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International Reserve Accumulation in East Asia

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Since the 1997 Asia financial crisis, East Asian countries, notably China, Japan, South Korea, Taiwan, Hong Kong, Singapore, and Malaysia have accumulated huge foreign exchange reserves beyond what is considered as 'optimal' levels. More than two-thirds of global foreign exchange reserves estimated at over $2.5 trillion are controlled by Asian central banks (ADB, 2005). Japan has the largest foreign exchange reserves exceeding $800 billion, followed by China, Taiwan and South Korea which combined to hold over $1 trillion reserves in 2004 (UOB Economics Treasury Research, 2005). This paper aims primarily at analyzing the economic rationale for foreign exchange reserve accumulation in East Asia, the perceived benefits and costs in relation to its 'optimal' levels, and the policy implications for global capital flows and exchange rate stability. Drawing on lessons from recent crises of foreign debt and liquidity risks, this paper argues that mobilizing excess foreign exchange reserves above the 'optimal' levels via a proposed regional monetary authority in East Asia will provide a vast pool of international reserves for greater intra-regional trade, investment and liquidity support in the event of regional balance of payment difficulties. It will contribute toward the long term prospect of enhancing the use of an 'Asian' currency composed of perhaps a 'basket' of trade-weighted currencies of US Dollar, yen or Euro.

1. Introduction

International reserves, according to IMF guidelines, refer to official public sector foreign assets that are readily available to and controlled by the monetary authorities .Three major components are foreign currencies, gold, and IMF Special Drawing rights. The official foreign exchange reserves are held in support of a broad range of macroeconomic objectives including:

- Credibility and confidence in monetary and exchange rate policies;

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- Foreign currency liquidity to contain external vulnerability;
- Balance of payment and debt management;
- Reserve holding in financial crisis or national emergencies

Massive accumulation of international reserves by Central Bankers in East Asia after the 1997-98 Asian Financial Crisis has reignited issues of growing global imbalances between the United States and the crisis-torn Asian economies as the latter attempt to re-establish their economic credibility by stockpiling foreign exchange reserves. The 'precautionary demand' for international reserves among emerging economies is reinforced by the rapid pace of globalization and the risk of future financial crisis arising from trade integration, financial opening, and capital flows, especially the influx of volatile short-term capital. (Joshua Aizenman, 2003)

Asian central bankers continue to accumulate foreign exchange reserves at an unprecedented rate. Asian (excluding Japan) foreign exchange reserves have increased by over 200% from about $500 billion in 1997 to more than $1.5 trillion in 2004 (UOB Economics-Treasury Research, 2005), averaging a growth rate of more than 20%. By August 2005, as reported in wjla.com (September 6, 2005), Japan's foreign exchange reserves increased $8.39 billion to $847.77 billion. China's reserves in May 2005 ranked second after Japan at $696 billion.

Sixty-five percent of the international reserves are invested in US Dollars by virtue of the dominant position of the US currency in international trade. To ensure international competitiveness in manufacturing trade, Asian currencies avoid appreciating against the US Dollar, falling into what McKinnon (2005) conceived as 'the Dollar Exchange rate Trap'. Asian countries are driven to perpetuate current account surpluses to buy into US currency and assets to avoid currency appreciation and deflation: the global savings glut is mobilized to finance the mounting US deficit from American overspending.

ADB's warning (2005) that foreign exchange reserves in Asia have soared well beyond its "optimal" levels and that policy makers should mobilize Asian savings into Asian investments highlight some of the crucial issues arising from the accumulation of international reserves in East Asia and the policy direction in reserve pooling for regional investment.

This paper is organized as follows. Following the introduction, Part 2 analyzes the changing motives for reserve building in East Asia as the region experiences rapid financial integration and trade openness. Part 3 examines the underlying significant long run relationship in the determinants of reserve accumulation in ASEAN+3 countries, against the evolution of reserve adequacy criteria from import-based to debt-based measurement, as capital account volatility supersedes capital account imbalances in a rapidly globalised economy. Part 4 discusses the perceived benefits of reserve accumulation and the underlying cost of stockpiling foreign exchange reserves. Part 5 discusses the options for investing the reserves in the ASEAN+3 regional integration initiatives in building up liquidity support in the new milestone for long term monetary integration. The concluding summary focuses on the positive role of regional reserve pooling from surplus reserves above what is considered as the 'optimal' level consistent with each country's respective macroeconomic needs.

2 Changing Motives for Reserve Accumulation in East Asia

Accumulation of international reserves in East Asia has been a primary factor in reducing exchange rate fluctuations after the 1997-98 crisis. Estimated at US$1,883 billion at the end of 2003, Asian reserves accounted for half of global total reserves (Akiko Terada-Hagiwara, 2005), with Japan, People's Republic of China, Taipei, Korea and India as the major leaders in reserve holdings (Table

1). The high opportunity cost of holding foreign exchange reserves estimated at 0.3-1 percent of GDP (Bird and Rajan, 2003) reflects the significance of the current interest regarding the issues of reserve adequacy policy in relation to global imbalances, capital mobility, exchange rate regimes and optimal reserve management.

