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A De Facto Asian-Currency Unit Bloc in East Asia: It Has Been There but We Did Not Look for It

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The title of the working paper echoes in a contrasting way what the author remembers Joan Robinson saying in her seminars at Cambridge in the 1970s: that the search for a measure of capital was like looking in a dark room for a black cat that probably was not there.

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Abstract

Pegging in a coordinated way to a regional basket currency is considered by many as optimal for east-Asian countries. By contrast, according to existing empirical studies, these countries have most often relied on noncooperative United States dollar or G3 pegs. We show for the first time that by the late 1990s, with some reversals, a majority of east-Asian countries had already moved, de facto, away from the dollar peg and started targeting a basket, including east-Asian currencies (an "Asian Currency Unit"). Common-shock or market-based interpretations of such moves are ruled out since we document that, with few exceptions, countries in the region have in reality stuck to fixed exchange rates. We obtain such results using a Markov-switching estimation benchmarked against Bai-Perron structural break tests for the synthesis model of Frankel and Wei (2007), which augments the inference about currency weights in a basket with the weight on exchange-market pressure. In order to measure the latter, the forward positions of central banks in the foreign exchange market are taken into account.

JEL Classification: F31, F41

Contents

1. INTRODUCTION

The exchange rate regime and basket composition of east-Asian currencies has been an area of lively debate. A widely-held hypothesis is that a noncooperative United States (US) dollar or G3 (Europe, Japan and the US) currency peg has been the dominant feature for a large number of them. In the view of many observers, a cooperative peg to a regional monetary unit would be far superior. We propose to reconcile these two apparently conflicting propositions by examining to what extent east-Asian countries have started to peg by stealth to a basket including a regional monetary unit. In order to address this question, this paper uses regime-switching approaches to dating modifications in exchange rate regimes of east-Asian countries and tracking movements in the composition of their basket pegs.

Recent events have motivated such an inquiry. In the face of the global financial crisis, it is expected that east-Asian countries would (jointly) allow more exchange-rate flexibility in order to cushion the impact of such an exceptionally large (common) shock on their economies. Further, if one country in the region changes its exchange-rate regime—such as the People's Republic of China (PRC) did in the summer of 2005, and Japan did in January 2003—will other countries in the region emulate them? The PRC's return of the yuan to a managed float in June 2010 makes such an inquiry all the more important.

The de facto peg to the dollar of most east-Asian currencies before the 1997–1998 crisis, as well as the alleged return to such a peg in the aftermath of the crisis, have been lamented as a coordination failure (Ogawa and Ito 2002; Ohno 1999). Given the rapid rise of intra-regional trade integration among these economies, and on the basis of models of optimal basket pegs (Benassy-Quéré 1999), many observers favor east-Asian countries pegging their currencies to a basket where regional currencies are included (Kawai and Takagi 2000; Kawai 2007; Ogawa and Shimizu 2005; Williamson 2005). However, it may not be optimal to include only one regional currency in the basket (i.e., the Japanese yen) on top of the dollar and the European Union euro, thus making it a basket of G3 currencies (Mundell 2003), particularly in view of the growing role of the PRC as a hub of regional trade. Indeed, it has been recently shown via simulations in a game-theoretical setting that the welfare of east-Asian economies would be enhanced by moving from a dollar peg to a basket including a regional currency unit (Sheng, Kwek, and Cho 2009).

On the empirical side, the workhorse for measuring de facto currency (basket) pegs, as suggested by Frankel and Wei (1992), is a regression of special-drawing-right (SDR) exchange rate returns of a domestic currency on the returns of the dollar, yen, and euro vis-a-vis the SDR. Such work shows the resilience of the dollar peg in east-Asian countries up to the mid-2000s (Ogawa and Shimitzu 2005; Kawai 2007). An alternative approach, using the relative volatilities of exchange-market-pressure indices, and combining changes in exchange rates and foreign currency reserves, reaches a similar conclusion (Henandez and Montiel 2003). A synthesis of the two approaches, suggested by Frankel and Wei (2008), would augment the inference about currency weights in a G3 basket with the weight on exchange-market pressure, enabling us to gauge the degree of exchange rate flexibility.

There is thus consensus about the significant gap between theory and practice: in theory a regional-currency-unit basket is preferable to a G3 basket, but east-Asian governments would be unable to get together and coordinate action for implementation of this preferred option, and would simply fall back on a noncooperative, or Nash, equilibrium where they peg to the dollar. This consensus is so strong that it has constrained all work on employing the type of test advocated by Frankel and Wei (1992), resulting in a focus on G3 currencies exclusively. However, suppose that east-Asian governments were as smart as game theorists (or were listening to their advice) and had in fact already started some time ago to target a basket that included a regional currency unit instead of the yen. This hypothesis could be tested by estimating the synthesis model modified to allow for exchange-regime

changes (and possible reversals) away from the much-documented dollar peg to a basket that included a regional monetary unit.

The construction of an Asian currency or monetary unit is a controversial step in this endeavor. Indeed, ongoing debate has those who champion basing weights for a regional currency unit on nominal gross domestic product (GDP) (Kawai and Takagi 2009; Girardin and Steinherr 2008) opposite those who would base such weights on GDP adjusted by purchasing power parity (PPP) (Ogawa and Shimizu 2005)—on top of trade and financial weights which are less controversial. While PPP-adjusted GDP weights have a forward-looking nature, they are rather arbitrary. Nominal GDP-based weights are arguably easier to assess and—partly due to this reason—were used by European countries for the European Currency Unit. In order to enlarge the set of possible anchor-baskets as well as to allow for the fact that not all east-Asian countries may have targeted the same unit, our analysis uses principal components of regional exchange rate returns on broad and narrow sets of currencies. First, our analysis in this paper uses a regime-switching framework to detect changes in the exchange-rate regimes of the 13 Association of Southeast-Asian Nations+3 (ASEAN+3) countries.[1] We propose to use a Markov-switching (Hamilton 1989; 1994) estimation of the synthesis model of Frankel and Wei (2007) in order to gauge the timing, possibility, and extent of a switch to a regional-currency-unit basket peg. Monthly data from January 1999 through May 2009 are used. This estimation is shown to be dominant for a larger number of countries than the Bai and Perron (2003) multiple structural break model [applied to the synthesis model by Fankel and Xie (2010)]. Second, forward positions—held by a number of east-Asian central banks in the foreign exchange market—are taken into account in order to better assess changes in the degree of exchange rate flexibility, through the exchange-market-pressure term. Finally, the composition of the basket is assessed using statistical measures, based on Principal-Component Analysis (PCA), to assign weights to the different currencies in the asian currency unit (ACU).

We first show that, far from implying a switch to more exchange-rate flexibility, the end of the east-Asian crisis saw most countries in the region sticking to fixed exchange rates. The rare exceptions were Japan and the Republic of Korea, where flexibility was a frequently dominant feature. We then document that, contrary to a widely-held belief, the east-Asian crisis did not lead to a general retreat to the status quo ante of a noncooperative dollar peg. Instead, it marked the beginning of a new era in which a core group of south-east-Asian countries started including a combination of regional currencies in their baskets. This group was later joined temporarily or permanently by other countries, as well as by northeast Asian countries. Given our first finding on the dominance of fixed exchange rates, such a basket cannot be the by-product of common shocks to countries in the region, or of market forces. Such deliberate moves certainly reflected appreciation of increasing regional interdependence. It also must have contributed to preserving stability in the region during the global financial crisis, and to forestalling beggar-thy-neighbor policies.

Section 2 of this paper reviews the literature on basket pegging in east Asia. In section 3, the econometric methodology and data are introduced, and construction of alternative ACUs is explained. Section 4 presents the results of the alternative regime-switching estimations of the "synthesis model." Section 5 interprets the results and examines their implications for regional cooperation. Conclusions are presented in section 6.

[1] Brunei Darussalam, Cambodia, the PRC, Indonesia, Japan, the Republic of Korea, the Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam.

