

Financial Market Integration in East Asia: Status and Options

July 2009

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ABSTRACT

As cross-border capital movements are expanding, financial markets in East Asia are becoming increasingly integrated. This paper attempts to investigate the current state of financial market integration in East Asia by measuring interest differentials among 10 East Asian countries along with various factors that determine these differentials. According to this paper, there is increasing interest rate convergence in East Asia although the interest deviations remain high compared to Europe. Also, the predominant obstacle preventing further integration is the increasing level of exchange rate fluctuations in East Asia. Given that successful financial market integration necessitates exchange rate stability, it is essential to establish an effective regional monetary institution in East Asia.

Key Words: East Asia, financial integration, Interest differential, interest rate parity condition

I. Introduction

Despite temporary disruptions caused by the currency crisis in 1997, East Asian countries have experienced growing intra-regional trade as their economies have become increasingly interdependent. Along with this real integration, financial linkages have also been established at an accelerating rate, especially in response to financial liberalization and capital market openings. Indeed, increasing short-term capital flows have strengthened the financial links among East Asian countries as well as to the US (Moon & Rhee (2009), Cowen et al.(2006)).

The growing trade and capital flows in Asia highlights the desirability of stable exchange rates within the region. Stable intra-regional exchange rate is important too, because Asian countries compete with one another in the world markets. The experience of Europe is especially illuminating because its real integration has led to financial integration, ending up with the introduction of a single currency, the Euro, which eventually eliminated the problem of exchange rate fluctuation entirely.

Largely based on this European experience, many studies were conducted to measure the extent of financial market integration (See for example Adams et al. (2002), Baele et al. (2004) and Laura Vajanne (2006)). A majority of these studies have concluded that money market integration was completed within Europe in 2002 while integration in other financial markets has been still lacking. However, studies examining East Asian financial markets have been relatively rare.

This paper aims to examine the extent of financial market integration in East Asia, particularly focusing on money market. Though there are numerous ways to examine money market integration, one well-established method is to rely on the interest parity condition and measure the interest rate differentials between home and foreign countries. (Cavoli et al. (.2004) and Ito. & Chinn (2007)) This paper measures money market interest differentials among East Asian countries and compares the interest deviations observed in East Asia to deviations in Europe. Finally, this paper examines factors that can explain such interest rate differentials and draws implications for future efforts in monetary cooperation.

This paper finds evidence of increasing interest rate convergence in East Asia, although deviations in Asia remain substantial. To further financial market integration in Asia, there is a need for closer cooperation to stabilize exchange and establish effective regional monetary

institutions.

The contents of this paper are as follows. Section II begins by introducing a method for measuring financial market integration in East Asia. With this method established, trends in money market interest rate differentials will be examined between the years 1991 and 2008. Section III examines determinants of such interest rate differentials in East Asia. Section IV discusses policy options for furthering Asian financial integration. Section V concludes.

II. Interest differentials in East Asia

1. Methodology

The interest rate parity condition states that if the domestic interest rate is higher than the foreign interest rate, the domestic currency can be expected to appreciate until the interest rate at home equals the foreign interest rate adjusted for the exchange rate changes. Specifically, the covered interest rate parity condition implies that the home interest rate should be equal to foreign interest rate plus forward premium. Any violation of this relationship suggests that the financial markets in question are not well integrated.

Let r_i represent the interest rate of country i at time t . Then the return a typical investor expects to earn at period $t+1$, investing 1 US dollar in country i , is:

$$R(i, t) = (1 + r_{it}) * S_{it} / F_{it}$$

where r_{it} is the money market interest rate of country i , S_{it} is the spot exchange rate of currency i against the US dollar, and F_{it} is the 3 month forward exchange rate of currency i against the US dollar.