TABLE 1: ASIAN CENTRAL BANK HOLDINGS OF FOREIGN EXCHANGE RESERVES

	End of Period				
Country/Region	Dec 04	% Share	Dec 03	% Share	2004 vs 2003 (% change)
Japan	844.5	34.8	673.5	35.6	25.4
China	609.9	25.1	403.3	21.3	51.3
Taiwan	241.7	9.9	206.6	10.9	17.0
South Korea	199.1	8.2	155.4	8.2	28.1
India	131.2	5.4	103.2	5.4	27.2
Hong Kong	123.6	5.1	118.4	6.3	4.4
Singapore	112.8	4.6	96.3	5.1	17.1
Malaysia	66.7	2.7	44.9	2.4	48.7
Thailand	49.8	2.1	42.1	2.2	18.2
Indonesia	36.3	1.5	36.3	1.9	0.1
Philippines	14.4	0.6	13.9	0.7	3.6
Total Asia Ex. Japan	1,585.5	65.2%	1,220.3	64.4%	29.9%
Total Asia	2,585.5	100%	1,893.8	100%	28.3%

Source: UOB Economics-Treasury Research, 2005, "Foreign Participation in the US Treasury Market: The Tail That Wags the Dog?

Many writers (Joshua Aizenman (2005), Joshua Aizenman, Yeonho Lee, and Yeongseop Rhee (2004), Ramkishen Rajan and Reza Siregar (2002)) have examined various reasons and motives for holding reserves in relation to exchange rate regimes, liquidity management and capital flows. The precautionary motive in using reserves as a buffer stock in anticipation of balance of payments problems or future currency attacks is found to be the motive underlying reserve accumulation in East Asia, at least in their initial phase of export-led growth policy. The precautionary motive is based on the theory of demand for reserves whereby a level of reserves is chosen to balance the macroeconomic adjustment costs if reserves are exhausted against the opportunity cost of holding reserves (IMF, 2003, p.16). Using time series data from 1950-2004, this paper has found that significant reserve accumulation took place after the 1997-98 crisis period in China, Japan, Korea, Indonesia, Malaysia, Thailand and Philippines (Table 2). Singapore had started to accumulate reserves much earlier in 1989 and was better able to avert the crisis. Table 2 shows the significant

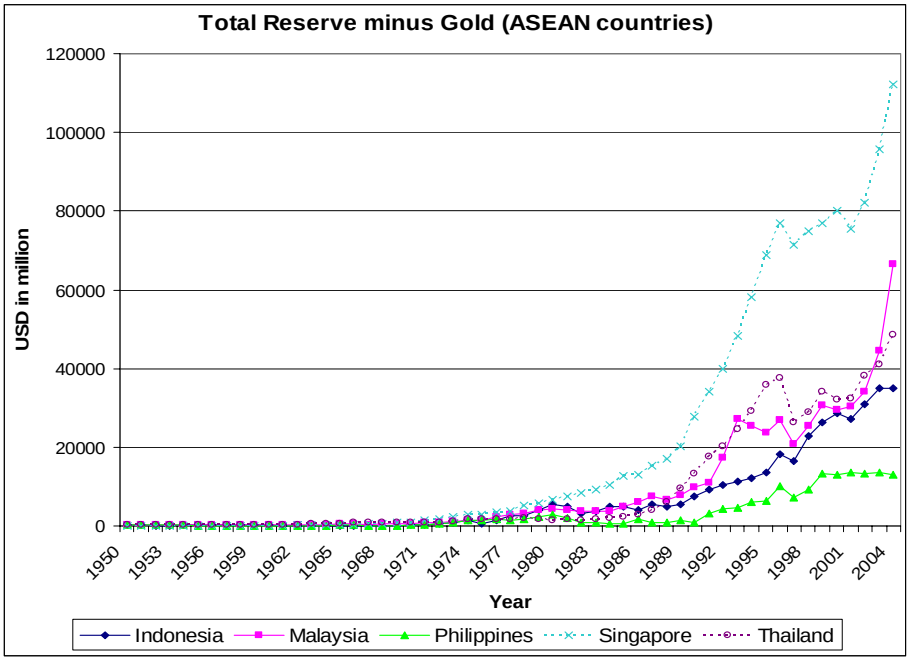
average reserve change in the pre- and post-crisis era. Graphs 1 to 3 shows reserve level in ASEAN countries; China, Japan and Korea; and ASEAN plus three (APT) as a whole respectively.