2. PEGGING TO A BASKET AND HOW TO FIND IT

2.1 Optimality of a Peg to a Regional Basket

The set for the choice of exchange rate regimes for east-Asian countries excludes corner solutions—such as currency boards or free floats—and comprises three options: (i) a unilateral (often implicit) dollar or basket peg, (ii) some form of multilateral regional exchange rate arrangement on the way to monetary union, and (iii) flexible (often managed) exchange rates. The east-Asian financial crisis led observers to question the heavy reliance of emerging east-Asian countries on a dollar or basket peg, since implicit exchange rate targeting was often combined with an implicit government bail-out guarantee for domestic banks. The 1997–1998 crisis showed, often painfully, that such a combination created a moral hazard through a new impossible trinity, involving exchange-rate targeting, free capital flows, and a bail-out guarantee (Dooley 2000). In the aftermath of the crisis, global financial institutions—particularly the International Monetary Fund (IMF)—commonly recommended that such countries rely on flexible exchange-rates with inflation targeting. While a number of emerging east-Asian countries indeed complied officially with such recommendations, it is now common knowledge that many of them de facto continued, to varying degrees, to target their exchange rate with the US dollar [see the Frankel and Wei (1992) type of test for east Asia applied by Kawai (2007) and Kearney and Muckley (2007), and complementary evidence by Hernandez and Montiel (2003)].

Another by-product of the east-Asian crisis were calls by regional organizations and some observers for the start of financial cooperation in the region (Girardin 2004). However, after cleaning up the financial turmoil generated by the crisis, most attention focused on the monetary side of regional cooperation. Some observers championed a basket currency, possibly anchoring a regional currency arrangement not dissimilar to the Exchange Rate Mechanism (ERM) of the European Monetary System (Kawai 2007). Active debate centered on the costs and benefits of such a basket currency, its composition—particularly with respect to the weights to be used, as well as its potential functions. Would it initially serve as the basis of a divergence indicator, or as the currency for denomination of bonds (Girardin and Steinherr 2008)? The diversity of the east-Asian countries involved (among ASEAN+3) was so large—compared to the similarity of initial ERM member countries [even if trade integration was similar (ADB 2008)]—that it led to a high degree of skepticism about the likelihood of the birth of an Asian Exchange Rate Mechanism. The diversity in economic size and level of development among east-Asian countries was particularly crucial in that these characteristics were changing rapidly across the region.

2.2 Inferring De Facto Exchange Rate Regimes

Generalizing work on bilateral pegs proposed by Giavazzi and Giovannini (1990) to a multi-anchor or basket peg, Frankel and Wei (1992) suggested using the following estimation equation to infer de facto weights in the basket:

$$\Delta log S_t = c + \Sigma_j \, \omega_j \, \Delta log E_{jt} + u_t \qquad (1)$$

where S_t is the number of SDRs per unit of domestic currency, and E_{jt} is the number of SDRs per unit of currency j, with j= dollar, euro, yen. The numeraire chosen should be similar to the one used by governments in measuring deviations from the target basket. It is likely they would use a weighted average of currencies instead of the Swiss franc (which was initially used in such estimations). Inserting a similar measure in the equation minimizes the correlation between the numeraire and the error term (Frankel and Wei 2008).

Frankel and Wei (1992) interpreted, for example, a coefficient ω close to unity for the dollar—with a small standard error and a high explanatory power—as implying a tight peg to the dollar for the domestic currency during the estimation period. In another line of inquiry,

work attempting to provide a de facto classification of exchange rate regimes—such as Gosh, Gulde, and Wolf (2002) and Levy-Yeyati and Sturzenegger (2003), which Hernandez and Montiel (2003) built on for east Asia—does not look at exchange-rate variability alone (prices), but rather compares it to the variability in foreign currency reserves (quantities). The question they address is: when there is a shock that increases international demand for the domestic currency, to what extent do authorities allow it to show up as an appreciation, and to what extent as an increase in foreign-currency reserves?

In order to encompass the two approaches, Frankel and Wei (2008) propose to augment the Frankel and Wei (1992) specification (equation 1) with an Exchange-Market-Pressure (EMP) variable. EMP is defined as the sum of the changes in the value of the currency and in foreign-currency reserves. The estimation-equation of the synthesis model suggested by Frankel and Wei (2008) is as follows:

$$\Delta logS_t = c + \Sigma_j \omega_j \Delta logE_{jt} + \gamma \Delta logEMP_t + v_t \quad (2)$$

where the percentage change in EMP is calculated as

$$\Delta logEMP_t = \Delta logS_t + \Delta logR_t. \quad (3)$$

with the foreign-currency reserves denoted by R_t. The $\omega(j)$ coefficients capture the de facto weights on the constituent currencies, while the de facto degree of exchange-rate flexibility is measured by coefficient γ. The polar exchange-rate regimes are represented by the extreme values of the latter coefficient. A pure float corresponds to $\gamma = 1$, since, in the absence of intervention in the foreign exchange market, foreign currency reserves do not change. A completely-fixed exchange-rate regime is detected when $\gamma = 0$, which implies that the exchange rate never changes in value. Any value of γ between *0* and *1* indicates intermediate exchange-rate regimes.

In order to ensure that all coefficients sum to unity, Frankel and Wei (2008) suggest subtraction of pound-sterling returns from currency returns on both sides of equation (3), as in (4):

$$(\Delta logS_t - \Delta log£_t) = c + \Sigma_j w_j (\Delta logE_{jt} - \Delta log£_t) + g\, \Delta logEMP_t + \varepsilon_t \quad (4)$$

where $£_t$ equal the number of SDRs per pound sterling, and the coefficient [1- {$\Sigma w(j)$}] represents the weight on the pound.

2.3 Detecting Regime Changes in Basket Composition

The possibility that the composition of basket pegs, as detected by the estimation of equations such as (4), may change over time was initially examined simply through splitting the sample in an ad hoc way, or around known policy changes [as for the yuan in Frankel and Wei (2007), updated by Frankel (2009) and Shu, Chow, and Chan (2007)]. Rolling regressions (Kawai 2007) or time-varying unobserved-component methods are also used (Ogawa and Sakane 2006). Very recently, multiple structural break tests, designed by Bai and Perron (2003), have been used to endogenize dates of regime changes, between which a linear estimation of equation (4) is implemented. This methodology is used with daily data (beginning in the late 1990s) for the Thai baht by Frankel and Xie (2010), and by Zeileis, Shah, and Patnaik (2010) beginning in the late 1970s.

The use of Markov-switching models to allow the exchange-rate dynamics to alternate between regimes was pioneered by Engle and Hamilton (1990). They show the presence of long swings in the mean and volatility of the US dollar–German mark exchange rate with quarterly data from 1973 through 1988. Engle (1994) extends the evidence to 18 currencies, and further extensions are provided by Bollen, Gray, and Whaley (2000). Cheung and Erlandsson (2005) show with simulations the importance of testing for the presence of

regime-switching against the linear alternative. Their results imply that a sufficiently high frequency must be used since a Markov-switching specification may be rejected for a quarterly frequency but accepted for a monthly frequency. Markov-switching models also provide evidence of regime changes in stock markets—with bull and bear episodes (Girardin and Liu 2003), or in economic activity—with growth cycles (Girardin 2005). They were extended to allow for regime changes in the coefficients of explanatory variables, or even in a vector-autoregressive framework (Krolzig 1997).

