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Abstract

Regional monetary and financial cooperation in Asia has been discussed for years. To move towards a coordinated exchange rate policy, Ogawa and Shimizu (2005) proposed both an Asian Monetary Unit (AMU), which is a common currency basket computed as a weighted average of the thirteen ASEAN+3 currencies, and AMU Deviation Indicators (AMU DIs), which indicates the deviation of each Asian currency in terms of the AMU compared with the benchmark rate. The AMU and the AMU DIs are considered both as surveillance measures under the Chiang Mai Initiative and as benchmarks for coordinated exchange rate policies among Asian countries. In this paper, the authors show that monitoring the AMU and the AMU DIs plays an important role in the regional surveillance process under the Chiang Mai Initiative. By using daily and monthly data of AMU and AMU DIs for the period from January 2000 to June 2010, which are available from the website of the Research Institute of Economy, Trade, and Industry (RIETI), they examine their usefulness as a surveillance indicator. Our studies of AMU and AMU DIs confirm the following: first, an AMU peg system stabilizes the nominal effective exchange rate (NEER) of each Asian country. Second, the AMU and the AMU DIs could signal overvaluation or undervaluation for each of the Asian currencies. Third, trade imbalances within the region have been growing as the AMU DIs have been widening. Fourth, the AMU DIs could predict huge capital inflows and outflows for each Asian country. The above findings support the usefulness of using the AMU and the AMU DIs as surveillance indicators for monetary cooperation in Asia.

JEL Classification: F31, F33, F36

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1. INTRODUCTION

Regional monetary and financial cooperation among the monetary authorities of Asian countries has become more robust since the recent global financial crisis of 2007–2008. On 24 March 2010, Finance Ministers and Central Bank Governors of the ASEAN members states, the People's Republic of China (hereafter, PRC), Japan, and the Republic of Korea (ASEAN+3), plus the monetary authority of Hong Kong, China, announced that the Chiang Mai Initiative Multilateralization (CMIM) Agreement had officially come into effect. They also reached agreement on establishing a surveillance office in Singapore, called the ASEAN+3 Macroeconomic Research Office (AMRO). Finance Ministers of the ASEAN+3 countries now have to ensure that technical details are ironed out. AMRO will monitor and analyze the regional economies, which will contribute to early detection of possible currency crises, swift implementation of remedial actions, and effective decision-making in the region.

Regional monetary cooperation in Asia has been discussed for years. Increased cooperation has been deemed necessary not only for preventing future currency crises but also for keeping intra-regional capital flows and exchange rates stable. A number of ideas for how best to promote regional monetary cooperation have been proposed. One way is to create a common currency basket (or regional monetary unit, RMU) and use it for economic surveillance. A common currency basket system with a fluctuation band, one similar to the so-called "BBC rule" suggested by Williamson (2000), would be an effective way to detect exchange rate misalignment among Asian currencies.

Ogawa and Shimizu (2005) proposed both an Asian Monetary Unit (AMU), which is a common currency basket computed as a weighted average of the thirteen Asian currencies, and AMU deviation indicators (AMU DIs), which indicate the level of deviation of each Asian currency, in terms of the AMU, from the benchmark rate.[1] The AMU and AMU DIs are considered both surveillance measures under the Chiang Mai Initiative and coordinated exchange rate policies among East Asian countries. In this paper, we show that monitoring the AMU and AMU DIs plays an important role in the regional surveillance process under the CMIM. By using daily and monthly data of AMU and AMU DIs in the period from January 2000 through June 2010, available from the website of the Research Institute of Economy, Trade, and Industry (RIETI) in Japan, we consider the following questions: First, how did the AMU move in relation to the

[1] For details on the AMU and AMU Deviation Indicators, see Appendix.

three major currencies—the US dollar, the euro, and the yen? Second, how could they stabilize a nominal effective exchange rate (NEER)? Third, how well did they do in predicting the Asian currency crisis and the recent 2007–2008 global financial crisis?

The rest of this paper is organized as follows. Section 2 presents an overview of previous research on proposals for a common currency basket among Asian countries. Section 3 investigates the AMU and its relationship with the three major currencies. Section 4 focuses on a comparison between a NEER calculated by the Bank for International Settlements (BIS) and a NEER under the hypothetical AMU peg system. The comparisons tell us how the AMU stabilizes a NEER among Asian currencies. Section 5 investigates the AMU and AMU DIs during the Asian currency crisis in 1997 and during the recent global financial crisis from 2007–2008. Finally, Section 6 summarizes our analytical results and provides concluding remarks.

2. RELATED RESEARCH ON COMMON CURRENCY BASKETS IN ASIA

After the Asian currency crisis of 1997, some Asian countries, including Singapore and Malaysia (since July 2005), adopted a currency system in line with a "Basket, Band, and Crawling" (BBC) rule.[2] During the recent global financial crisis from 2007–2008, however, a number of Asian currencies depreciated sharply while the Japanese yen has been appreciating against the other Asian currencies. At the same time, the Chinese yuan has remained relatively stable, especially against the US dollar, despite the Chinese government's July 2005 announcement to adopt a managed floating exchange rate system with reference to a currency basket. As a result, movements in intra-regional exchange rates among Asian currencies have changed dramatically. Such large fluctuation among intra-regional exchange rates is undesirable for the Asian economy where the private sector has established production networks.