TABLE 2: AVERAGE RESERVE IN PRE- AND POST-CRISIS ERA

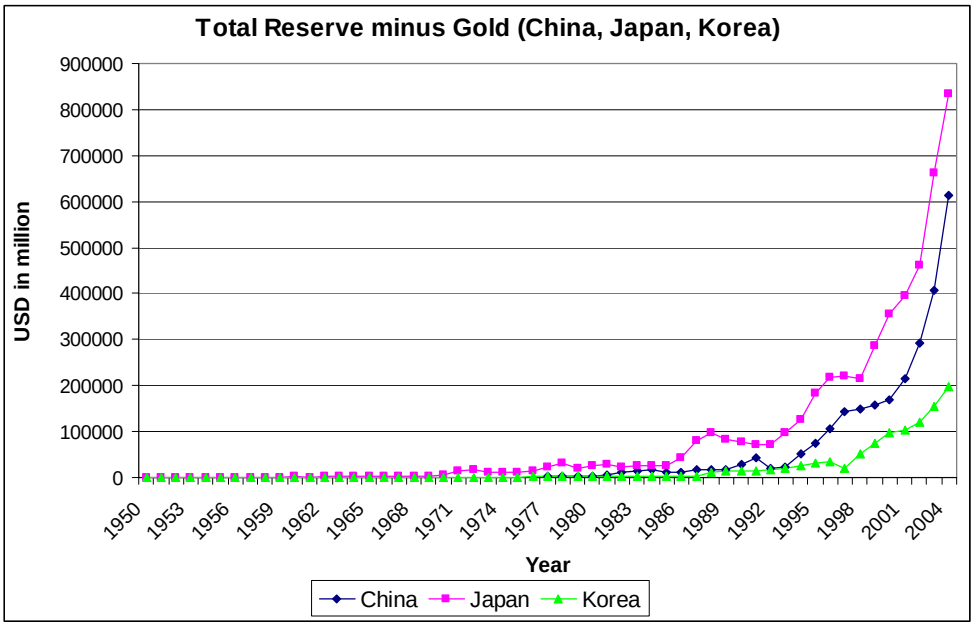
Country	Pre-crisis (1990 - 1997) [USD in million]	Post-crisis (1998 – 2004) [USD in million]	Change in Average Reserve [%]
China	$61,794.87	$286,367.98	363.42%
Indonesia	$12,388.39	$29,398.83	137.31%
Japan	$133,264.20	$458,687.36	244.19%
Korea	$22,320.60	$114,353.02	412.32%
Malaysia	$20,263.84	$37,323.83	84.19%
Philippines	$5,379.96	$12,744.34	136.89%
Singapore	$53,141.95	$85,325.29	60.56%
Thailand	$25,609.70	$36,435.07	42.27%

Source: International Financial Statistics Database, International Monetary Fund

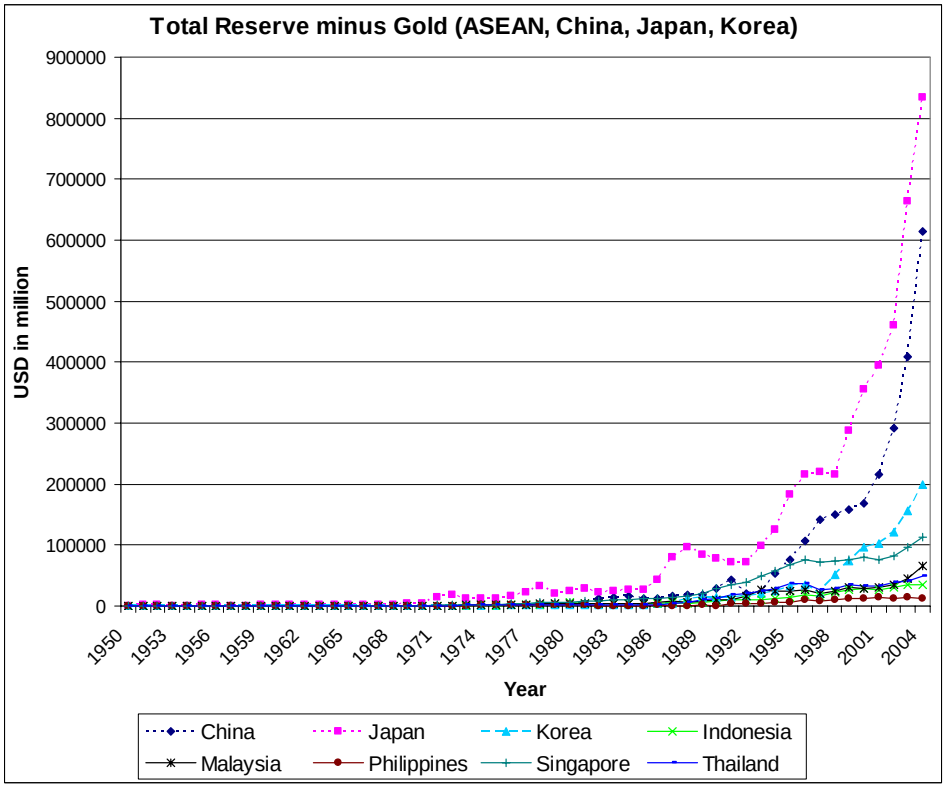
GRAPH 1: TOTAL RESERVE IN ASEAN COUNTRIES



GRAPH 2: TOTAL RESERVE IN CHINA, JAPAN AND KOREA



GRAPH 3: TOTAL RESERVE IN ASEAN PLUS THREE COUNTRIES



International reserves are held in five currencies: the US Dollar, the Euro, the Japanese Yen, the British Pound, and the Swiss Franc. Dollar reserves holdings are by far the largest, accounting for 70% of the total at the end of 2003 (BIS 2004). Euro reserves holdings rank second at about 20% of the total. The choice of currency composition of international reserves is determined by the various purposes for which reserves are held. The common reasons include transaction needs, intervention needs and wealth diversification (Srichander Ramaswamy, 1999). The eminent position of the dollar reserves is due to the depth and liquidity of the US currency and the currency preference of reserve managers worldwide. This has made Asian central banks important players in US financial markets (Federal Reserve Bank of New York, 2004).