3. METHODOLOGY AND DATA

3.1 Methodology

Instability in the estimated coefficients of the synthesis equation (4) is indeed an important issue. A major difficulty faced by standard methods of estimation, and even less-standard methods of break detection, is that the global financial crisis is a recent development, possibly leaving too few observations after the break. Given this difficulty, it seems relevant to compare two alternative approaches to regime-switching detection: Hamilton's (1989; 1994) Markov-switching, and the Bai and Perron (2003) multiple structural break test.[2]

Markov-Switching Approach

The strength of the Markov-switching approach is that it detects the rise of regimes which may have been present in the past, even temporarily (Hamilton 1989). The relevant sample size is thus much larger than a few recent observations. In the Markov-switching specification, all coefficients in equation (4) can become regime dependent. The estimation equation of the regime-dependent version of the synthesis model of Frankel and Wei (2008) that we employ for two regimes (s=1,2) is then as follows:

$$(\Delta logS_t - \Delta log£_t) = c(s_t) + \Sigma_j\, w_j\,(s_t)\,(\Delta logE_{jt} - \Delta log£_t) + g(s_t)\,\Delta logEMP_t + \Sigma_k\, b_k\,(s_t)\,(\Delta logS_{t-k} - \Delta log£_{t-k}) + \sigma(s_t)\,\mu_t \quad (5)$$

In a regime-switching model of returns, some or all parameters depend on an underlying unobservable stochastic variable, s_t, which aims at representing the phases of the returns regimes (Hamilton 1994). Use of this approach enables us to assign probabilities to the occurrence of the different regimes. In its most popular version, which we use here, it is assumed that the process s_t is a first-order Markov process (Hamilton 1989), while higher-order processes are much less frequently used. We also allow for the dynamics arising from autoregressive lags whenever they prove significant, according to information criteria, and useful to suppress residual autocorrelation. We assume that the regime-generating process is an ergodic Markov chain with a finite number of states, governed by constant transition. All coefficients of equation (5), plus the variance, are assumed to be regime-dependent. We use standard information criteria to check that the null of linearity is rejected.

An expected maximization algorithm for maximum likelihood estimation is used to obtain estimates of the parameters in such a Markov-switching model (Hamilton 1994). For a given parametric specification of the model, probabilities are assigned to the unobserved-return regimes, conditional on the available information set which constitute an optimal inference on the latent state of the economy. We thus obtain the constant probability of staying in a given regime when starting from that regime, as well as the probability of shifting to another regime. The classification of regimes and the dating of periods imply that every observation in the sample is assigned to one of the regimes. We assign an observation to a specific

[2] The first to use this method was made by Patnaik and Shah (2010), who were unable to detect any recent break for the few Asian currencies they examined (PRC yuan, Republic of Korean won, and Indian rupiah). Frankel and Xie (2010) used it on weekly data with a controversial interpolation of monthly reserve data.

regime when the smoothed probability of being in that regime is higher than 0.5. The smoothed probability is computed by using all observations in the sample.

Multiple Structural Break Test

An alternative approach to detect structural beaks was proposed by Bai and Perron (2003). It is important to test the hypothesis of structural breaks against the no-break alternative in case the multiple regime Markov-switching specification is rejected in favor of linearity. Moreover, it may be of interest to use information criteria (Schwartz's Bayesian criterion) to test the multiple break assumption against the Markov-switching one.

The multiple-break specification of the synthesis equation (4) is as follows[1]:

$$(\Delta logS_t - \Delta log£_t) = c_i + \Sigma_j w_i(i)\,(\Delta logE_{jt} - \Delta log£_t) + g(i)\,\Delta logEMP_t + \Sigma_k b_k(i)\,(\Delta logS_{t-k} - \Delta log£_{t-k}) + \varpi_t \quad (6)$$

$$t= T_{i-1}+1,\ldots,T_i;\ T_0=0;\ T_{m+1}=T; \quad i=1,\ldots,m+1.$$

The specification in (6) allows m structural breaks, and m+1 exchange-rate-regime parameters (g), as well as basket weights (w), intercepts (c), or autoregressive coefficients. The break dates are endogenous (not known in advance). Break dates are estimated using Generalized Least Squares. Subsequently, the best partition (T1,…,Tm) is obtained by using dynamic programming, as suggested by Bai and Perron (2003), in order to minimize a partition-dependent objective function. For the best partition we obtain for each linear regime the b, c, g, and w parameters. A minimum window of 12 months between two breaks is used, which corresponds to up to 10% of the observations[2].

Common Factor Estimation

We use principal component analysis (PCA) to extract the common component in east-Asian exchange-rate returns in which the estimated factors are only linear combinations of current exchange-rate returns for the component currencies. We thus refrain from using some alternative estimation techniques (e.g., Forni, Lippi, and Reichlin 2000), since they involve leads and lags. The traditional approach to the implementation of PCA is based on the linear projection of the original data onto a space where the variance is maximized. Employing such PCA, with X_t an N-dimensional multiple time series (in our case, currency returns), it is assumed that the latter admit a factor-model representation with r common latent factors F_t:

$$X_t = A\,F_t + e_t \quad (7)$$

where e_t is an N x 1 vector of idiosyncratic disturbances. In cases where such idiosyncratic disturbances are cross-sectionally independent and temporally independent and identically distributed (i.i.d), then (7) would correspond to traditional factor analysis. However, to the extent that such assumptions are unlikely to be met, we prefer to employ the methodology suggested by Stock and Watson (2002), which allows the error terms to be cross-sectionally and serially correlated.

3.2 Data and Construction of Regional Monetary Units

The source of data used in this paper is the IMF's International Financial Statistics CD-ROM. These data include both mean monthly exchange rates expressed in terms of SDRs, and end-of-month foreign-currency reserves for 12 of the 13 ASEAN+3 countries. Data for reserves covering our sample for the Lao People's Democratic Republic (Lao PDR) are unavailable. The data sample spans January 1999 through May 2009. Two alternative

[1] This corresponds to the specification suggested by Frankel and Xie (2010).

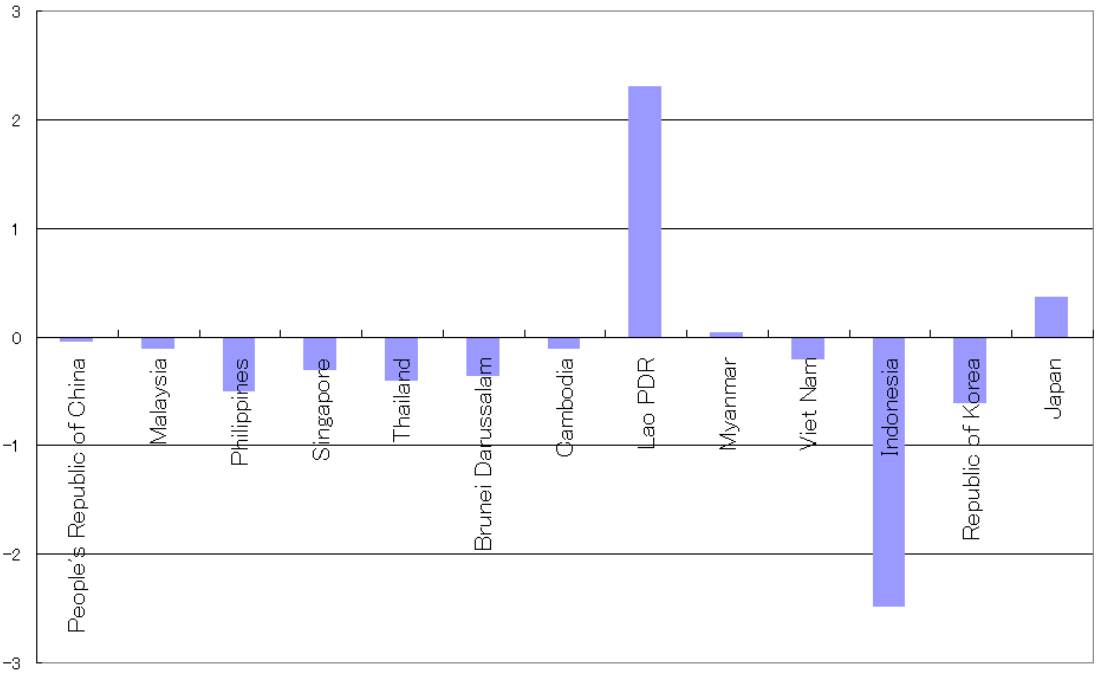
[2] We make an exception for the PRC yuan since the July 2008 break is only ten months before the end of our sample.

measures of an ACU for east Asia are used in this paper, both constructed employing PCA. In order to construct an EMP index, forward positions of central banks in the foreign exchange market are used, extracted from the IMF Special Data Dissemination Standard (SDDS) database.

