a case of strict capital control. On the contrary, if λ approaches 1, it implies that the domestic interest rate responds completely to a change in the foreign interest rate, which we consider to be a case without capital controls. Furthermore, $\sigma \left(e_t^{EA/US} \right)$ denotes a risk premium that depends on the US dollar exchange rate. If $\lambda = 1$, equation (1) can be rewritten as:

$$i_{t+1} = i_t^{US} + e_{t+1}^{EA/US} - e_t^{EA/US} - \sigma \left(e_t^{EA/US} \right) \quad (A1')$$

As we explain in Section 3.1, under a dollar peg regime with capital controls, equation (1) does not hold. The equilibrium condition for the money market is:

$$m_t - p_t = -\varepsilon i_{t+1} + \phi(y_t - \bar{y}) \quad (A2)$$

The demand for goods depends on the real exchange rates, the real interest rate and the exchange rate risks written as:

$$\begin{aligned} y_t - \bar{y} = & \delta \left(e_t^{EA/US} + p^{US} - p_t \right) + \delta' e_{t+1}^{EA/US,e} + \theta \left(e_t^{EA/JP} + p^{JP} - p_t \right) + \theta' e_{t+1}^{EA/JP,e} \\ & - \rho \{ i_{t+1} - (p_{t+1}^e - p_t^e) \} - \tau \Delta e^{EA/US} - \varsigma \Delta e^{EA/JP} \end{aligned} \quad (A3)$$

where the term $(p_{t+1}^e - p_t^e)$ shows the expected rate of inflation. The last two terms correspond to exchange rate risks.

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

$$e_t^{EA/JP} = e_t^{EA/US} + e_t^{US/JP} \quad (A4)$$

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

$$\begin{aligned}
p_{t+1} - p_t = & -\alpha_t + \psi(y_t - \bar{y}) + \eta \left(e_t^{EA/US} + p^{US} - p_t \right) + \eta' e_t^{EA/US,e} + \mu \left(e_t^{EA/JP} + p^{JP} - p_t \right) \\
& + \mu' e_t^{EA/JP,e} + (p_{t+1}^e - p_t^e) + \chi \Delta e^{EA/US} + \xi \Delta e^{EA/JP}
\end{aligned}
\tag{A5}$$

where the first term on the right-hand side shows the total productivity of the home economy and the last two terms denote the dollar exchange rate risk and the yen exchange rate risk. We assume aggregate production depends on total productivity, imported materials from Japan and the US, and the inflation rate. We assume that the East Asian economy imports materials from Japan and the US and exports final goods to Japan and the US. Both aggregate demand and aggregate supply depend also on the exchange rate expectation, as exporting and importing firms are concerned with significant deviations of the exchange rate for the next period from the current level. Among the variables, α_t , \bar{y} , p^{US} , p^{JP} , $e_t^{US/JP}$, $\Delta e^{EA/US}$, and $\Delta e^{EA/JP}$ are common exogenous variables under any exchange rate regime. We assume that all exogenous variables, except $e_t^{US/JP}$, p_{t+1}^e , p_t^e , $e_t^{EA/US,e}$, $e_t^{EA/JP,e}$ are constant (= 0) in the analysis below. All the coefficients above are positive.

APPENDIX A3: DETAILS OF SIMULATION EXERCISE

For the simulation exercise, Yoshino, Kaji, and Asonuma (2015a) use the PRC and Thai quarterly data from the IMF (2007) International Financial Statistics (IFS). Details of data used in this simulation are summarized in Table A2.¹

Table A3: Source of Data for Estimation

Variables	Definition	Economy	Source
$e_t^{EA/\$}$	Nominal US dollar exchange rate	PRC, THA	IMF IFS
$e_t^{EA/yen}$	Nominal yen exchange rate	PRC, THA	IMF IFS
$e_t^{EA/\$} + p_t^{US} - p_t$	Real US dollar exchange rate	PRC, THA	IMF IFS
$e_t^{EA/yen} + p_t^{JP} - p_t$	Real yen exchange rate	PRC, THA	IMF IFS
$e_t^{\$/yen}$	Nominal dollar-yen exchange rate	JPN	IMF IFS
i_t	Nominal government bond yields	PRC, THA	IMF IFS
$i_t - (p_{t+1}^e - p_t^e)$	Real government bond yields	PRC, THA	IMF IFS
i_t^{US}	Nominal US government bond yields	US	IMF IFS
$m_t - p_t$	Real money supply (M1)	PRC, THA	IMF IFS
$\Delta e_t^{EA/\$}$	Risk premium on US dollar exchange rate	PRC, THA	IMF IFS
$\Delta e_t^{EA/JP}$	Risk premium on yen exchange rate	PRC, THA	IMF IFS
$p_{t+1} - p_t$	Change in domestic CPI	PRC, THA	IMF IFS
$y_t - \bar{y}$	Output gap	PRC, THA	Authors' calculation