The massive accumulation of Dollars by Asian central bankers has placed Asian economies as significant players in global capital flows. The net capital flow out of a country is equal to domestic savings minus domestic investments, which also represents a country's current account balance. In 2003, net capital flows from Asia amounted to $309 billion out of an inflow of -$531 billion to the United States, with the remaining capital flows from:

- Fuel exporting countries : $71 billion;
- Western Europe and Canada : $96 billion;
- Other countries and unallocated outflows : $55 billion

The high savings in Asia in a way finance the growing deficit in the United States. The US current account deficit has become the world's largest – it is being financed out of around two-thirds the cumulative current account surpluses of all the world's surplus economies (Summers 2004).

3 Reserve adequacy and its optimal level: What determines reserve accumulation in East Asia?

The debate on reserve adequacy and its 'optimal' level is illusive as international capital flows in the 1990s has led to the development of debt-based and monetary-based indices as an alternative approach to the conventional import-based measure in terms of the ratio of international reserves to months of imports that dominated reserve adequacy literature in the 1960s and 1970s (three months of imports in the IMF's rule of thumb (Movchan, 2002, Jeanne and Ranciere, (2005). The two basic approaches to measure reserve adequacy are not without their underlying shortcomings. Reserve estimation based on an analysis of demand functions for reserves (Kelly (1970), Iyoha (1976), Frenkel and Javanovic (1981) suffers from incorrect specification of country-specific demand function arising from changing economic conditions or short-term economic turbulence. Import-based criterion developed in response to current account volatility, with reserves-import ratio varying from 3-6 months of imports. With greater global capital mobility and the experience gained from recent financial crisis import-based reserves adequacy criteria have lost its luster as capital account volatility supersedes capital account imbalances. Debt-based criterion for reserve adequacy became more widely used under the Guidotti's rule to maintain a level of reserve above a one-year scheduled amount of foreign currency debt amortization (with no rollover). IMF (2000) introduced what is known as the augmented short-term debt criterion to measure reserve adequacy on the basis of how long a country can survive without external borrowing (Greenspan, 1999).

Reserves to import ratio, short term indebtedness, and trade openness are identified as the major determinants of reserve accumulation in East Asia.

The model by Heller (1966) postulated that optimal demand for reserves is an increasing function of uncertainty (average yearly imbalances) and a decreasing function of the cost of holding reserves and of the marginal propensity to import (Ragen and Siregar, 2002). This has provided the rule of thumb for the estimate of reserve adequacy in terms of three to four months of import.

Against this brief survey on reserve adequacy measurement in relation to what is theoretically considered as the 'optimal' level of reserves, we have found that reserves to import ratio, the traditional yardstick of reserve adequacy, has remained a significant determinant in reserves holding in all countries except Japan over the period 1980-2003 (see Appendix 1 and Table 3). The long run relationship postulated using cointegration method is given in Table 3. We also expanded this traditional yardstick to include other variables such as short-term indebtedness and trade openness, as East Asia becomes more integrated with trade and capital flows after the 1997-98 crisis, as observed in Malaysia and Indonesia. The 1997-98 financial crisis in Asia reveals the severity of short-term indebtedness as a vital indicator of the lack of liquidity, currency attacks and financial crisis. Reserve adequacy is more accurately measured against the reserve to short-term debt ratio as well as reserve to import ratio. More revealing is the rapid pace of reserve accumulation by East Asian countries since the 1990s as their efforts to reduce exchange rate fluctuations as trade openness increases with trade and capital flows, especially in countries newly embarked on export-led growth strategy, such as Indonesia and Malaysia in particular.

TABLE 3: ESTIMATED LONG RUN RELATIONSHIP

$$lnrsvgold_t = \beta_0 + \beta_1 lnopenness_t + \beta_2 lnrsvimport_t + \beta_3 lnstedebt_t + e_t \quad (1)$$

Note: Equation (1) is the estimated cointegrating vector which represents the long run relationship between variables.

Country	Trade openness	Reserve-import ratio	Short term indebtedness
China	1.720173**	1.733629**	-0.061709
	[9.87897]	[29.8217]	[-0.67911]
Indonesia	0.285010	0.563083*	0.803173**
	[1.28621]	[4.38626]	[18.1284]
Japan	-0.062426	0.017619	-
	[-0.48631]	[0.37298]	
Korea	-3.648368**	1.354447*	0.793658**
	[-10.2529]	[16.4724]	[7.91986]
Malaysia	1.877224**	0.932099**	0.421719**
	[33.8751]	[17.9223]	[14.9329]
^ Philippines (cointegrating vector 1)	0.0000	2.761551	-1.884505
		[12.7944]	[-2.70223]
^ Philippines (cointegrating vector 2)	-1.0000	1.044569	-2.113855
		[10.4544]	[-6.54780]
Singapore	11.50298**	1.024014**	-
	[8.74547]	[3.28546]	
Thailand	0.352694	-0.351166*	0.368726*
	[2.53117]	[-3.73601]	[3.75005]

Note: * and ** denotes significance at 5% and 1% level respectively. The *t*-statistics are reported in parentheses. In the case of Philippines^, Johansen cointegration test found two co-integrating vectors and thus a joint test performed indicate that all three variables are significant at both 5% and 1% level. All tests are carried out using the likelihood ratio test. Refer to Appendix 1 for more details.