Now we can define the interest differential between country i and country j at time t , $Dif(i, j, t)$, by the absolute value of $R(i, t) - R(j, t)$.

$$\begin{aligned} Dif(i, j, t) &= |\ln R(i, t) - \ln R(j, t)| \\ &= |(r_{it} - f_{it}) - (r_{jt} - f_{jt})| \end{aligned}$$

where $f_{it} = (S_{it} - F_{it}) / F_{it}$ and $f_{jt} = (S_{jt} - F_{jt}) / F_{jt}$

If the financial markets of country i and country j are fully integrated, then we expect arbitrage by the investors to drive the interest deviation down to zero. In reality, however, there are many impediments preventing financial arbitrage, such as differing macroeconomic policies and regulations, capital controls, and political risks. These impediments are especially significant for developing countries and therefore substantial interest deviations can be expected for developing countries. However, as Ito and Chinn (2007) revealed, interest deviations do not vanish even among developed nations.

Since most East Asian currencies are not internationally exchanged and the US dollar is accordingly used as a vehicle currency to mediate financial transactions between national currencies, East Asian financial markets are closely linked to the US market and indirectly connected to each other. Then we can rewrite the interest deviation as $|(r_{it} - f_{it} - r_{ust}) - (r_{jt} - f_{jt} - r_{ust})| < |(r_{it} - f_{it} - r_{ust})| + |(r_{jt} - f_{jt} - r_{ust})|$. Thus, if countries i and j are closely linked to US financial markets, they are also closely integrated to each other.

To measure the overall degree of money market integration in East Asia, we take the average value of 45 interest differentials, AD .

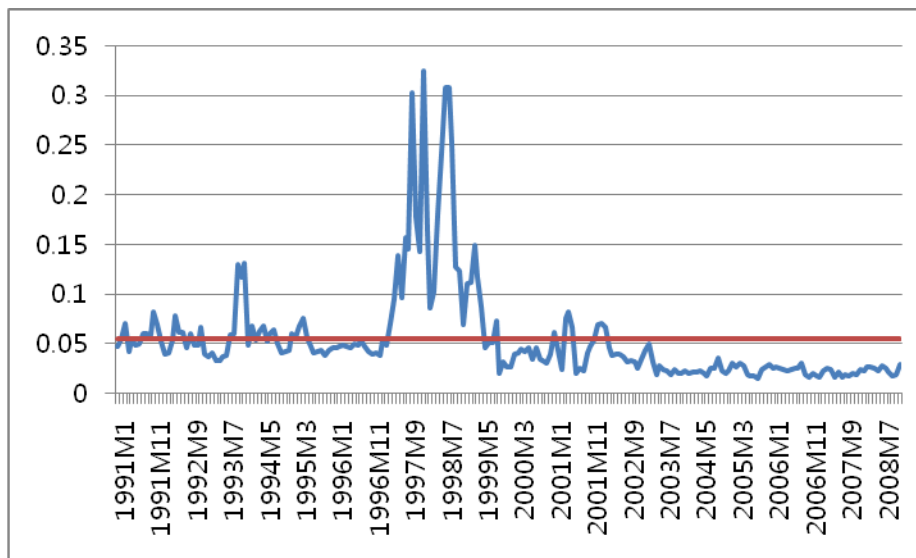
$$AD(t) = \sum_{i=1} \sum_{j \neq i} Dif(i, j, t) / 45$$

This basic methodology was first used by Pasely & Wei to measure goods market integration and subsequently expanded upon by Moon & Yoon (2006). Since we consider 10 East Asian countries including Korea, Japan, China, Hong Kong, Taiwan, Indonesia, Malaysia, Philippine, Singapore, and Thailand, there are 45 country pairs when determining bilateral interest rate differentials. The value of AD for the 10 East Asian countries during the period 1991-2008 was based on 3 month money market rates obtained from International Financial Statistics, IMF and spot and forward exchange rates from *Bloomberg*.

2. Trend

Figure 1 shows trends in interest differentials among the 10 East Asian countries.