As Asian economies have experienced greater interdependence in terms of intra-regional trade and foreign direct investment (FDI), it has become increasingly important to establish regional currency coordination in order to minimize exchange rate fluctuations and exchange rate risk in international trade and investments within the

[2] The "BBC rule" was first proposed by Williamson (2000).

region[3]. One proposed approach is to create a common currency basket, which will serve as an anchor for Asian currencies. Ogawa and Shimizu (2005) proposed an Asian Monetary Unit (AMU), which is computed as the weighted average of thirteen Asian currencies (the ASEAN countries, the PRC, Japan, and the Republic of Korea). Moreover, we have developed AMU Deviation Indicators based on the AMU in order to monitor fluctuations and misalignments of intra-regional exchange rates under the Chiang Mai Initiative.[4] The AMU DIs are employed as benchmarks for enabling the monetary authorities of Asian countries to maintain regional coordination in exchange rate policies. Using these indicators, the monetary authorities can ensure that each of their Asian currencies does not deviate markedly from a common currency basket or the AMU. This would enable these countries to achieve stability among intra-regional exchange rates and float jointly against outside currencies, include the US dollar and the euro. Ogawa and Shimizu (2007) also proposed a step-wise approach for transitioning from an individual currency basket system to a common currency basket system in Asia as an additional proposal.

There are other proposals to stabilize intra-regional exchange rates among Asian currencies without depending on any common currency basket. For example, Ma and McCauley (2008) have suggested that stability of intra-Asian exchange rates might build on similar national policies of stabilizing home currencies against their own respective currency baskets, a prospect made possible by the similarities among these countries' trade-weighted currency baskets. Similarly, Wyplosz and Park (2008) advocate adopting a currency basket peg vis-à-vis that country's non-regional trading partners, which they argue is sufficient to stabilize the exchange rate. Both of the studies indicate that the effective exchange rates of Asian currencies can be stabilized without any further monetary cooperation. Shimizu and Ogawa (2009), in a more recent analysis, find strong relationships between NEERs, the AMU, and AMU Deviation Indicators even during the global financial crisis. Their study suggests that an individual basket system is appropriate for Asian countries at the first stage of exchange rate

[3] On one hand, Ravenhill (2009) claimed that the current East Asian corporation was shallow and its shallowness reflected the primacy of political motivations in driving intra governmental agreement on trade and finance.

[4] Such a unit has also been extensively discussed in East Asia, for example, in the ADB (Kuroda and Kawai, 2003). The data for AMU and AMU Deviation Indicators has been published on the website of RIETI (http://www.rieti.go.jp/users/amu/en/index.html) since September 2005.

policy coordination. In this sense, it seems that the aforementioned proposals are not fundamentally different, at least as a first step.

3. DECOMPOSITION OF THE AMU

Currency regimes adopted by Asian countries differ from each other, and their choices are broad-ranging—from a hard peg (a currency board) to a managed float (with reference to a currency basket) to a free float. In other words, Asian currencies' degree of linkage with the US dollar varies from very strong (under a hard peg to the US dollar), weak (under a soft peg to the US dollar), to no relationship at all (under a free float). The AMU also has some degree of linkage with the US dollar because it is composed of the thirteen Asian currencies. Movements in the AMU should thus reflect the choice of currency regime in the region.

Following the methods of Frankel and Wei (1994), we identify estimated coefficients on the US dollar, the euro, and the Japanese yen for the AMU to investigate how strong the linkages are between the AMU and the three major currencies. We use daily data of exchange rates to estimate the following regression equation for each year for the period 2000 to 2010.[5]

$$\dot{e}_{AMU/Sfr} = c_o + c_1 \cdot \dot{e}_{USD/Sfr} + c_2 \cdot \dot{e}_{Euro/Sfr} + c_3 \cdot \dot{e}_{Yen/Sfr}$$

If Asian countries actually shift their currency regimes from a strict or *de facto* US dollar peg to an individual currency basket system, the AMU's linkage with the US dollar should become weaker while its relationship with the euro becomes stronger. Since the Japanese yen is one of the composition currencies of the AMU, the coefficient on the Japanese yen should be the same as a weight of the Japanese yen in the AMU. However, if an estimated coefficient is smaller than the basket weight, it means that the monetary authorities of the other Asian countries conduct an exchange rate policy without regard for stability against the Japanese yen. In this connection, the linkage between the AMU and the three major currencies reflects currency regime or exchange rate policy adopted by the monetary authorities of the Asian countries.

[5] In the 2010 sample, we use daily data from 4 January to 30 June 2010. The data of foreign exchange rate vis-à-vis the AMU are from RIETI and Datastream.

Table 1 summarizes the analytical results of the regression. Figure 1 plots movements in the estimated coefficients of the three major currencies year by year. In the sub-sample periods from 2000 to 2005, coefficients on the US dollar decreased from 70% to 58%. On one hand, coefficients on the Japanese yen increased from 32% to 37%. Coefficients on the euro became significant in 2003 and 2004 even though they are just about 5%. The analytical results indicate that Asian countries shifted from the US dollar peg system to an individual basket peg system.

Table 1: AMU De-composition with Three Major Currencies

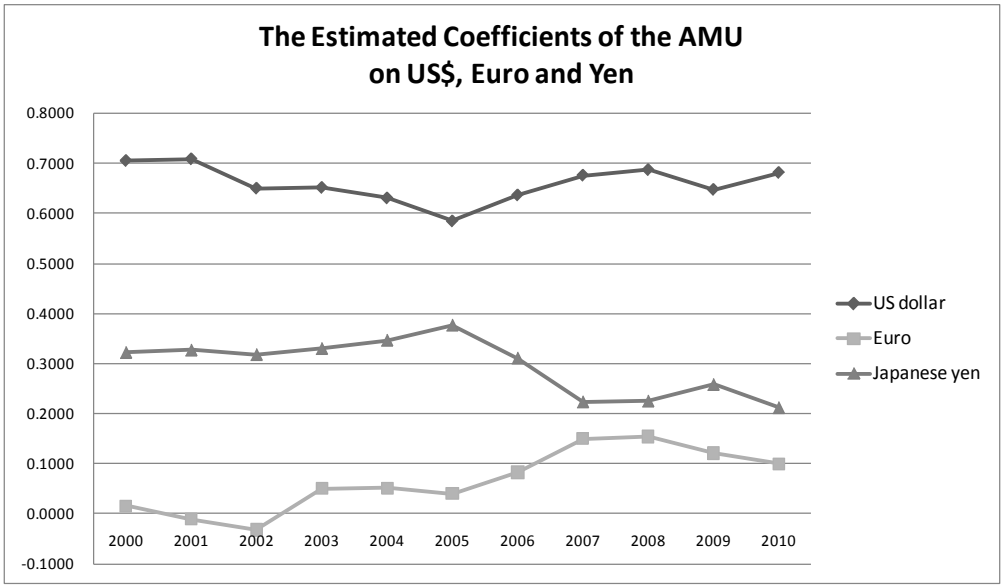
Dependent Variable: AMU/SFR
Method: Least Squares