As shown in Table 3, trade openness is found to be significant for China, Korea, Philippines and Singapore. Short term indebtedness on the other hand is significant in Indonesia, Korea, Malaysia, Philippines and Thailand.

Intuitively, we would expect the signs for the coefficients of trade openness, reserve-import ratio and short term indebtedness to be positive. However, our analysis reported that Japan and Korea's trade openness coefficient is negative, with Korea's being highly significant (at 1% level). Meanwhile, Thailand's coefficient for the reserve-import ratio is also negative despite being significant at the 5% level. The coefficient of short term indebtedness is negative for China and the Philippines, with the Philippines's being significant at the 1% level. These contradictory results could be due to the small sample size used in the estimation. Owing to the unavailability of long annual time series data for our variables, the analysis was carried out on approximately 24 observations for all countries. Zhou (2001) has highlighted that both the trace test and maximum eigenvalue test for cointegration suffer power and size properties problems if the sample size is small. Furthermore, the tests conducted on the long run coefficient (β) in the cointegrating relations are based on asymptotic results. Since our sample size is small, the distribution of the test may not be asymptotically *chi*-squared (test for joint significance) or *t*-distributed (test for individual significance). The problem of inconsistency arises when the sample size is not large enough and this may be the reason why the estimated coefficients are not of the expected signs despite being highly significant. Thus, caution must be taken to accept the results of these tests.

4 Perceived Benefits and Costs in international reserve

It is possible to estimate a level of reserves consistent with different adequacy criteria to derive what is called an 'optimal' level. Owing, however, to the diverse and changing reserve measurement indices, such an exercise serves little purpose for static regional comparison. Commenting that there is as yet no formula to calibrate the 'optimal' level of reserves, Jeanne and Ranciere (2005) developed an inter-temporal optimization model of a small open economy in crisis arising from a sudden drop in output, showing that the optimal level of reserves is very sensitive to the interest rate spread, the output cost of a crisis and the risk aversion of the authorities. Aware of the difficulties in quantifying the benefits of reserves holding, this study looks at the main benefits of reserves in smoothing domestic absorption in response to crisis and the additional benefits of reducing the probability of a crisis and mitigating the associated output loss.

Estimates of the optimal level of reserves were derived under the hypothesis that emerging market economies hold reserves as insurance against crisis. This is in contrast to the alternate view (Dooley et al, 2004) of reserves as policies in maintaining large current account surpluses. The Greenspan-Guidotti rules may offer an appropriate benchmark against contagion-related crisis, according to Bussiere and Mulder (1999). Benefits of reserve accumulation may be perceived as a reduction in probability of financial crisis associated with reserves' holdings (Feldstein, 1999) or in terms of losses associated with a crisis that could be avoided with adequate reserves.

The IMF (2003) pointed out that the level of reserve accumulation in some of the Asian economies far exceeded the conventional determinants such as economic size, level of imports, export volatility

and exchange rate flexibility. Two major sources of reserve accumulation are derived from current account and capital flows which comprise mainly of equity investments and commercial bank loans. Decomposition of changes in reserves reveals three subgroups in Asia:

- Economies experiencing current account surplus and capital inflows: PRC, India, Korea, Japan, Taipei, China;
- Economies with current account surplus and capital outflows: Hong Kong (SAR) China, Indonesia, Malaysia, Singapore and Thailand;
- Economies with all accounts less than $5 billion: Pakistan, Philippines, Vietnam

Significant inflows in net portfolio capital occur in PRC, India, Japan, Korea and Taipei, China. The PRC has become by far the most attractive destination of equity investment, receiving $190 billion in the past four years (4% of GDP on average). For sizeable bank inflows, PRC, India, and Korea take the lead (Akiko Terada-Hagiwara, 2005). Maintaining macroeconomic financial and exchange rate stability is of strategic importance to many Asian economies. The accumulation of adequate level of reserves will ensure payment liquidity, and enable the Central Banks to intervene in the foreign exchange market to smooth out exchange rate variability. The average monthly nominal and real exchange rate variability of the PRC, Hong Kong, China (Currency Board) and Malaysia (pegged to US Dollar until recently) is less than 1%. Korea and Japan are more volatile (exceeding 2% monthly), and Indonesia is the most volatile. Countries on managed regimes vary from 0.8% to 3.5% volatility (Table 4). The low variability in nominal and real exchange rates reflects interventions in foreign exchange markets by the Central Banks in Asia. The massive accumulation of international reserves after the 1997-98 financial crisis has provided the major benefits for reducing the region's exchange rate variability.