Figure 1 Interest Rate Differentials in 10 Asian countries

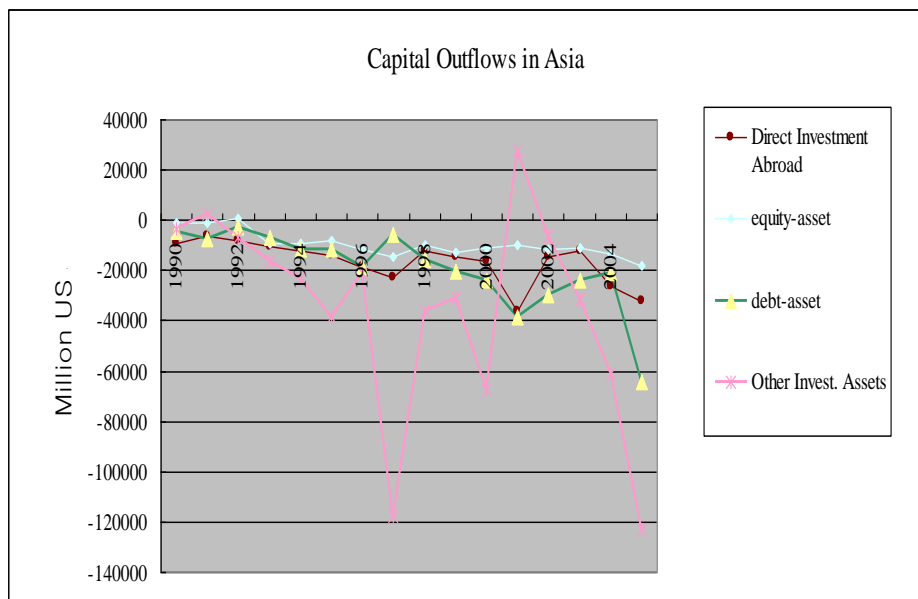
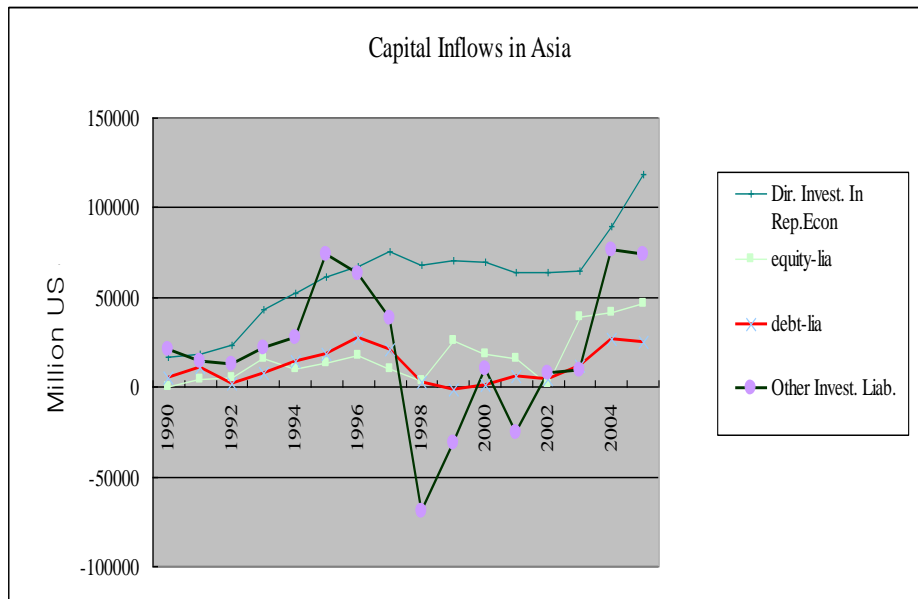


Source: International Monetary Fund, *International Financial Statistics*, and Bloomberg