Common Factor

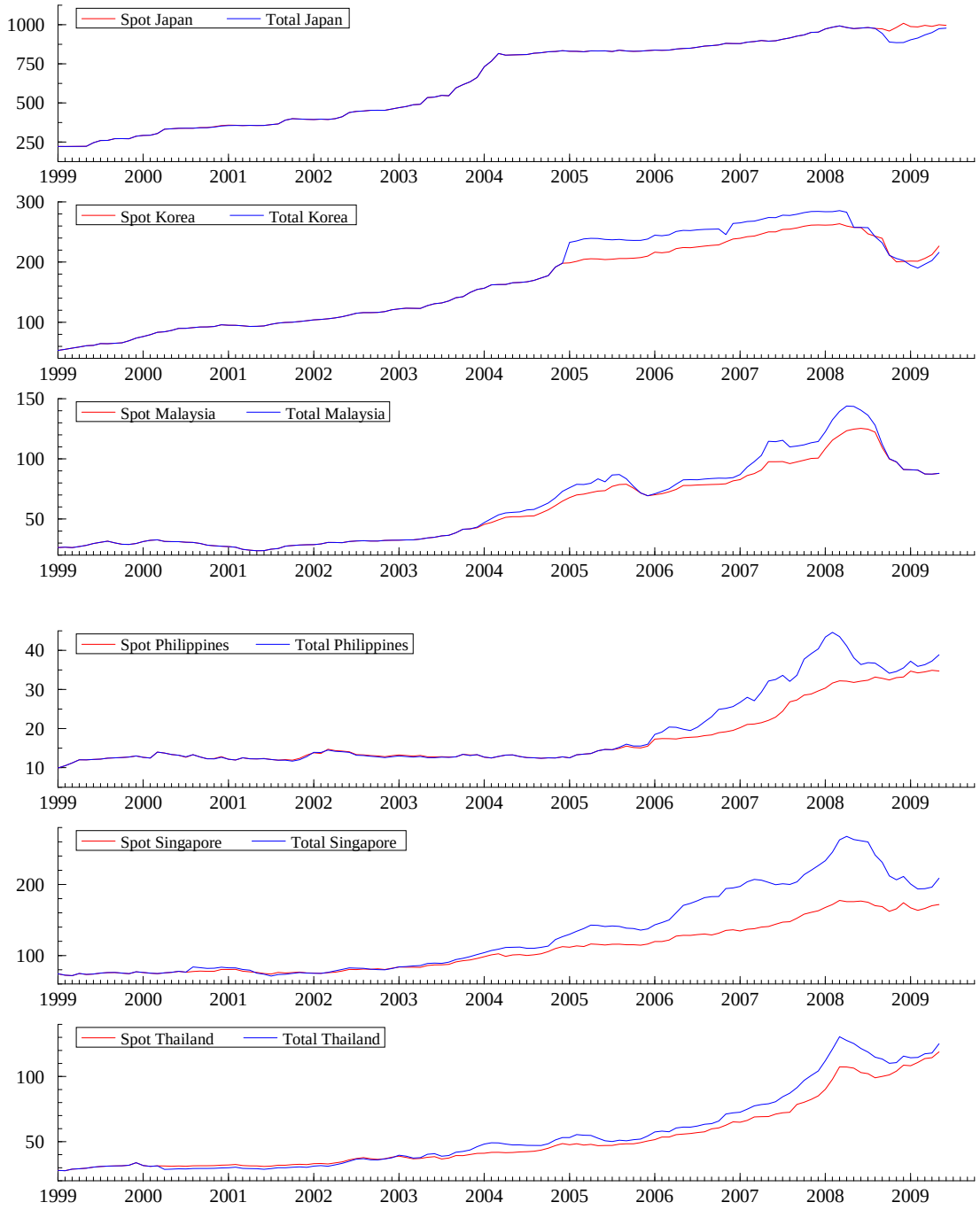
Common factors are extracted using the Stock and Watson (2002) method for PCA and applied to the SDR returns of the currencies of the 13 ASEAN+3 countries. In the first factor (ACU-PC13), a group of 11 currency returns move in the same direction on average but at very different frequencies, with Indonesia's currency return moving much more than those of other countries (Figure 1). The yen and the Lao PDR kip move in the opposite direction. In subsequent analysis, the first principal component for 11 currencies (ACU-PC11) is extracted, with those for Japanese and Lao PDR currencies excluded. In all cases, such a first factor accounts for more than two-fifths of the variance, and is the only one with an eigenvalue larger than one.

Figure 1: Weights in Stock and Watson Principal Component Analysis, February 1999 to May 2009



Source: Author's calculations

Figure 2: Spot and Total Reserves (including forward positions) Held by Some East-Asian Central Banks (US$ billion)



Source: International Monetary Fund: International Financial Statistics and SDDS

Foreign Currency Reserves with Forward Positions

Six central banks in east Asia held substantial forward positions over at least part of our sample period. Indonesia also used them from 2005 to 2008, but with with initial (and final) upward (and downward) discrete jumps which did not alter the dynamics of its reserves (thus not reported here). In all cases except Japan in late 2008 and early 2009, such positions enabled these countries to enhance their total reserves (Figure 2). The addition to spot reserves represented by forward positions was constant for the Republic of Korea from late 2005 to mid-2008, while it rose over time in the Philippines and Singapore. For Malaysia and Thailand, it was substantial only from 2007 onwards. Accordingly, for these countries changes in total reserves may be substantially different from movements in spot reserves.

4. UNCOVERING DE FACTO EXCHANGE RATE REGIMES IN EAST ASIA

Estimating the synthesis model of Frankel and Wei (2008) in a regime-switching framework, we compare the Markov-switching and structural-break models in order to investigate the possible move toward greater exchange rate flexibility and the extent of targeting a regional monetary unit (RMU) by east-Asian countries.

4.1 From Dollar to Asian Currency Unit Pegging

A majority of currencies in the region (9 out of 13) show evidence of a change in regime over the 1999–2009 sample. The Markov-switching specification with two regimes for equation (5) is indeed accepted for six countries (Cambodia, Japan, the Republic of Korea, Malaysia, Myanmar, and Viet Nam) on the basis of Schwartz's Bayesian information criterion reported in Table 1, column 2. Figures 3 to 6 present for each of the six countries with regime change the smoothed probabilities of the first regime (the probability of the second regime is simply the complement to unity). Three countries (the PRC, Indonesia, and the Lao PDR) show evidence of a dominance of the structural-break model (Table 1, columns 3 to 6). In contrast, the linear specification with no break is dominant for the Philippines, Singapore–Brunei Darussalam,[4] and Thailand (Table 1, column 1).

[4] Brunei Darussalam had a currency board vis-a-vis the Singapore dollar over the whole of the sample period used in this paper. With a Singapore-dollar peg being the dominant specification, there was not a detectable difference between the behaviors of the two currencies.