TABLE 4: AVERAGE MONTHLY EXCHANGE RATE VARIABILITY (IN RELATION TO US$)

	Nominal Exchange Rate (Percent)	Real Exchange Rate (Percent)	Official Regime
Hong Kong, China	0.06	0.58	Currency Board
PRC	0.00	0.75	Fixed
Malaysia	0.11	0.34	Fixed
Japan	1.86	2.96	Float
Korea	1.80	2.09	Float
Philippines	1.31	1.24	Float
Taipei, China	0.71	1.34	Managed
India	0.38	1.27	Managed
Indonesia	3.24	3.59	Managed
Pakistan	0.65	1.07	Managed
Singapore	1.01	1.29	Managed
Thailand	1.09	1.30	Managed
Vietnam	0.16	0.81	Managed
Average	*0.95*	*1.43*	

Note: Average variance of monthly exchange rate changes

Fee

Source: International Financial Statistics, DataStream, in Akiko Terada-Hagiwara (2005), "Foreign Exchange Reserves, Exchange Rate Regimes, and Monetary Policy Issues in Asia", ERD Working Paper No.61

There are fixed and variable costs in reserve holdings. Reserve holdings are locked up in anticipation of future financial crises. A Dollar held as reserves is essentially a Dollar of foregone investment in capital-scarce developing economies; as such cost is very similar to insurance premiums paid in advance of currency crisis. More difficult to estimate are the costs of intervention, the trading loss and the cost of restoring the level of foreign exchange reserves to some appropriate level after the currency crisis (Reserve Bank of New Zealand, 2004). Feldstein (1999) views a higher level of exports relative to imports in the domestic economy as the cost of sacrificing domestic consumption and investment, unless the domestic markets are unable to absorb products exported to foreign markets. Other costs include cost of borrowing reserves, as well as investment diverted from national resources (Movchan, 2002).

Baker and Walentin (2001) has estimated substantial increase in the cost of increase in reserve holdings from 1960-1990s, using the weighted averages of the ratio of reserves to GDP. The opportunity costs of reserve holding in East Asian region exceeded 3 percent of annual GDP in the high cost scenario. (Table 5).

TABLE 5: COST OF INCREASED RESERVE HOLDINGS 1960'S TO LATE 1990'S (GDP WEIGHTS)

(PERCENT OF GDP)

	Annual Cost		*Cumulative Cost – 10 years*	
Region	**Low Cost**	**High Cost**	**Low Cost**	**High Cost**
East Asia and Pacific	1.5%	3.1%	15.5%	31.1%
South Asia	0.5%	1.0%	5.1%	31.1%
Latin America and Caribbean	0.4%	0.8%	4.7%	9.4%
Middle East and North America	0.9%	1.8%	10.6%	21.3%

Source: World Bank 2001 in Dean Baker and Karl Walentin (2001), "The Increasing Cost of Foreign Reserve Holdings To Developed Nations", Center For Economic and Policy Research.

In examining the fiscal impact of the (opportunity) costs of international reserves over 100 countries from 1990-2004, Hauner concluded that while most countries made money on their reserves during 1990-2001, most countries have been losing money during 2002-04. The rising cost of reserves holdings drove up the foregone savings from external debt repayment. The falling interest rates with increased reserves and the depreciating US dollar affect the benefits of reserves holding.

Table 5 shows the much higher costs of reserve accumulation in the developing countries, especially in East Asia and the Pacific and South Asia compared to the more affluent and developed economies in the Middle East (due to the rising revenue from oil price gyration in recent years) and the highly developed economies in North America. Several reasons may have contributed to the disparity. Martin Feldstein (1999) has concluded from the aftermath of the Asian financial crisis that the East Asian countries have learned to protect themselves from the failure of the International Monetary Fund or reforms from the "international financial architecture" to bail them out from the crisis. Increased liquidity through reserve accumulation seems to be a better alternative to avert financial/currency crisis from reversals in capital flows. Aizenman and Marion (2002) have observed that the size of international transactions, their violatility, exchange rate arrangement and political considerations are the key factors behind the reserve holdings of 125 developing countries over the period 1980-1996.Soverign risks and costly tax collection to finance fiscal deficits after the financial crisis led to rising demand for international reserves. High discount rates, political instability or corruption have driven some countries to hold smaller precautionary balances, while countries suffering from financial volatility or risk aversion to financial losses are predicted to hold a large demand for international reserves. Rodrik (2006) has estimated the social cost of foreign exchange reserves as equivalent to around 1 percentage points of GDP annually fro developing nations taken as a whole.