Variable	2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010	
Constant	0.0002		0.0000		0.0000		0.0000		0.0000		-0.0001		-0.0002		-0.0001		0.0000		-0.0001		-0.0002	
US dollar	0.7046	***	0.7080	***	0.6496	***	0.6511	***	0.6302	***	0.5844	***	0.6361	***	0.6754	***	0.6865	***	0.6472	***	0.6808	***
Euro	0.0153		-0.0106		-0.0321		0.0509	**	0.0516	**	0.0408		0.0830	*	0.1499	***	0.1544	***	0.1210	***	0.0996	***
Japanese yen	0.3219	***	0.3267	***	0.3177	***	0.3298	***	0.3462	***	0.3763	***	0.3109	***	0.2238	***	0.2254	***	0.2584	***	0.2123	***
Adj. R-squared	0.9812		0.9793		0.9691		0.9814		0.9911		0.9719		0.9577		0.9458		0.9528		0.9737		0.9429	

Source: Author's calculation; data of foreign exchange rate vis-à-vis the AMU are from RIETI and Datastream.

Note: *** significant at 1% level ** sigunificant at 5% level * significant at 10% level

Figure 1: Estimated Coefficients of the AMU on the US Dollar, Euro, and Yen



Source: Authors' calculations.

However, in the sub-sample periods from 2006 to 2009, coefficients on the US dollar and the euro increased from 63% to 68% and from 8% to 15% in 2008, respectively. In contrast, coefficients on the Japanese yen decreased from 31% to 21% during that period. The analytical results indicate that Asian countries shifted back to a pro-US dollar foreign exchange rate policy or a US dollar peg system again. Comparison with the estimated coefficients on the Japanese yen and its basket weight in the AMU suggests that the former (37.63) was larger than the latter (27.80) in 2005. However, the former (21.23) was smaller than the latter (26.44) in 2010. These results suggest that the monetary authorities of the other Asian countries have in recent times shifted from a pro-Japanese yen foreign exchange rate policy to a pro-US dollar policy.[6]

Adopting a basket peg to one's own currency would contribute to stabilization of intra-regional foreign exchange rates among Asian currencies in the future, a finding in line with much of the research summarized in the previous section. However, most Asian countries' current exchange rate policy is still far from an individual currency basket system, despite the fact that the monetary authorities of these countries should not heavily target the US dollar, but a basket of currencies. This is why common indicators,

[6] Given the strong linkage of the Chinese yuan with the US dollar, it can be interpreted that Asian countries shifted to a pro-Chinese yuan exchange rate policy.

such as the AMU and the AMU Deviation Indicators, may be especially useful for surveillance of intra-regional exchange rates.

4. HOW COULD THE AMU STABILIZE EFFECTIVE EXCHANGE RATES?

Previous research has investigated the stabilizing effects of a common currency basket peg system on the effective exchange rates of Asian currencies. For example, Williamson (2005) investigated whether the use of a common currency basket would provide adequate stability of the effective exchange rate for the participating countries' currencies. Given two exchange rate systems—one an individual currency basket peg system, the other a common G3 currency basket peg system—Williamson demonstrated that the latter system could stabilize the NEERs of Asian currencies more effectively than the former. Similarly, Ogawa and Shimizu (2006) simulated how NEERs would have moved under alternative exchange rate systems, including an individual currency basket system, a G3 common currency basket system, and an AMU peg system by using data on exchange rates of Asian currencies vis-à-vis the AMU during a sample period from 2000 to 2004. They obtained an analytical result that the AMU peg system stabilized the NEERs more effectively for Indonesia, the Philippines, the Republic of Korea (hereafter, Korea), and Thailand than for the other countries with peg systems.

In this paper, following Ogawa and Shimizu (2006), we extend the sample period from January 2005 and June 2010 to investigate the stabilization effects of the AMU peg system on the NEERs of East Asian currencies. Specifically, we compare standard deviations of NEERs under a hypothetical AMU peg system with those of NEERs calculated by the BIS (monthly average, 2005=100). Exchange rates of the Asian currencies in terms of the AMU, standardized as 100 in January 2005, are used to simulate NEERs under the hypothetical AMU peg system. Basket weights on each currency of the NEER are the same as those of NEERs calculated by the BIS.

Table 2 summarizes the analytical results. Standard deviations of the NEERs under the hypothetical AMU peg system are lower than those of actual (historical) NEERs calculated by the BIS. Accordingly, we obtain an analytical result that the AMU peg system stabilized the NEERs of Asian currencies even during the global financial crisis. We also find that differentials in the standard deviations between actual NEERs and

AMU-pegged NEERs vary by country. For example, in the case of Singapore, the standard deviation of the NEER calculated by the BIS was 3.728, while that of NEER under the hypothetical AMU peg system was 2.321. Similarly, in the case of Malaysia, the standard deviation of NEER calculated by the BIS was 2.699, while under the hypothetical AMU peg system it was 1.677. Thus, the differences are small in the case of Singapore and Malaysia, which adopted a managed floating exchange rate system with reference to a currency basket.