Three facts are worth noting. First, there are considerable gains to be reaped through financial arbitrage in East Asia as the average interest differential from 1991 to 2008 on a monthly money market rate basis was 5.4% (0.053). Secondly, the interest rate differentials between East Asian countries were greatly affected by the financial crisis and resultant exchange rate volatilities. It can be assumed that wide fluctuation in the exchange rate would not wipe out gains from arbitrage. However, during the currency crisis period, exchange rate volatility was so large that it discouraged any arbitrage trade. Indeed, Asian countries saw their interest rate differentials widened during the period of financial market turbulence. Thirdly, despite the currency crisis, interest differential seemed to be decreasing over time, thereby suggesting the possibility of interest rate convergence in East Asia. In fact, interest differentials in the post-crisis era were notably lesser than those observed in pre-crisis period.

Perhaps in response to important opportunities for interest arbitrage, short-term capital movements increased substantially as well. Figure 2 shows capital inflows and outflows in eight East Asian countries (Korea, Japan, China and advanced ASEAN 5 countries).

Figure 2: Capital Flows in East Asia 1990-2008



Note: Other investment liabilities and assets consist largely of commercial borrowings and loans.

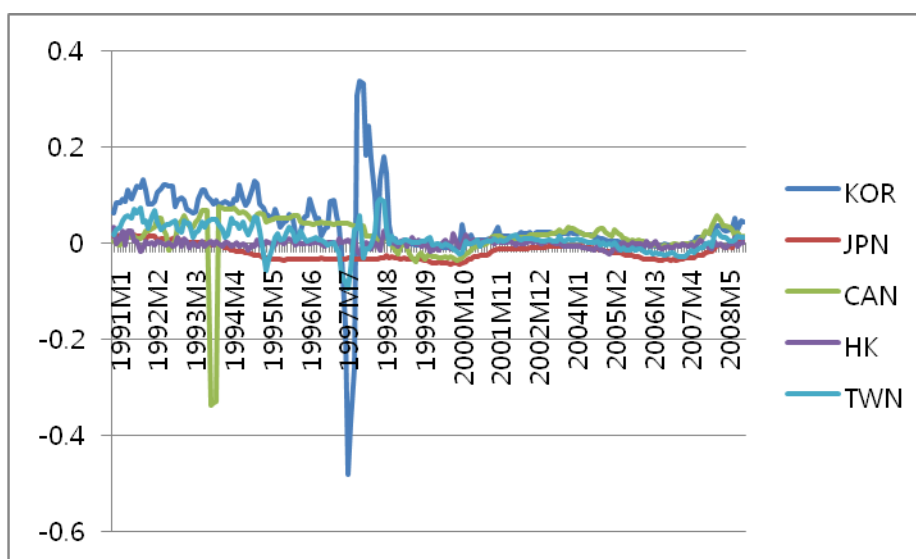
Source: International Monetary Fund, *International Financial Statistics*.

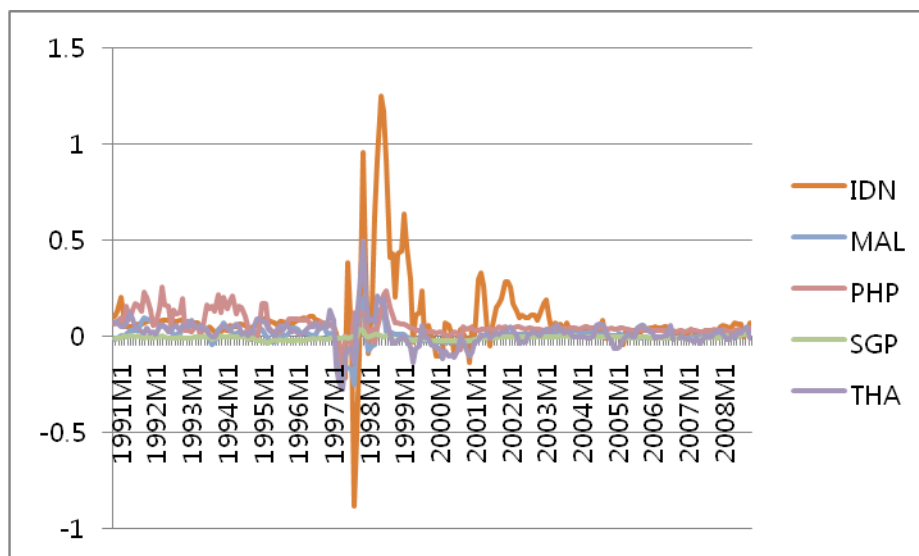
Cross-border bank loans were the most important component of these flows. Loans rose sharply following the crisis, partly as a reaction to their collapse in the previous period. This rebound was subsequently followed by an equally sharp increase in cross-border debt and equity flows. Japan was a major lender, generating massive capital flows known as the yen carry trade. In fact, Japanese banks could fund themselves at a very low interest cost and