Table 1: Linearity versus Regime-Switching Tests

BIC-SC	Linear	Markov-switching	BP : 1 break	BP : 2 breaks	BP : 3 breaks	BP : 4 breaks	Break dates
Cambodia	-10.236	**-10.598**	-10.168	-9.969	-9.951	-9.862	-
PRC	-11.386	-11.338	-11.665	-11.948	**-12.107**	-12.067	2005 :6 2007 :3 2008 :4
Indonesia	-6.612	[a]	-6.75	**-6.785**	-6.742	-6.684	2000 :1 2008 :3
Japan	-8.03	**-8.208**	-8.111	-8.102	-7.995	-8.124	-
Republic of Korea	-8.574	**-8.758**	-8.452	-8.455	-8.438	-8.353	-
Lao PDR	-6.47	[a]	**-6.65**	-6.50	-6.381	-6.25	2000 :1
Malaysia	-9.72	**-15.458**	-10.354	-10.599	-11.0	-11.557	-
Myanmar	-11.637	**-12.392**	-11.579	-11.601	-11.443	-11.344	-
Philippines	**-8.957**	-8.738	-8.855	-8.833	-8.710	-8.589	-
Singapore	**-10.05**	-10.028	-9.763	-9.565	-9.373	-9.215	-
Thailand	**-8.677**	-8.618	-8.536	-8.498	-8.203	-8.037	-
Viet Nam	-8.68	**-11.08**	-9.09	-8.95	-8.82	-8.67	-

BIC-SC = Schwartz Bayesian Information Criterion, BP = Bai and Perron test, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Notes:

In all cases BIC-SC corresponds to the estimation of equations (4) and (5) for each currency. The specification used corresponds to dollar and euro for Indonesia and Viet Nam. In addition, the yen (ACU-PC13) is included for the Republic of Korea and Myanmar (PRC and Japan). For all other countries, ACU-PC11 replaces ACU-PC13.

ACU-PC11 and ACU-PC13 report the first Stock and Watson (2002) principal component among 11 and 13 currencies, respectively, excluding and including the Lao PDR kip and the yen.

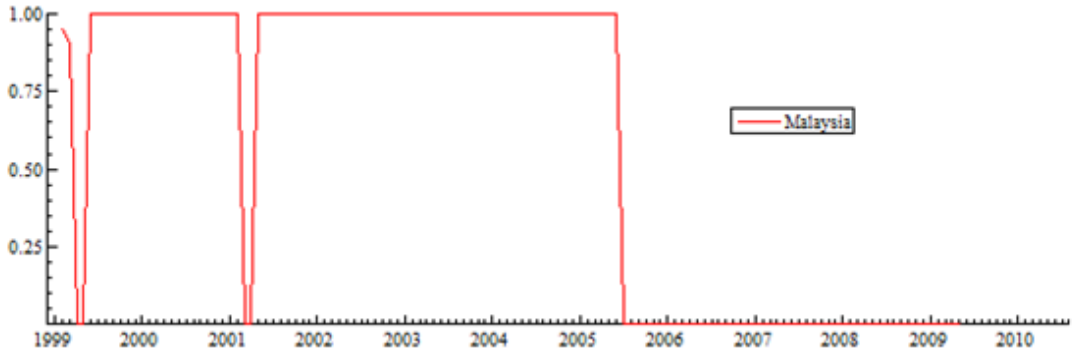
The first column corresponds to the linear specification. Column (2) reports the Markov-switching two-regime case. Subsequent columns report the Bai and Perron (2003) tests for one to four breaks. The best models are highlighted in bold letters.

[a] For Indonesia and the Lao PDR, even though the Markov-switching specification minimized the BIC (6.818 and 8.038, respectively), one of the regimes presented insignificant parameters.

Source: Author's calculations

Figure 3: Currency with Main Regime Change in 2005

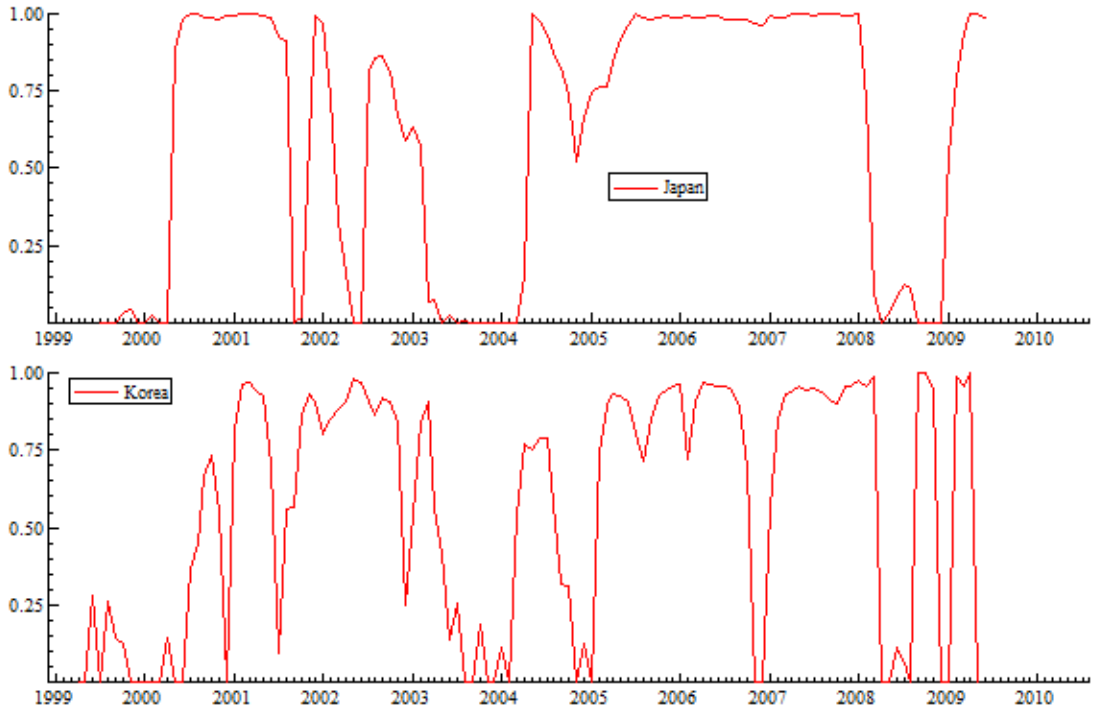
(Probability of Regime One)



Source: Author's calculations

Figure 4: Currencies with Main Regime Change in 2003–2004

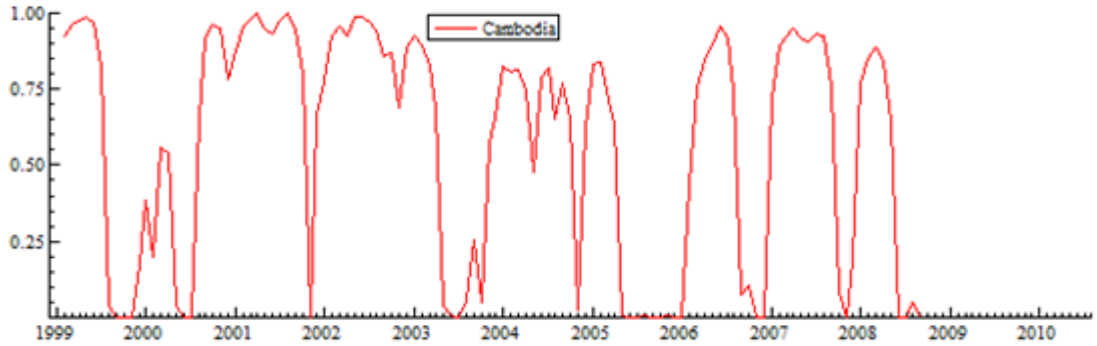
(Probability of Regime One)