Table 2: Standard Deviation of NEER (BIS) and NEER Simulated Under AMU Peg System, (Monthly Data, January 2005 to June 2010)

Country	NEER (BIS) (1)	NEER simulated under the AMU peg system (2)
People's Republic of China (PRC)	8.280	2.715
Indonesia	7.785	1.630
Japan	7.968	2.773
Republic of Korea	13.038	1.160
Malaysia	2.699	1.677
Philippines	10.148	1.486
Singapore	3.728	2.321
Thailand	5.900	1.334

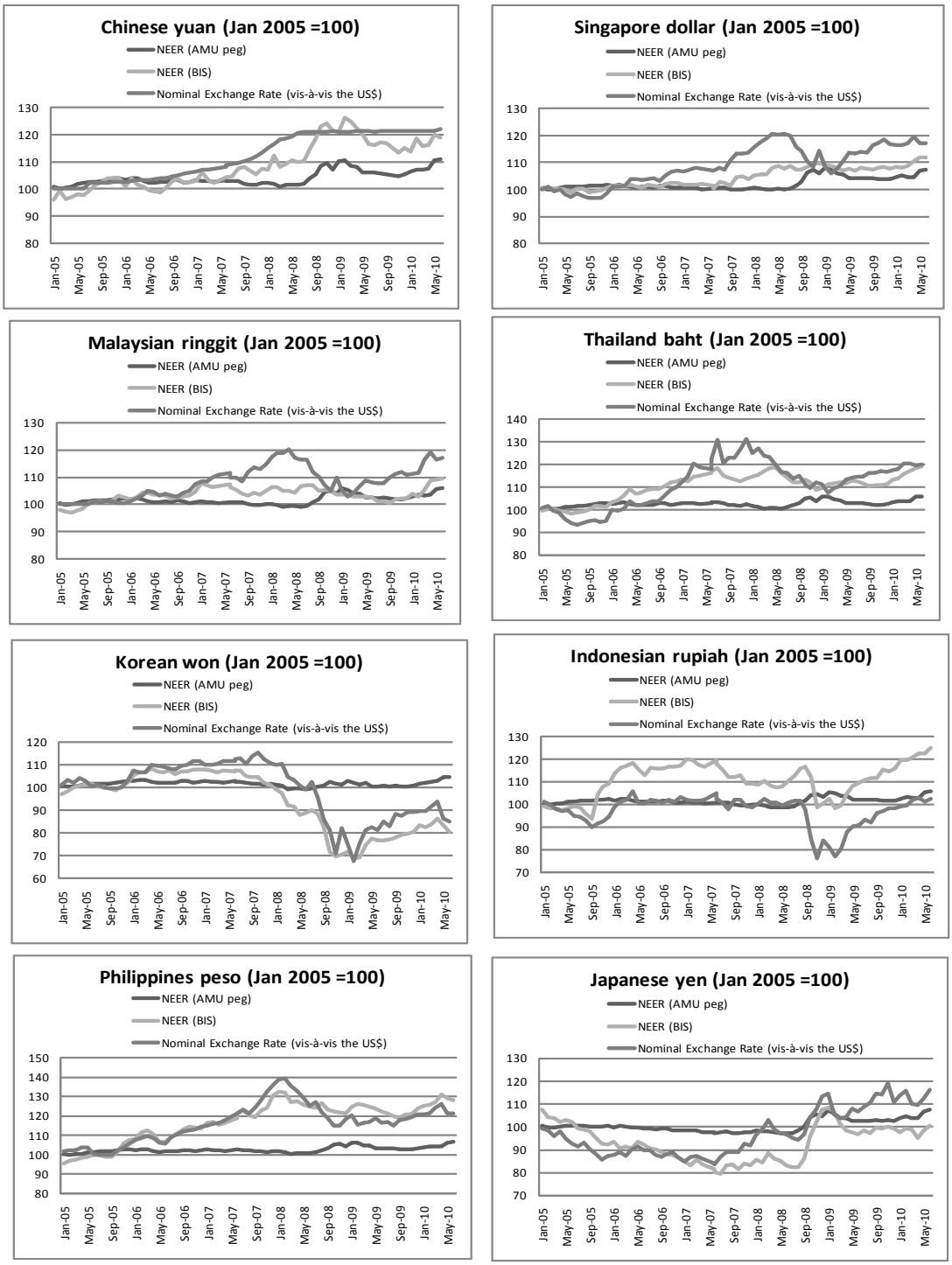
Source: Autor's calculations.

Notes: (1) Standard deviations of month end nominal effective exchange rates calculated using January 2005=100; (2) Nominal effective exchange rates (NEER) under the hypothetical AMU peg simulated by using each exchange rate vis-a-vis the AMU which is standardized at 100 in January 2005. The basket weights of NEER are same as those of NEER calculated by BIS.

On the other hand, in the case of Korea, which adopts a free-floating exchange rate system, the standard deviation of NEER calculated by the BIS was 13.038, compared to 1.160 calculated using the hypothetical AMU peg system. Similarly, in the case of Indonesia, the standard deviation of NEER calculated by the BIS was 7.785, compared to just 1.630 under the hypothetical AMU peg system. The results indicate that the NEER of free floating currencies are dramatically more stable when monetary authorities adopt an AMU peg system.