use the proceeds to invest in assets denominated in other higher-yielding Asian currencies. To be sure, capital controls maintained by some countries such as China and Malaysia limited portfolio flows and financial-market integration to lower levels than would have prevailed otherwise. Nonetheless, given the search for yield, market participants found various ways around these controls. (See, for example, Goodfriend and Prasad (2005) and Ma and McCauley (2007)).

These developments not only deepened financial links among East Asian countries but also expanded East Asian links to the United States and major world markets, as evidenced by the substantial fraction of inter-regional capital flows. Furthermore, as previously mentioned, East Asian countries had maintained close financial linkages with the US because the US dollar was the most important vehicle currency in the region. Figure 3 shows the trend in interest differential for 10 East Asian countries vis-à-vis the US market.

Figure 3: Interest Rate Differentials of East Asia with the US 1990-2008



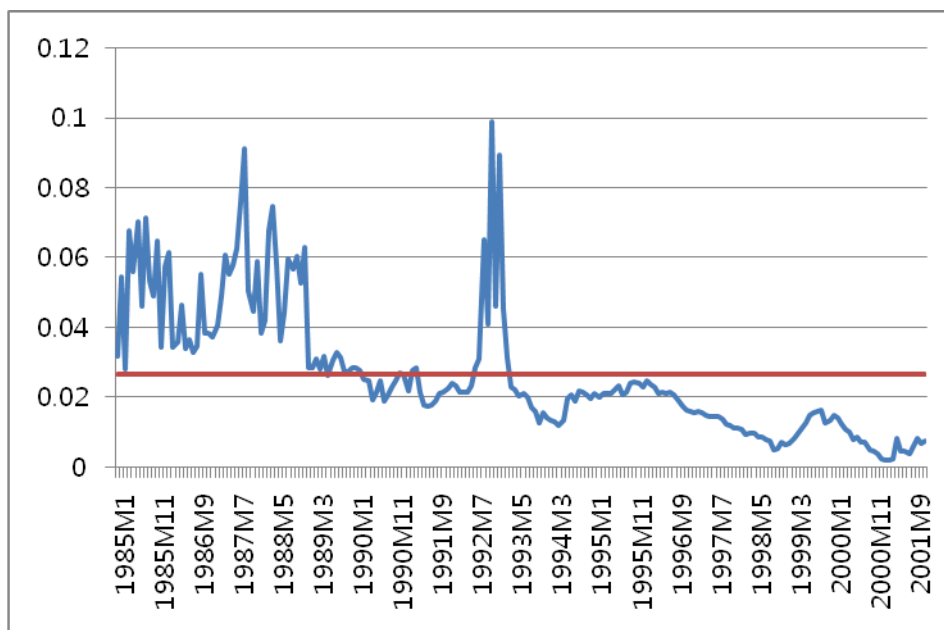


Source: International Monetary Fund, *International Financial Statistics*, and Bloomberg

3. Comparison with Europe

To comprehend how extensively money markets in East Asia are integrated, we compare interest rate differentials in Asian and European countries. 10 European countries (including Germany, France, Netherland, Belgium, Denmark, Finland, Portugal, Ireland, Spain and Italy) are considered. Figure 4 shows the degree of money market integration as measured by the average of 45 bilateral interest rate differentials among 10 European countries until the introduction of the single currency.