In international finance, theory suggests that countries with fixed or heavily managed exchange rates should accumulate more reserves than countries with more flexible regimes. This is contrary to the observed trend that more countries have shifted from pegs to floating exchange rate regimes in the post financial crisis in 1990s while reserve accumulations continue to rise. Choi and Baek (2004) revised the exchange regime classification of Reinhart and Rogoff (2002) and discovered that exchange rate regimes with intermediate flexibility accumulated more reserves than polar regimes under hard pegs and freely floating.The policy implication is that "current large stockpiles of reserves in East Asian countries can be significantly reduced if they adopt a single currency" (op. cit)

Despite the high opportunity costs of holding reserves, it can be concluded that most countries held currency reserves in support of exchange rate policy and overall economic stability. Reserves provide the liquidity support for central banks to intervene in foreign exchange markets, irrespective of whether reserves actually contribute to the economic efficiency and growth objectives. Archer and Halliday have argued that foreign exchange market stability is the primary reason for holding foreign currency reserves as the financial markets are inherently vulnerable to shocks and crisis. Very large shocks and increased price volatility may disrupt liquidity and convertibility in foreign exchange markets. The cost of dysfunction requires intervention in the foreign exchange markets to maintain liquidity for convertibility.

5 RESERVE POOLING FOR ASEAN+PLUS THREE (APT) INITIATIVE

The experience of the 1997-98 Asian financial crisis provided a driving force for the ten ASEAN countries together with China, Japan and Korea known collectively as ASEAN Plus Three (APT) to engage in a dialogue process for regional cooperation. The APT finance ministers at the Asian Development Bank annual meeting in Cheng Mai, May 2000 agreed to pool currency reserves via a network of bilateral currency swaps and repurchase agreements to provide liquidity support to assist currency crisis to and avert future financial crises. The initial program of the Chiang Mai initiative (CMI) may be limited on account of the meager magnitude of liquidity support and an essentially weakly coordinated and voluntary swap arrangement. However a big step in regional cooperation has been taken for information exchanges on movement of short-term capital as an early warning system and economic surveillance. Although distant in vision, there remain prospects of a larger regional

trade bloc for Asia (Jeffrey Robertson, 2002) similar to that of the European Union (EU) and the Free Trade Area of the Americas (FTAA).

Pooling of international reserves in excess of its optimal levels for investment in the APT economies will propel the region towards the financing of domestic development plans in both the public and private sectors. This will strengthen financial integration without sacrificing monetary independence in the respective member countries. It will overcome the current reluctance among more developed countries with strong currencies such as Japan, China, Korea or Singapore to forgo their monetary systems in exchange for a more formalized regional structure incorporating other countries with weak currencies.

Drawing on the West African experience on reserve pooling, Rajan and Siregar (2002) has suggested a short-term regional liquidity facility to supplement the role of IMF, similar to an East Asian regional fund for the prevention of financial crisis or an East Asian Monetary Fund as a regional lender of last resort as elaborated by Park (2001). A member country in crisis can draw on "tiers of liquidity" as concentric defence lines, utilizing owned reserves placed with the regional pool and other members' reserves with the pool. This pooling mechanism is similar to the recommendation of the West African Economic and Monetary Union (WAEMU) where each central bank maintains 65 percent of its official reserves in operations account. Each member in crisis must draw on its own account of pooled and non-pooled reserves before other countries' pooled reserves can be used. (Williams et al., 2001, p.7). The third tier comes from the conventional IMF lending.

For effective conditionality compliance and economic surveillance of potential financial crisis, this paper argues that the establishment of an Asian Monetary Authority (AMA) to implement regional reserve pooling arrangement is a prerequisite to closer regional financial and monetary integration. With Central Bankers from 13 ASEAN+3 countries represented in the AMA, the detailed set up of the reserve pooling mechanism can be worked out.

An Asian Monetary Authority is best placed to work out a regional reserve currency allocation mechanism, taking into consideration the 'optimal' currency reserves required to meet the macroeconomic objectives of each respective monetary authorities of APT. The broad objectives of regional reserves holding would include:

- Precautionary motives to meet balance of payment, reserve currency composition for import and other international transaction needs to hatch against exchange rate risks;
- The risk aversion preference of central banks in the choice of optimal portfolio of currency composition;
- Global economic conditions and the predictability of currency crisis;
- Diversification need to protect the value of currency reserves selected against international inflation or unexpected shocks;
- Costs of reserve holdings –fixed and variable costs, exchange rate intervention cost and the opportunity cost foregone for domestic investment for reserve currencies held.

Concluding remarks

Reserve accumulation in East Asia has assumed a level viewed as beyond the desired level after the 1997-98 crisis. It has successfully narrowed the exchange rate variability in East Asian economies. Such massive accumulation of reserves is a symptom of renewed economic growth in the post-crisis era in Asia. It is also a reflection of growing global imbalances as the US deficits continue to widen.

While trade and capital flows and current account surpluses largely explain Asian reserve accumulation, the issue of optimal reserves is difficult to generalize as reserve adequacy has changed with the changing motives of reserve holding, from the traditional reserve import ratio for current account balance to short-term indebtedness and trade openness as the Asian economies become more integrated with global trade and capital flows. The precautionary motive for reserve holding is even becoming more important as the need to avert future financial crisis become an overriding policy in the rapidly growing Asian economies.

The benefit-cost issues of reserve holding depend not only on the levels of reserves held to be adequate and the annual costs of holding reserves plus cost of intervention in the foreign exchange markets, but also the macroeconomic factors such as crisis predictability and risk preferences of exchange regimes in different economies.