Figure 2 plots movements in the two kinds of NEERs mentioned above, as well as the nominal exchange rate expressed in US dollar terms for reference, by country, for the period between January 2005 and June 2010. In the case of the PRC, the actual NEER calculated by the BIS appreciated more than 10% during the global financial crisis (2007–2008) although the nominal exchange rate of the Chinese yuan in terms of the US dollar was kept very stable. Had the monetary authority of the PRC adopted the AMU peg system during the same period, the Chinese yuan would have appreciated by less than half, in terms of the NEER. In the case of Korea, both the actual NEER calculated by the BIS and the nominal exchange rate of the Korean won in terms of the US dollar depreciated more than 30% during the global financial crisis. Had the monetary authority of Korea adopted the AMU peg system in the same period, their NEER would have been kept very stable. The analytical results suggest that the AMU peg system would have stabilized the NEERs of Asian currencies even during the global financial crisis.

Figure 2: Movements of NEERs and NERs vis-à-vis the US Dollar



Source: Authors' calculations.

Note: AMU exchange rates have been downloaded from RIETI. NEERs (BIS) were downloaded from BIS. Nominal exchange rates were downloaded from Datastream.

5. AMU AND AMU DEVIATION INDICATORS DURING THE CRISES

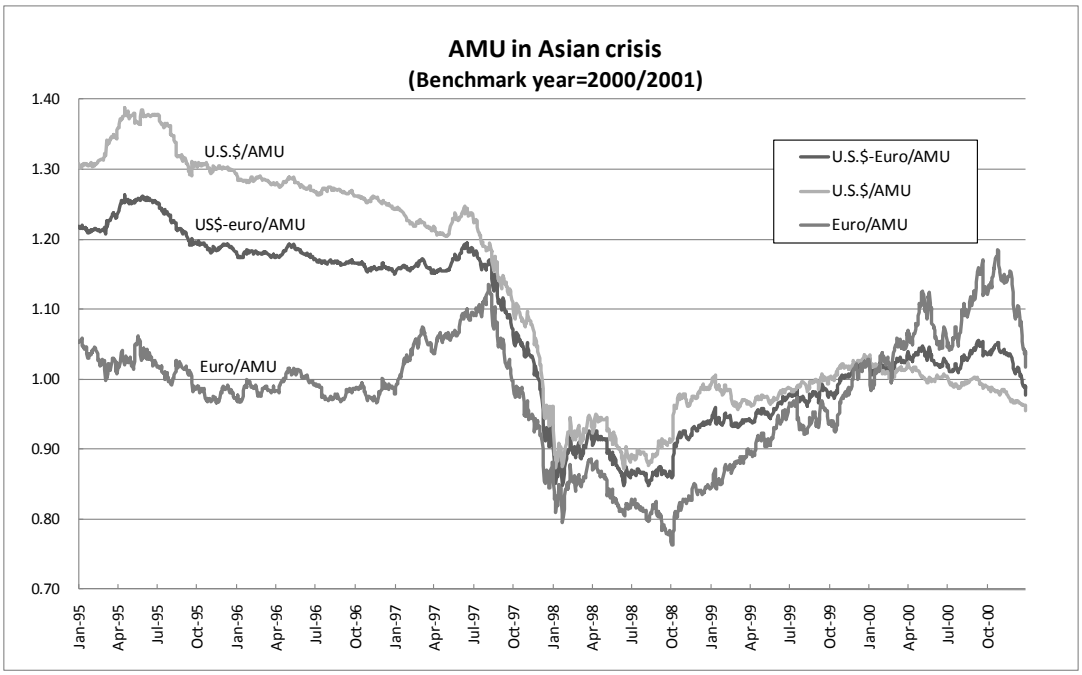
Our research used the AMU and the AMU Deviation Indicators to conduct macroeconomic analysis for surveillance purposes. In this section, we focus on the Asian currency crisis in 1997 and the 2007–2008 global financial crisis. We investigate how accurately the AMU and AMU DIs predicted crisis situations as an earlly warning indicator during the two crises.

5.1 AMU during the Asian Currency Crisis in 1997

First, we apply both the AMU and the AMU DIs retroactively in the period around the Asian currency crisis in 1997, before the benchmark period 2000–2001.[7] Figure 3 shows the movements of the AMU in terms of the US dollar, the euro (or the weighted average of European currencies before January 1999), and the US dollar-euro basket currency from January 1995 to the end of 2000. In 1996, the exchange rate of the AMU in terms of the euro was around 1.0, while the exchange rate in terms of the US dollar was larger than 1.2. This means that the AMU was more than 20% overvalued vis-à-vis the US dollar in the period immediately before the Asian crisis, compared with the AMU benchmark year (2000–2001).

[7] For the retroactive calculation of the AMU and AMU DIs in the 1990s, we use the simulated euro before the introduction of the euro.

Figure 3: The AMU during the Asian Crisis (January 1995–December 2000)