Figure 4: Interest rate differentials in Europe 1985-2001



Source: International Monetary Fund, *International Financial Statistics*, and Bloomberg

The average interest differential for the 10 EU countries from 1985 to 2002 on a monthly money market rate basis was 2.6% (0.0266), less than half of the average differential for the 10 Asian countries. Also, the interest differentials appeared to rapidly decrease over this period and nearly approached zero by the end of 2001. Therefore, even before completing the integration process by introducing the Euro and abolishing national currencies, financial market integration was much deeper in Europe compared to East Asia.

The comparison with the Europe suggests that exchange rate stability may be the most critical factor in accelerating financial market integration. Similar to Asia's experience during the 1997 currency crisis, European interest rate differentials widened during the 1992-1993 ERM crisis. The excessive exchange rate volatility hurt intra-regional capital markets as well as intra-regional trade.

III. Determinants of Interest Differentials

1. Model and data.

To identify the determinants of the interest differentials in East Asia and see how the interest differentials were determined, we consider the following model.

$$Dif(i,j,t) = c + \beta_1(exvol(i,j,t)) + \beta_2(infla(i,j,t)) + \beta_3(IP(i,j,t)) + \beta_4Dis(i,j) + \beta_5rating(I,j,t) + \beta_6Crisis + \beta_7Time$$

Dif(i,j,t) : absolute value of the interest rate difference between country i and j at time t.

exvol(i,j,t) : standard deviation of absolute value of the log changes in monthly exchange rate of country i against country j over the time period of 12 months around time t

infla(i,j,t) : absolute value of the inflation rate difference between country i and j at time t. Alternatively, *m(i,j,t)*, as the absolute value of money stock growth rate differentials between country i and j, could be used to substitute *infla(i,j,t)* in estimating the model

IP(i,j,t) : absolute value of the industrial production growth rate difference between country i and j at time t.

Dis(i,j) : log distance between country i and j.

Rating(i,j,t): absolute value of the difference in the credit rating scores between country i and j .

Crisis: dummy variable that has a value of 2 if a pair of countries experience financial crisis, 1 if one country has a financial crisis and the other does not, and 0 if both countries do not experience crisis.

Time: time dummy

This model was modified from Moon and Yoon (2006), which originally tried to explain goods price differentials on the basis of exchange rate volatility, distance and income difference between a pair of countries. Given that the interest rate differential is now the dependent variable, we assume that it is affected by inflation differentials as well as the exchange rate volatility. Distance was included in the model to see whether it affects movements of financial capital as well as the movement of goods. Income difference was replaced by the differential of industrial production growth rate. The difference in credit rating scores was newly added to reflect differences in the political and credit risk structure of the two countries in question. Credit rating scores provided by the Standard and Poor's Corporation were transformed into numerical values (See Annex). Higher values for this credit rating difference reflect larger differences in credit risk between the two countries and

greater difficulties in arbitraging interest rates between two countries.

In addition, two dummy variables were used. First, countries are separated based on whether they had undergone a financial crisis. If a pair of countries had experienced a crisis, the financial dummy was assigned a value 2, and if one country had a crisis while the other did not, the variable was given a value of 1. The financial dummy had a value of 0 if neither country had experienced a crisis. Secondly, the time variable was included to test whether the interest differentials tended to increase or decrease over time. If the coefficient for this variable was negative, it meant that the interest deviation was decreasing over time, thus suggesting interest rate convergence.