Source: Author's calculations

Figure 5: Currency with Main Regime Change in 2003–2004 and 2005–2006

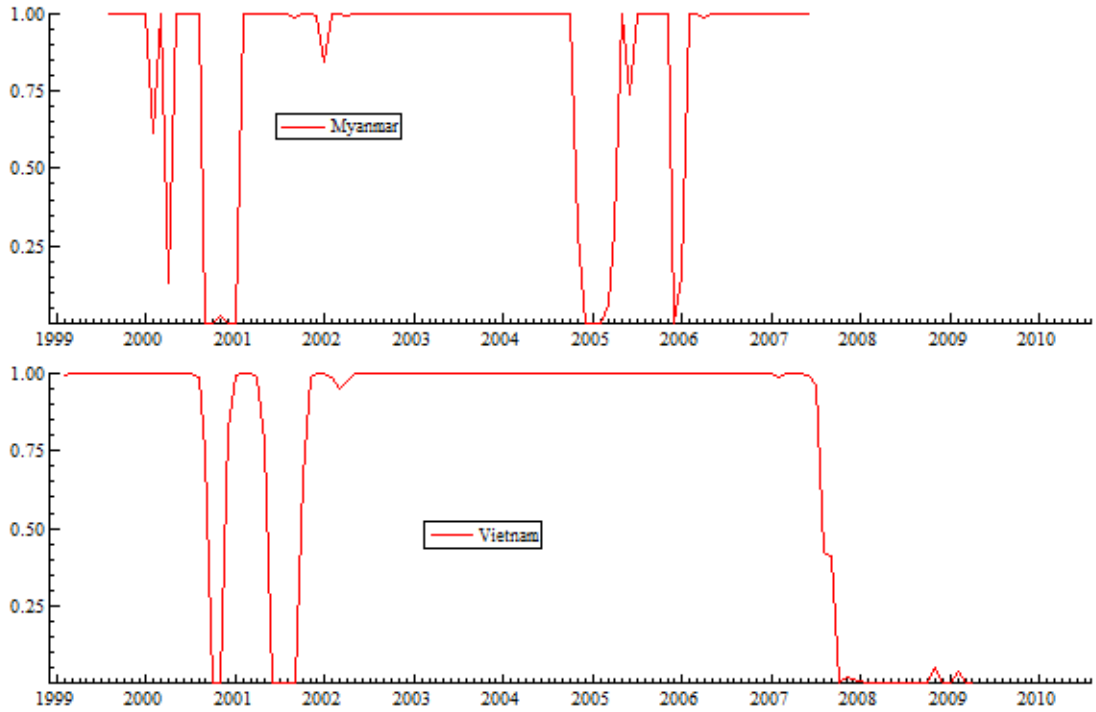
(Probability of Regime One)



Source: Author's calculations

Figure 6: Currencies with Other Timing in Regime Change

(Probability of Regime One)



Source: Author's calculations

On the basis of these results, across specifications, five categories of countries are notable. The first group, which includes Malaysia and the PRC, is characterized by a sharp and persistent regime change in mid-2005. However, the PRC subsequently departs from Malaysia since it shows a first break in March 2007—during its managed-float period—and a second break in the early summer of 2008 (Figure 3 and Table 1, column 7). In a second group, which includes Japan and the Republic of Korea with a broadly similar timing, the regime change occurred earlier (in 2003), was temporary (ending in 2004), but reemerged in 2008–2009 (Figure 4). In the case of Japan, the first occurrence of this other regime corresponded to a period of well-documented heavy intervention by Japanese authorities (Girardin and Lyons 2008). Cambodia belongs to both the first and second groups since it showed evidence of temporary regime change in both 2003 and in 2005, as well as a

reemergence of the second regime at the end of the sample (Figure 5). In the fourth group, composed of Myanmar and Viet Nam, some temporary regime changes occurred in late 2000 or early 2001, as well as in early 2005 for the former country and from 2007 onwards for the latter (Figure 6). Viet Nam showed evidence of a new regime in late 2007. Finally, in both Indonesia and the Lao PDR, a new regime appeared with the new millennium—in a permanent way for the latter country, but only for 8 years in the former. The stability of the currency regimes of the Philippines, Singapore-Brunei, and Thailand is remarkable.

4.2 Exchange Market Pressure

The coefficient of EMP in the single (different) regime(s) enables us to gauge the degree of flexibility of the exchange rate regimes adopted by the ASEAN+3 countries (Table 2). Flexible exchange rates were present in the dominant regime (regime One) and already in action in the new millennium—unambiguously in Japan, and less so in the Republic of Korea, with an EMP coefficient equal to 1.0 for Japan and 0.7 for the Republic of Korea.

Table 2: Coefficient on Exchange Market Pressure

Regime	**Cambodia**	**PRC (a)**	**Indonesia (b)**	**Japan**	**Rep. of Korea**	**Malaysia**
One	0.01	**0.00/0.00**	0.281**	1.0**	0.7**	0.0
Two	0.06*	**0.16**/0.21****	-	0.2**	0.25*	0.09**
Regime	**Myanmar**	**Philippines**	**Singapore**	**Thailand**	**Viet Nam**	
One	0.0	0.21**	0.13**	0.32*	0.01	
Two	0.0	-	-	-	0.3**	

** = significant at the 5% (* 1%) level, PRC = People's Republic of China, Rep. = Republic.

Notes:

1. The Lao People's Democratic Republic was omitted due to the unavailability of foreign currency reserve data over our sample. In all cases this corresponds to the estimation of equation (4) or (5) for each currency.

2. Sample: January 1999–May 2009, Regime One and Two are as defined in the Markov-switching estimation, except:

Regime One corresponds to February 1999–June 2005 and July 2008–May 2009, and the alternative regime to July 2005–March 2007/March 2007–June 2008.

(b) January 2000–February 2008.

Source: Author's calculations

The usual "fear of floating" (Calvo and Reinhart 2002) seems to have been widespread among the remaining 11 countries. A de facto fixed exchange-rate regime is documented with different modalities in two groups of countries. Indeed, such a regime is valid for the whole sample for Cambodia, Malaysia, and Myanmar. It is valid only in regime One for the PRC [confirming the evidence provided by the rolling regressions of Frankel (2009)] and Viet Nam, both characterized by the presence of an alternate intermediate regime with only a moderate EMP coefficient (0.15 to 0.3). Such an intermediate regime is present all along for Indonesia, the Philippines, Singapore–Brunei Darussalam, and Thailand.

4.3 Targeting Blocs in East Asia

With respect to the composition of the basket to be included in the specification—selected, for a given number of regimes, on the basis of likelihood-ratio tests—four categories of currencies can be distinguished (Table 3). First, the PRC before mid-2005 and after mid-2008 was the only country where the dollar-only specification dominated. Second, Indonesia (up to the summer of 2008) and Viet Nam included the euro as well as the dollar. In addition

to these two currencies, the yen was included for a group of three countries—the PRC (2007–2008), the Republic of Korea, and Myanmar. All other countries included some regional monetary unit on top of the dollar-euro. In a majority of cases—i.e., for Cambodia, the Lao PDR, Malaysia, the Philippines, Singapore–Brunei Darussalam, and Thailand—this ACU represented the 11-country factor, excluding the yen and the Lao PDR kip. Two countries were singled out with the inclusion in their basket of a 13-country factor: Japan during the period of heavy intervention in 2003–2004 and the PRC in the first part of its managed-float period (July 2005–March 2007).

On the basis of the weights on the different components of the basket in the single regime, or in each of the regimes, a return to a dollar peg after the east-Asian crisis is confirmed only for a minority of countries, including Cambodia, the PRC, Malaysia, and Viet Nam (Table 4). A "yen bloc," in which the yen was targeted alongside the euro and the dollar, was present permanently for the Republic of Korea and Myanmar, but only for a limited time in the PRC (in the second part of the managed-float period). An RMU bloc had already emerged in the late 1990s and remains in place in the Lao PDR (from the early 2000s), the Philippines, and Singapore–Brunei Darussalam, as well as in Thailand. The bloc was joined in mid-2005 by Malaysia (permanently) and by Cambodia and the PRC (temporarily); Japan joined the bloc temporarily in 2003–2004. It is remarkable that the weights on the dollar, the 11-country ACU-PC11, and the euro were almost identical for the Philippines, Singapore–Brunei Darussalam, and Thailand, and have been invariant since the late 1990s. It is well known that Malaysia followed the PRC in abandoning the dollar peg in July 2005, but our results show that this emulation went as far as replicating closely the weights on the dollar, the euro, and the RMU set by the PRC authorities. These results confirm for the yuan the rolling-regression estimates of the synthesis model (Frankel 2009),[5] which show that (in a four-currency basket) the weights on the dollar and the euro respectively fell and rose to 0.5 and 0.45 in the first semester of 2008. The presence of an RMU in the yuan basket from 2005 to 2007, as well as the weight obtained for the dollar, conform with speeches in 2005 and 2006 by Zhou Xiaochuan, Governor of the People's Bank of China (Zhu 2005; 2006). He confirmed that 11 currencies were included in the basket—selected on the basis of shares of trade in goods and services, foreign direct investment, and current transfers—and that the weight of the dollar was close to half.