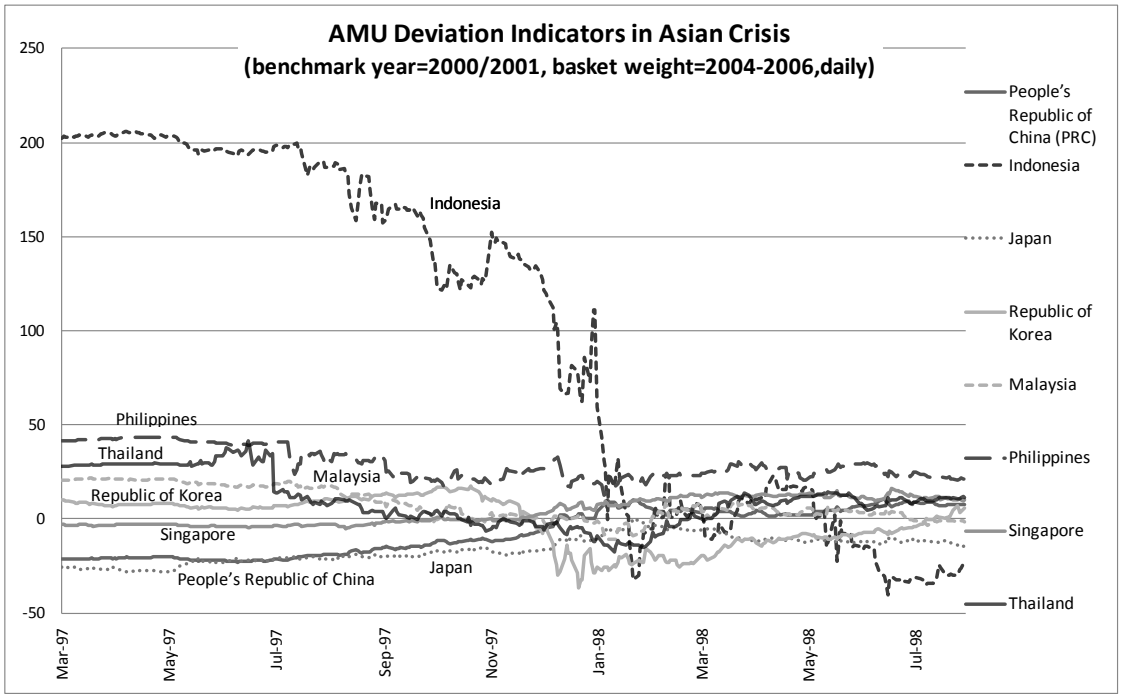


Source: Authors' calculations.

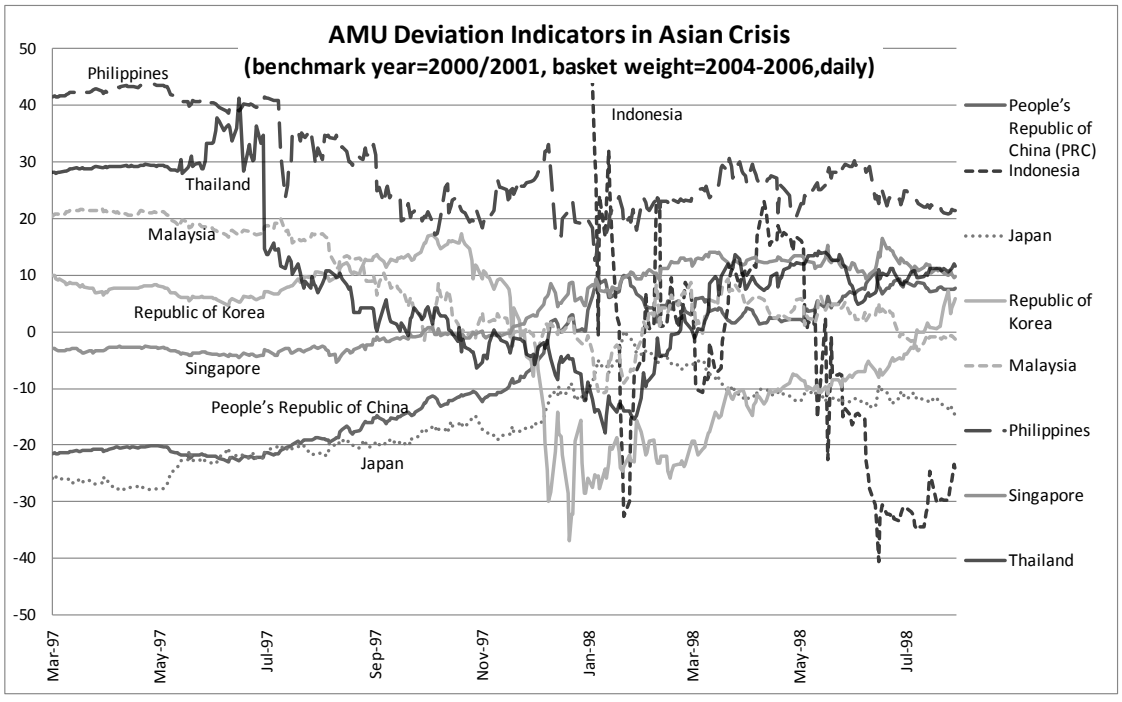
Figure 4 shows movements in the AMU DIs of some Asian currencies before and after the Asian currency crisis. It is clear that AMU DIs of crisis-hit currencies were overvalued before the crisis. In particular, the AMU DI of the Indonesian rupiah had the largest overvaluation among the Asian currencies (Figure 4a). Figure 4b shows that the AMU DIs of the Thai baht and the Malaysian ringgit were also overvalued by more than 20%. On one hand, the AMU DI of the Korean won was overvalued by less than 10% when the Thai baht started to collapse in July 1997. After that, it climbed gradually up to 17% of overvaluation. It started to depreciate sharply to almost minus-40% of undervaluation in December 1997. Thus, the movements in the AMU DIs exactly replicated the scenario of currency crisis contagion from Thailand to Korea. In contrast, the AMU DIs of the Singapore dollar, the Chinese yuan, and the Japanese yen were undervalued before the Asian currency crisis. In particular, those of the Chinese yuan and the Japanese yen were below minus-20% of undervaluation, which means that the crisis-hit currencies were more than 40% overvalued compared with the two major Asian currencies.

Figure 4: AMU Deviation Indicators in Asian Crisis (March 1997–December 1998)

(a) With Indonesia



(b) Without Indonesia



Source: Authors' calculations.

Observing movements in both the AMU and the AMU DIs during the Asian currency crisis, we find that the AMU was more than 20% overvalued vis-à-vis the US dollar, and the crisis-hit currencies were more than 40% overvalued compared with the Chinese yuan and the Japanese yen. These results suggest that monetary authorities should monitor the AMU and the AMU DIs to predict currency crises in the near future.