Data was collected from 1990 Q1 to 2008 Q4 and a detailed description for the data used is as follows. Interest differentials were calculated on the basis of three month money market rates or call rates. For Korea, China, Hong Kong, the Philippines, and Thailand, IFS provided 3 month money market rates while 3 month treasury rate were used for Malaysia. All data was obtained from IFS except for data on Taiwan, which came from the Central Bank of Taiwan.

Data for exchange rates were obtained from Bloomberg. The spot rate was obtained for all Asian countries but the forward rate could not be found for all Asian countries. For instance, the forward rate could not be obtained for Indonesia or the Philippines, and consequently the future spot rate was used instead. Data for credit rating scores of Standard and Poor's Corporation for each Asian country were obtained from Bloomberg. Figures for distance were acquired from the website of John Haveman. Inflation differentials and industrial production differentials were calculated based on monthly growth rates for consumer price and industrial production indices, which were obtained from Global Insight. Finally, M2 data was obtained from IFS.

<Table 1> Basic Statistics

	mean	SD	Max	Min	Number of Obs.
Dif(i,j,t)	0.053	0.088	0.950	0	3240
exvol(i,j,t)	0.020	0.029	0.251	0	3240
infla(i,j,t)	0.014	0.028	0.493	0.	3240
m(i,j,t)	0.029	0.031	0.282	0	3231
IP(i,j,t)	0.048	0.056	0.558	0	3119

Rating(I,j,t) ¹	1.774	1.305	9	0	2949
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Note 1; The number 9 means AAA while the number 0 means D/SD in the rating.

2. Basic Regression Result

Table 2 shows basic estimation results for interest rate differentials. The estimation was conducted by means of OLS estimation with and without the time dummy. Since the time dummy was included to capture the time effect on interest rate differentials and to inspect convergence patterns in interest differentials over time, the OLS estimation with the time dummy ended up being more significant.

<Table 2> Basic Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
constant	0.0025 (0.14)	-0.0096 (-2.83)	-0.0151 (-4.29)	6.0406 (10.78)	6.0353 (10.77)	5.4430 (9.52)
exvol	1.4053 (30.40)	1.4026 (30.44)	1.3125 (32.47)	1.3185 (28.63)	1.3163 (28.68)	1.4423 (31.15)
Infla	0.5460 (11.37)	0.5450 (11.36)		0.5878 (12.44)	0.5869 (12.43)	
m			0.1743 (3.85)			0.1717 (3.85)
Dis	-0.0015 (-0.71)			-0.0012 (-0.58)		
IP	-0.0935 (-3.17)	-0.0919 (-3.66)	-0.0339 (-1.35)	-0.0719 (-2.90)	-0.0706 (-2.86)	-0.0102 (-0.41)
Rating	0.0107 (10.28)	0.0056 (10.32)	0.0120 (11.37)	0.0111 (10.87)	0.0111 (10.90)	0.0125 (12.00)
Crisis	0.0101 (4.96)	0.0101 (4.96)	0.0111 (5.35)	0.0106 (5.30)	0.0106 (5.30)	0.0116 (5.70)
Time				-0.0030	-0.0030	-0.0027

				(-10.78)	(-10.79)	(-9.55)
R2	0.38	0.38	0.35	0.40	0.40	0.37

Note: The figure in () denotes the t-value.