The increasing costs of reserve holding and the loss of investment opportunity foregone in reserves held in capital-scarce developing economies will ultimately set an upper limit to reserve accumulation. Given the rising costs of holding reserves, the case for regional pooling of reserves cannot be underestimated. This paper argues that the establishment of an Asian Monetary Authority will be an important step to enhance the CMI move towards regional liquidity support and perhaps Asian monetary integration and the possible use of an Asian currency made up of a basket of US dollar, Yen and Euro or perhaps other Asian currencies including the Yuan, in the distant future.

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Appendix 1

Data

The data used for this analysis were collected from various sources: CEIC Asia Database, International Financial Statistics (IMF), World Bank World Tables, World Development Indicators and Asian Development Bank. Due to data constraints, the analysis is conducted only for five ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, Thailand) as well as China, Japan and Korea. All data used range from 1980 to 2003.

Variables

lnrsvgold : Log of International Reserve excluding gold

lnopenness : Log of Openness of the Economy ratio

$$\left[openness = \frac{imports + exports}{GDP} \right]$$

lnrsvimport : Log of Reserve-Import ratio

$$\left[rsvimport = \frac{rsvgold}{import} \right]$$

lnstedebt : Log of Short Term External Debt

Analysis

The general model in this analysis is as follow:

$$lnrsvgold_t = \beta_0 + \beta_1 lnopenness_t + \beta_2 lnrsvimport_t + \beta_3 lnstedebt_t + e_t \qquad (1)$$

Since all variables are non-stationary and they are cointegrated, equation (1) above is modeled using Johansen cointegration method, where equation (1) is the estimated normalized cointegrating vector. Thus, equation (1) represents the long-run equilibrium relationship in the Vector Error Correction Model.

Estimated long run relationship (cointegrating vectors) with t-statistics in parentheses

China:

$$\widehat{lnrsvgold_{t-1}} = 14.41267 + \underset{[9.87897]}{1.720173} lnopenness_{t-1} + \underset{[29.8217]}{1.733629} lnrsvimport_{t-1} - \underset{[-0.67911]}{0.061709} lnstedebt_{t-1}$$

Indonesia:

$$\widehat{lnrsvgold_{t-1}} = 2.247936 + \underset{[1.28621]}{0.285010} lnopenness_{t-1} + \underset{[4.38626]}{0.563083} lnrsvimport_{t-1} + \underset{[18.1284]}{0.803173} lnstedebt_{t-1}$$

Fee

Japan:

$$\widehat{dlnrsvgold_{t-1}} = 0.037534 - 0.062426 lnopenness_{t-1} + 0.017619 lnrsvimport_{t-1}$$
$$[-0.48631] \qquad [0.37298]$$

Korea:

$$\widehat{lnrsvgold_{t-1}} = 1.877530 - 3.648368 lnopenness_{t-1} + 1.354447 lnrsvimport_{t-1} + 0.793658 lnstedebt_{t-1}$$
$$[-10.2529] \qquad [16.4724] \qquad [7.91986]$$

Malaysia:

$$\widehat{lnrsvgold_{t-1}} = 6.321917 + 1.877224 lnopenness_{t-1} + 0.932099 lnrsvimport_{t-1} + 0.421719 lnstedebt_{t-1}$$
$$[33.8751] \qquad [17.9223] \qquad [14.9329]$$

Philippines:

$$\widehat{lnrsvgold_{t-1}} = 29.15207 + 2.761551 lnrsvimport_{t-1} - 1.884505 lnstedebt_{t-1}$$
$$[-12.7944] \qquad [\ 2.70223]$$
$$\widehat{lnopenness_{t-1}} = 19.89586 + 1.044569 lnrsvimport_{t-1} - 0.537382 lnstedebt_{t-1}$$
$$[-10.4544] \qquad [-6.98673]$$

Singapore:

$$\widehat{dlnrsvgold_{t-1}} = -11.26320 + 11.50298 lnopenness_{t-1} + 1.024014 lnrsvimport_{t-1}$$
$$[8.74547] \qquad [3.28546]$$

Thailand:

$$\widehat{dlnrsvgold_{t-1}} = -0.052780 + 0.352694 lnopenness_{t-1} - 0.351166 lnrsvimport_{t-1} + 0.368726 dlnstedebt_{t-1}$$
$$[2.53117] \qquad [-3.73601] \qquad [3.75005]$$

Testing the significance of long run relationship on international reserve

This test involves testing the long run coefficients (β) in the cointegrating vectors to determine if the particular variable enters the cointegration relation. In general, the null and alternative hypotheses are given by:

$H_0 : \beta_{j1} = \beta_{j2} = ... = \beta_{jk} = 0$ (The *jth* variable does not enter the cointegrating relation)

H_1 : At least one of $[\beta_{j1}, \beta_{j2}, \beta_{jk}] \neq 0$ (The *jth* variable enters the cointegrating relation)

where $k = \mathrm{k}^{\mathrm{th}}$ cointegrating relation

Test statistics: $LR_{cal} = 2(L_u - L_r) \overset{asy}{\sim} \chi^2(q)$ under H_0

where q = number of restrictions under H_0

The results for this test are reported in Table 3.

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