5.2 AMU during the Recent Global Financial Crisis

Some Asian currencies have been depreciating against the US dollar as a result of the sell-off of local currencies accompanying capital outflows, which were related to the deleveraging policies by US and European financial institutions beginning in 2007. These dramatic events transpired as a result of the Lehman shock on 15 September 2008. Among Asian currencies, the only exception was the Japanese yen, which has appreciated substantially against the US dollar. The Chinese yuan has been kept relatively stable vis-à-vis the US dollar by the Chinese monetary authority's heavy intervention in the foreign exchange market, even during the global financial crisis. The Singapore dollar and the Malaysia ringgit have also not depreciated considerably against the US dollar because these two countries' monetary authorities have kept a currency basket system. In contrast, the Korean won has had much larger depreciation than any other Asian currency. The Thai baht and the Indonesian rupiah also have depreciated due to the subprime mortgage problem and fallout from the demise of Lehman Brothers.

Figure 5 shows movements in the AMU DIs from January 2000 to March 2010. It is clear that the Asian currencies have been widening in terms of increasing weighted averages of the AMU DIs, just as Ogawa and Yoshimi (2008) have pointed out. The increasing weighted averages of the AMU DIs might reflect regional trade imbalances in some instances, since the benchmark period to calculate AMU DIs is set as the period when total trade balances (intra-regional trade balances) of Asian countries was closest to zero. Figure 6 shows movements in trade balances within the region (by country) from the first quarter of 2000 to the fourth quarter of 2009. Regional trade imbalances have been growing as the weighted average of AMU DIs has increased. Notably, the large regional trade surplus suddenly became a large deficit once the subprime crisis hit in the third quarter of 2008. These findings suggest that sudden and volatile movements in the AMU DIs have negative impacts on intra-regional trade among Asian countries.

Volatile movements in the AMU DIs might also be caused by erratic capital flows. Suppose that we set a plus/minus-15% fluctuation band for the AMU DIs where this band is the same as the fluctuation band in Exchange Rate Mechanism (ERM) II in the EU. Figure 5 shows that most of the Asian currencies except for the Philippine peso stayed within the band during the period from 2000 to 2005. Since 2006, however, an AMU DI of the Korean won started to rise beyond the upper band of 15%, an upward trend followed by the Thai baht and the Singapore dollar. In contrast, an AMU DI of the Japanese yen was undervalued.

What caused the currencies to deviate from their benchmark levels? One possible answer is a carry trade between the Japanese yen and other currencies. As a funding currency, the Japanese yen was highly involved in carry trade strategies because of Japan's extremely low interest rates throughout the 2000s.[8] It is said that higher interest rates for other Asian currencies, such as the Korean won and the Thai baht facilitated the yen-related carry trade. As Gyntelberg et al. (2009) has shown, net purchases of Thai equities by non-resident investors led to appreciation of the Thai baht in 2007, implying that the movement in capital flows is an important factor in destabilizing intra-regional exchange rates.[9]

In the rest of this section, we investigate relationships between the AMU DIs and capital flows. We focus on three volatile Asian currencies—the Korean won, the Indonesian rupiah, and the Thai baht—and compare their AMU DIs and capital flows—especially the "other investments" listed on their balance-of-payments sheets—by using data from the IMF's "International Financial Statistics." Figure 7 shows relationships between the AMU DIs and the "other investments" for the three countries.

In the case of Korea, the AMU DI went up gradually from the middle of 2004 and was kept above 15% from the second quarter of 2006 through the fourth quarter of 2007. During this period, the Republic of Korea had large capital inflows on the liability side of "other investments." In the third quarter of 2008, the AMU DI of the Korean won went down sharply, below minus-15% of undervaluation. At the same time, large capital outflows occurred on both the liability and asset sides of "other investment." In the case of Indonesia, large capital outflows occurred on the asset side of "other Investments" in

[8] Hottori and Shin (2007) confirmed that the volumes of carry trade involving the yen were high when interest differential against the yen were high.

[9] Plantin and Shin (2006) express that a high-yield currency will exhibit the classic price pattern of going "up by the stairs" and coming "down with the elevator."

the third quarter of 2008, while the AMU DI of the Indonesian rupiah went down below 15% of undervaluation.

The case of Thailand is different from that of Korea and Indonesia. When the AMU DI of the Thai baht climbed up above 15% of overvaluation during the period from the first quarter of 2007 to the first quarter of 2008, Thailand had no large capital inflows except in the first quarter of 2008. This was probably due to the capital controls suddenly introduced by the Bank of Thailand in December 2006, which were eliminated on 3 March 2008. In fact, the Thai baht did not sharply depreciate like the other two currencies during the recent global financial crisis.

These findings indicate that the AMU DI's reach to an upper band—for example, plus-15% of the fluctuation band—could alert countries to excess capital inflows that might cause capital outflows thereafter. Thus, monitoring the AMU DIs may be useful to predict excess capital inflows and outflows from the country.

6. CONCLUSION

In this paper, we have shown that monitoring the AMU and the AMU DIs plays an important role in the regional surveillance process in Asia. Daily and monthly data of the AMU and AMU DIs can be used to monitor intra-regional exchange rates among Asian currencies. Our investigation of the AMU and the AMU DIs suggest the following: First, the AMU peg system stabilizes the NEERs of East Asian currencies. Second, the AMU and the AMU DIs just before the Asian currency crisis in 1997 showed that a weighted average of the Asian currencies was overvalued against the US dollar, while the currencies of crisis-hit countries also were overvalued against the other Asian currencies. Thus, both the AMU and the AMU DIs could have signaled the overvaluation of the Asian currencies before the Asian currency crisis. Third, trade imbalances within the region were growing as the AMU DIs were widening among Asian currencies. Fourth, the AMU DIs can help predict excess capital inflows into the countries and capital outflows from the countries. The findings support the usefulness of using both the AMU and the AMU DIs as a surveillance indicator for monetary cooperation in Asia.