A high value of the coefficient of determination (R^2) in the Frankel and Wei (1992) model is sometimes interpreted as a sign of limited exchange rate flexibility (Zeileis, Shah, and Patnaik 2010). On this metric, unavailable for Markov-switching models, the PRC shows the least flexibility of all the regimes, followed by Singapore–Brunei Darussalam, the Philippines, and Thailand with limited flexibility. Indonesia shows a high degree of flexibility, which is in contradiction with the more rigorous result from the EMP coefficient. The Lao PDR shows some flexibility, which made up for the lack of sufficient data on reserve holdings and the resulting inability to build an EMP measure. At any rate, the intercept can be interpreted as giving an indication of trend appreciation (depreciation) vis-a-vis the SDR when it is significantly positive (negative). In almost all cases, the only documented trend corresponded to a depreciation as reported in the penultimate column of Table 4. In the case of the PRC over the two subsamples spanning July 2005–July 2008, the latter results confirm the findings of Frankel (2009), with the difference that the intercept is significant here. Finally, by construction, equations (4) and (5) imply that one minus the sum of reported weights on basket components corresponds to the weight on the pound sterling. The latter weight was smaller than 5% for the vast majority of countries. The only true exceptions were Myanmar and Thailand, since in the other two cases—the first regime for Japan (Republic of Korea)—this corresponds to (close to) free floating, a regime where the adding up constraint does not apply.

[5] In contrast, Zeileis, Shah, and Patnaik (2010) were unable to document departures from a full dollar peg during the managed float period of the yuan—which raises questions about the adequacy of the modified Bai-Perron procedure they developed.

Table 3: Specification Test: Basket Composition for East-Asian Currencies

Log Likelihood	US Dollar	US Dollar and Euro	+Yen	+ACU-PC11	+ACU-PC13	AR(L)
Cambodia	434.6	435.8	460.5	460.7*	446.4	7
PRC (a)	607.07*	608.12	608.28	608.46	608.16	1
	95.5	100.59	100.75	99.44	102.30*	1
	62.7	70.1	80.0*	66.06	69.76	1
	48.7*	48.7	48.8	48.86	48.89	1
Indonesia (b)	229.1	232.5*	233.1	n.a.	n.a.	0
Japan	344.8	374.9	-	375.7	379.8*	5
Rep. Of Korea	370.4	377.2	404.7*	380.3	377.9	2
Lao PDR (c)	300.3	302.9	304.1	311.1*	310.0	0
Malaysia	780.8	788.7	788.8	816.4*	790.0	6
Myanmar	369.3	419.8	509.5*	425.8	437.7	6
Philippines	368.7	381.2	382.4	391.4*	383.4	0
Singapore	404.4	447.2	419.3	450.9*	449.6	7
Thailand	350.7	367.5	367.9	372.4*	368.9	3
Viet Nam	533.7	535.8*	537.4	536.0	536.3	0

ACU-PC11 and ACU-PC13 report the first Stock and Watson (2002) principal component among 11 and 13 currencies, respectively, excluding and including the Lao PDR kip and the yen; Lao PDR = Lao People's Democratic Republic; PRC = People's Republic of China; Rep. = Republic.

Notes:

1. AR(L) denotes the number of autoregressive lags necessary to ensure the absence of autocorrelation.

2. ACU-PC11 and ACU-PC13 report the first Stock and Watson (2002) principal component among 11 and 13 currencies, respectively, excluding and including the Lao PDR kip and the yen.

3. N.a. (not available) means that the specification yielded inconsistent coefficients.

4. The benchmark in all specifications is the dollar and euro basket for which the Log likelihood is reported in the first column. The specifications reported in the other columns add in turn one variable to that benchmark. For the associated likelihood ratio test to be significant at the 1% and 5% level, the likelihood should be larger than the one reported for the benchmark by an amount of 3.3 and 1.9, respectively. Figures followed by a star indicate the best model chosen on the basis of a likelihood ratio test. In all cases this corresponds to the estimation of equation (4) or (5) for each currency respectively for the linear and Markov-switching models.

5. Sample: January 1999–May 2009, except:

(a) first row: January 1999- June 2005; second row: July 2005–March 2007; third row: March 2007–June 2008; Fourth row: July 2008-May 2009.

(b) January 2000–February 2008; and

(c) January 2000–May 2009

Source: Author's calculations

Overall, three "blocs" can be distinguished in the light of the above results. The first, a dollar bloc, from the late 1990s or early millennium, included Cambodia, the PRC, Malaysia, and Viet Nam. A second bloc included countries with stable exchange-rate regimes over the entire sample which formed the core of an ACU bloc: the Lao PDR, the Philippines, Singapore–Brunei Darussalam, and Thailand. This bloc was joined by Malaysia and the PRC in mid-2005, as well as occasionally by Cambodia and temporarily by Japan. Both Japan and the PRC targeted a wider ACU than the other countries in the bloc since they included the yen. The third bloc comprised Indonesia, the Republic of Korea, and Myanmar (joined by Viet Nam in 2008), which targeted the dollar and the euro (to which the Republic of Korea added the yen).

Table 4: Currency Weights in the Baskets of East-Asian Currencies

RRg1	US Dollar	Euro	Yen	PC11	PC13	Cst.	R^2
Cambodia							
1)	0.99			0.31		-0.02	n.a.
2)	0.64					-0.65**	
People's	1.00					0.00	0.999
Republic of	0.58	0.16			0.19	-0.23**	0.991
China	0.44	0.42	0.15			-0.44**	0.98
(a)	0.95					0.00	0.991
Indonesia (b)	0.55	0.45				-0.55**	0.361
Japan							
1)		0.44				-0.63**	n.a.
2)	0.40				0.60	0.00	
Rep. of Korea							
1)	0.19	0.22	0.29			-0.38**	n.a.
2)	0.43	0.06	0.31			-0.28	
Lao PDR (c)	0.60			0.42		0.00	0.64
Malaysia							
1)	0.99					0.00	n.a.
2)	0.55	0.21		0.17		0.19	
Myanmar							
1)	0.42	0.30	0.15			0.02**	n.a.
2)	0.27	0.05	0.11			-0.32**	
Philippines	0.49	0.19		0.36		-0.39**	0.84
Singapore	0.45	0.17		0.34		0.00	0.92
Thailand	0.48	0.10		0.30		-0.31**	0.74
Viet Nam							
1)	0.99					-0.13**	n.a.
2)	0.61	0.35				-0.09	

Cst. = intercept; Lao PDR = Lao People's Democratic Republic; ACU-PC11 and ACU-PC13 report the first Stock and Watson (2002) principal component among 11 and 13 currencies, respectively, excluding and including the Lao PDR kip and the yen; , R^2 = Coefficient of determination.

Notes:

1. In all cases this corresponds to the estimation of equation (5) for each currency.

2. N.a. means unavailable for Markov-switching estimation.

3. ** means significant at the 5% level.

4. Since only the significant variables were kept in the linear equations, the adjusted R^2 is very close to the unadjusted one which is reported here.

5. Sample: January 1999–May 2009; 1) corresponds to the Markov-switching regime One, and 2) to regime Two, except:

a) First row: February 1999–June 2005; Second row: July 2005–March 2007; Third row: March 2007–May 2008; Fourth row: July 2008–May 2009.

b) January 2000–February 2008; and

c) January 2000– May 2009.

Source: Author's calculations

4.4 Tests of Robustness

The presence of multicolinearity may seem to put into question the robustness of the results reported in Table 4. In the Appendix we thus report Generalized Method of Moments estimation for the four countries which show stability of a linear model over a long-enough sample: the Lao PDR, the Philippines, Singapore, and Thailand. The single-equation results seem to be robust since the weights are only marginally changed, except for the Philippines, with a rise of the coefficient on the euro (Appendix table).