CPI = consumer price index; IMF IFS = International Monetary Fund, International Financial Statistics; PRC = People's Republic of China; THA = Thailand; US = United States.

Source: Yoshino, Kaji, and Asonuma (2015a).

We apply the Instrumental Variable (IV) method to estimate parameters simultaneously. We differentiate two sample periods based on regimes: for the PRC case (1) 1999Q1–2005Q2 for a dollar peg, and (2) 2005Q3–2010Q4 for a floating regime. As the PRC has never adopted a de facto floating regime, we use estimated coefficients obtained for a basket peg regime (2). For the Thai case, we set (1) 1993Q1–1997Q2 for a dollar peg and basket peg and (2) 1997Q3–2006Q1 for a floating regime. A dummy variable is used to exclude impacts of the Asian currency crisis period 1997Q3–1998Q2 for the Thai case. Table A3 shows estimation results.²

¹ Applying Dicky-Fuller General Least Square (DF-GLS) unit root tests, some variables are found to have unit roots. Then we apply Johansen co-integration tests, and find that co-integration relations exist among variables which have unit roots. Most variables, except interest rates are defined in natural log. For exchange risks, we use a variance of monthly exchange rate data as a proxy. See Yoshino, Kaji, and Asonuma (2015a) for Dicky-Fuller GLS unit root and Johansen co-integration test results.

² Coefficients correspond to those in model equations in Yoshino, Kaji, and Asonuma (2015a).

Table A4: Estimation Results for the People's Republic of China and Thailand

	People's Republic of China		Thailand	
Coefficients	Fixed, Basket peg	Floating	Fixed, Basket peg	Floating
Sample	1999Q1–2005Q2	2005Q3–2010Q4	1993Q1–1997Q2	1997Q3–2006Q1
λ	-	0.26*** (0.09)	-	0.51** (0.07)
σ	-	0.05*** (0.03)	-	0.006 (0.02)
ε	3.20*** (0.89)	10.13*** (1.89)	0.05 (0.08)	1.70** (0.82)
ϕ	0.23*** (0.05)	0.50*** (0.10)	0.94** (0.19)	0.44 (0.36)
δ, δ'	-1.20 (2.51)	1.27* (0.69)	-0.73*** (0.08)	0.01 (0.10)
θ, θ'	0.70** (0.33)	-0.007 (0.42)	0.27*** (0.07)	-0.005 (0.08)
ρ	-0.52 (0.38)	0.63** (0.25)	-3.73*** (0.50)	1.13*** (0.34)
τ	-36.11 (46.78)	-0.14 (0.77)	0.05 (0.22)	0.002 (0.009)
ς	0.40 (1.50)	8.66 (15.91)	-2.00 (2.55)	0.53 (0.94)
α	0.16*** (0.02)	0.13*** (0.04)	0.01*** (0.003)	0.007*** (0.001)
ψ	-0.04* (0.02)	0.12** (0.05)	-0.25*** (0.04)	0.20*** (0.05)
η, η'	-0.06* (0.03)	-0.15** (0.07)	-0.19*** (0.03)	0.02 (0.02)
μ, μ'	-1.32*** (0.26)	-0.35*** (0.11)	0.07*** (0.02)	0.02 (0.02)
χ	-7.28** (3.13)	-0.001 (0.14)	0.01 (0.06)	0.002 (0.002)
ξ	-5.87*** (0.88)	-7.80*** (2.80)	-0.55 (0.66)	-0.30 (0.23)

Notes: Values inside parentheses denote standard errors of coefficients. ***, **, * indicate 1%, 5%, and 10% significance respectively.

Source: Yoshino, Kaji, and Asonuma (2015a).