Practical ways to utilize the AMU DI as a surveillance indicator should be discussed in future research. For example, determining an appropriate fluctuation band for the AMU DI is an important issue. In order to decide the height of the band, we need to analyze the relationship between interest differentials and capital inflows/outflows. This paper

focused on the AMU and the AMU DIs only in terms of nominal exchange rates. The nominal AMU and AMU DIs are therefore suitable for daily surveillance over nominal exchange rates and capital inflows/outflows. However, we need to use the AMU and the AMU DI in terms of real exchange rates for macroeconomic surveillance over exports/imports, trade balances, as well as FDI. These are issues that warrant further research in future.

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APPENDIX: THE AMU AND AMU DEVIATION INDICATOR

Calculating the AMU

We calculated the AMU according to the approach employed for calculating the European Currency Unit (ECU) under the EMS before the introduction of the euro in 1999. Just as the ECU was defined as a basket of currencies of member countries of the European Union (EU), the AMU has been defined as a basket of currencies of the ASEAN 10+3 countries (Brunei, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Viet Nam, Japan, the People's Republic of China, and Korea). The weight assigned to each currency in this basket is based on the share of GDP measured at Purchasing Power Parity (PPP) and the overall trade volumes (the sum of exports and imports) of each sample country. We calculated the share of GDP measured at PPP and trade volumes for each country using the average of the last three years in order to arrive at the currency shares of the AMU (the current version is based on 2005–2007).

Since both the United States and EU countries are important trading partners for East Asia, the AMU is quoted in terms of a weighted average of the US dollar and the euro. The weighted average of the US dollar and the euro (hereafter, US$-euro) is based on the trade volumes of East Asian countries with the United States and EU. The weights assigned to the US dollar and euro were 65% and 35%, respectively.

Subsequently, we selected a benchmark period in order to calculate AMU Deviation Indicators. The benchmark period was defined in the following manner: the total trade balance of member countries (intra-regional trade balance), total trade balance of the member countries with Japan (excluding Japan), and total trade balance of member countries with the rest of world must be approximately zero. Consequently, it was found that the trade balance in 2001 was the closest to zero. Assuming a one-year time lag before changes in exchange rates affect trade volumes, we chose 2000 and 2001 as the benchmark period. For the benchmark period, the exchange rate of the AMU in terms of the US$-euro was set at unity. We defined the exchange rate of each East Asian currency in terms of the AMU during the benchmark period as the benchmark exchange rate.

Overall, the AMU weights were calculated based on both the arithmetic share of trade volumes and GDP measured at PPP. The table below indicates the AMU basket weights and benchmark exchange rates.

AMU Basket Weights of East Asian Currencies

(revised in 10/2010****, benchmark year=2000/2001)

	Trade volume* %	GDP measured at PPP** ,%	Arithmetic average shares % (a)	Benchmark exchange rate*** (b)	AMU weights (a)/(b)
Brunei	0.35	0.13	0.24	0.589114	0.0041
Cambodia	0.21	0.17	0.19	0.000270	6.9779
People's Republic of China	26.48	46.65	36.57	0.125109	2.9228
Indonesia	5.68	5.54	5.61	0.000113	497.9163
Japan	22.40	28.15	25.28	0.009065	27.8842
Republic of Korea	13.03	8.27	10.65	0.000859	123.9422
Laos	0.13	0.08	0.10	0.000136	7.5226
Malaysia	7.37	2.36	4.87	0.272534	0.1786
Myanmar	0.37	0.37	0.37	0.159215	0.0232
Philippines	2.22	1.95	2.09	0.021903	0.9527
Singapore	12.74	1.48	7.11	0.589160	0.1207
Thailand	6.54	3.41	4.98	0.024543	2.0272
Viet Nam	2.48	1.44	1.96	0.000072	273.9808

* : The trade volume is calculated as the average of total export and import volumes in 2006, 2007 and 2008 taken from DOTS (IMF).
**: GDP measured at PPP is the average of GDP measured at PPP in 2006, 2007 and 2008 taken from the World Development Report, World Bank. For Myanmar's share of GDP measured at PPP, we use the sahre of Trade volume because of the data constraint.
*** : The Benchmark exchange rate ($-euro/Currency) is the average of the daily exchange rate in terms of US$-euro in 2000 and 2001.
**** : AMU shares and weights were reviced in Oct. 2010. This is the 6th version.
Source: RIETI (http://www.rieti.go.jp/users/amu/en/index.html)

Calculating the AMU Deviation Indicator

The nominal exchange rate of each East Asian currency in terms of the AMU is used in order to determine its AMU Deviation Indicator. The AMU Deviation Indicator signifies the deviation of each East Asian currency from the benchmark exchange rate vis-à-vis the AMU, and is represented by a formula in the following manner:

$$\text{AMU Deviation Indicator (\%)} = \frac{\text{actual exchange rate of } \text{AMU}/\text{a currency} - \text{benchmark exchange rate of } \text{AMU}/\text{a currency}}{\text{benchmark exchange rate of } \text{AMU}/\text{a currency}} \times 100.$$

When the AMU deviation indicator of, say, currency A is positive, it implies that currency A's actual exchange rate vis-à-vis the AMU is higher than its benchmark

exchange rate vis-à-vis the AMU (this represents an appreciation of currency A against the AMU). Similarly, when the AMU deviation indicator of say, currency A, is negative, it implies that currency A's actual exchange rate vis-à-vis the AMU is lower than its benchmark exchange rate vis-à-vis the AMU (this represents a depreciation of currency A against the AMU)