We experimented with alternative measures of the ACU, such as one constructed in a way similar to the European Currency Unit with weights based on nominal GDP, trade shares, and financial links (as suggested in Girardin and Steinherr 2008). However, such an ACU was always dominated by the ACU-PC for all countries, so the results are not reported.

5. IMPLICATIONS OF ASIAN CURRENCY UNIT PEGS

The presence of a de facto ACU bloc in east Asia and its implications for regional cooperation require explanation.

5.1 Interpretation

Evidence presented in the previous section implies that basket pegs have been the rule in east Asia, with a predominance of an ACU bloc. Such pegs could have been the result of three nonexclusive forces: deliberate exchange-rate targeting by governments [a la Frankel and Wei (1992)], common shocks [as in Hernandez and Montiel (2003)], or market behavior. The strength of the synthesis model compared to the initial Frankel and Wei (1992) specification lies in its ability to help us discriminate between these possible driving forces. Indeed, when the coefficient on EMP was close to zero the interpretations which emphasized the role of common shocks and market factors can be ruled out. This was the case in the dominant (or single) regime for all countries except Japan and the Republic of Korea (where this is true in the alternative regime), and during the global financial crisis for all countries except Thailand and Viet Nam. Accordingly, the dominant presence of an ACU bloc for a large majority of east-Asian countries in the decade following the east-Asian crisis seems to have been due to deliberate action by governments.

5.2 Regional Cooperation in Light of Asian Currency Unit Targeting

Three main implications of the existence of a de facto ACU bloc can be drawn with respect to regional cooperation. First, since a majority of east-Asian countries started targeting the ACU by stealth, with several of them even applying very similar basket weights, it may be better for them to start doing it in a coordinated way, defining jointly the shares of their currencies in the regional basket. This conclusion is supported by our results on the diversity of regional monetary units involved in the targeting: even though a majority of countries de facto coordinated on a common 11-currency target, the two largest countries favored a wider basket. Second, though it may seem that the region would benefit from coordinating on the nature of the target, it is less clear whether details of the target should be made public. Indeed, it may be desirable to keep such information confidential in order to avoid attracting speculative attacks in a world with high international capital mobility (Genberg 2006). Secrecy of targets also would help, in a microstructural perspective (Vitale 1999), maximize the effectiveness of interventions, by keeping the exchange rate target as private information of the authorities.

The third implication concerns regional financial cooperation. To the extent that RMU targeting is present, a regional financial institution would benefit from "officially" declaring some weights as a basis for better coordination of countries on the basket that they target, and for issuance of bonds denominated in such a unit. Further, greater reserve pooling within the Multilateralized Chiang Mai Initiative (CMIM), and strengthened regional economic surveillance within the Economic Review and Policy Dialogue (Kawai and Takagi 2009), may contribute to reaching exchange rate targets de facto adopted by many countries in the region.

6. CONCLUSIONS

This paper has provided evidence about changes in the exchange-rate regimes of east-Asian countries during the decade following the east-Asian financial crisis. Changes in both the degree of exchange rate flexibility and the nature of the basket peg of their currencies were documented.

Evidence for changes in the new millennium in the exchange rate regimes for 9 of the 13 ASEAN+3 countries was found. There was a collective break, but with some lags in the timing. Japan and the Republic of Korea acted early (in 2003–2004) but temporarily, while the PRC and Malaysia acted later (in 2005) but more permanently. Cambodia emulated these four countries, but on a temporary basis. Such strategies, with some countries following the lead of others, may be replicated after the recent decision (June 2010) by the PRC to return to a managed float. At any rate, the global financial crisis corresponded to a break for only one country: Viet Nam.

East-Asian currencies were linked for the entire data sample period to an exchange-rate basket. Since a large majority of them were characterized by the predominance of de facto fixed exchange rates, we were able to rule out common-shocks or market forces as the origins of such baskets in favor of discretionary targeting by governments. Only a few countries allowed a substantial degree of exchange rate flexibility. This was the case in Japan and the Republic of Korea for a substantial part of the sample, including part of the global financial crisis period. It also was true in Thailand and Viet Nam during the global financial crisis. For these four cases, the alternative interpretations may be partly relevant.

A change in the nature of the basket peg of east-Asian currencies was noted. Only a minority of countries (4 out of 13) went back to a dollar peg after the east-Asian crisis, but they later gave some non-negligible weight to the euro, and often to an RMU. The basket composition in east Asia is a three-speed affair. Half of ASEAN countries (the Lao PDR, the Philippines, Singapore–Brunei Darussalam, and Thailand) target, de facto, a basket, with very similar weights, including an RMU, forming a core ACU bloc. This paper is the first to provide such evidence. Such a core group was enlarged temporarily by Cambodia, the PRC, and Japan, and permanently with Malaysia. Some countries, including the PRC (very briefly) and Myanmar (more permanently) rather joined the Republic of Korea in including the yen in their baskets. Finally, Indonesia (most of the time) and Viet Nam (permanently) targeted only the dollar-euro.

Overall, implicit coordination seems to be at work among many countries in east Asia. On one hand, only one country (Viet Nam) left de facto fixity to unilaterally allow more flexibility during the global financial crisis. On the other hand, coordination went much farther than affecting just the timing of regime changes or basket components to involve even the weights in the basket. This was the case with Malaysia following the PRC in 2005–2007, and for the Philippines, Thailand and Singapore–Brunei Darussalam for more than a decade.

At least three significant implications for regional cooperation can be drawn from the above evidence of the de facto ACU bloc in east Asia. First, to the extent that many Asian countries have started targeting an RMU by stealth, it may be better for all of them to start doing this in

a coordinated way, defining jointly the shares of their currencies in the regional basket. Second, it is not clear that countries in the region would benefit from making their (joint) target explicit. Secrecy may help maximize the effectiveness of interventions and provide some protection against speculative attacks in today's environment of highly-integrated international financial markets—unless governments are ready to maintain or strengthen capital controls. The third implication concerns regional financial cooperation. To the extent that RMU targeting is present—and depending on actions taken regarding the previous point—a regional financial institution may wish to declare basket weights in order to facilitate coordinated targeting as well as provide a basis for the issuance of bonds denominated in such a unit. Also, greater multilateral regional reserve pooling may help in reaching the exchange rate targets adopted, de facto, by many countries in the region.

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APPENDIX

Controlling for Multi-colinearity

In order to check whether multi-colinearity may have biased the weights obtained in the currency baskets of east-Asian countries, we conducted Generalized Method of Moments (Hansen 1982) estimation. We included only currencies for which the linear specification was accepted over a long-enough sample (this excluded the People's Republic of China over its second subsample), and in which the east-Asian common factor (ACU-PC11) was significant. As reported in the table, in three-fourths of cases the weights were only marginally changed. The only exception was the Philippines, with a sharp rise of the coefficient on the euro.

Table A1: Generalized Method of Moments Estimation—Currency Weights in the Baskets of Four East-Asian Currencies

FIML [OLS]	US Dollar	Euro	PC11	EMP	Cst.
Lao People's Democratic Republic (a)	0.65		0.35	0.17 [0.19]	0.25 [-0.26]
Philippines	0.33	0.41	0.26	0.21	0.40
Singapore	0.53	0.21	0.27	0.05	
Thailand	0.42	0.27	0.30	0.47	0.48

Cst. = Intercept, EMP = Exchange Market Pressure index, FIML =Full information maximum likelihood estimation , OLS = Ordinary Least Squares, PC11 = principal component among 11 currencies.*Notes:*

1. In all cases this corresponds to the estimation of equation (4) for each currency. Generalized Method of Moments estimation with two lags of all variables plus (when appropriate on the basis of the J-statistic) two lags of the special drawing right (SDR)–Japanese yen returns were used as instruments. All reported parameters are significant at the 5% level, so t-statistics were not reported.

2. Sample: February 1999–May 2009, except: a) January 2000–May 2009.

Source: Author's calculations