As expected, the distance variable was not significant and implied that distance was not a meaningful proxy for transportation costs related to financial flows as it had been for goods market integration (Parsley and Wei (2001) & Moon and Yoon (2005)). Thus, once we focus on regression results that exclude the distance variable, all variables were significant. The interest rate differential between two countries was significantly affected by their credit rating score difference as wider differences in two countries' risk structure prevented arbitrage transactions and allowed both countries to maintain separate interest rate policies. The interest rate differential was also affected by inflation rate and production activity differences as well as exchange rate volatility. Reducing exchange rate variability was particularly important to decreasing interest rate differentials. For instance, according to column 2, reducing monthly exchange rate variability from the sample average 0.020 to zero would reduce interest rate differential by 0.028 ($=1.4026 \times 0.020$), while an increase of exchange rate variability to its maximum value 0.251 would bring about an increase in price differentials by 0.324 ($=1.4026 \times (0.251 - 0.020)$). Furthermore, the interest rate differential increased when country pairs showed a larger inflation gap. All these variables generally exhibited correctly signed positive coefficients. However, the coefficient of industrial production gap did not appear positive, although its significance was small compared to those of other variables. Since it is likely that the negative coefficient for production activity was due to its close negative correlation with inflation rate difference, we replaced inflation rate difference by the growth rate difference of money stock and re-estimated the regression equation. Then, as seen in column 3 and 6, production growth difference lost its explanatory power.

In addition, two dummy variables were significant. The positive sign for the crisis dummy implied that countries experiencing currency crisis showed larger interest rate differentials. In fact, in the case of Korea, there was a sharp rise in short term interest rate due to induce foreign capital and under such situation it is extremely difficult to expect a regular arbitrage transaction. Lastly, the time dummy appeared to be very significant and the negative coefficient for the dummy meant that interest rate differentials tended to decrease over time. Indeed, financial markets in East Asia have become increasingly integrated to each

other as well as to global markets.

3. Non-linearity Check

To consider possible non-linear effects of exchange rate volatility and differences in the credit ratings between two countries, we included the squared values of these variables as additional regressors. The estimation results presented in Table 3 suggest that these additional variables did not substantially improve the fitness of the model but the squares of exchange rate volatility and credit rating difference were nevertheless significant. The negative sign of the square of exchange rate volatility means that higher exchange rate volatility was associated with larger interest rate differentials but the incremental effect became smaller as volatility increased. In contrast, the positive sign of the square of credit rating difference and the consequent negative sign of the credit rating difference means that credit rating differences only widened interest rate differentials when the ratings difference was appreciably large.

<Table 3> Non-linear Regression Results

	(1)	(2)	(3)	(4)
constant	5.9097 (10.66)	6.1121 (11.04)	5.4765 (8.96)	5.7934 (9.50)
exvol	2.2131 (19.79)	1.2949 (28.52)	2.2006 (19.83)	1.4042 (29.81)
(exvol) ²	-4.4116 (-8.19)		-4.3457 (-7.66)	
Infla	0.6213 (13.25)	0.5966 (12.79)		
m			0.2607 (5.48)	0.2230 (4.75)
IP	-0.0694 (-2.84)	-0.0736 (-3.01)	-0.0054 (-0.21)	-0.0106 (-0.41)
Rating	0.0098	-0.0072	0.0113	-0.0059

	(9.64)	(-3.07)	(10.59)	(5.18)
(Rating) ²		0.0036 (8.63)		0.0036 (8.22)
Crisis	0.0096 (4.85)	0.0099 (5.03)	0.0101 (4.84)	0.0108 (9.51)
Time	-0.0029 (-10.69)	-0.0030 (-11.03)	-0.0027 (-9.00)	-0.0028 (-2.37)
R2	0.42	0.42	0.39	0.39

Note: The figure in () denotes the t-value.

VI. Implication for Regional Monetary Cooperation

The preceding results suggest that East Asia economies have become increasingly integrated with one another as well as to world markets, and highlight the general importance of exchange rate stability. In reality, achieving exchange rate stability in relation to the US, and with Asian countries as a consequence, has been a critical priority of economic policy for a long time. To prevent excessive volatility in exchange rate changes and to cope with unforeseen crises, East Asian nations had to accumulate massive amounts of foreign reserves, which were eventually invested by Asian countries in U.S. government and agency securities. When U.S. banks subsequently recycled these investments by making their own bank loans to East Asia, they perpetuated a process that increasingly integrated the various financial markets of East Asia.

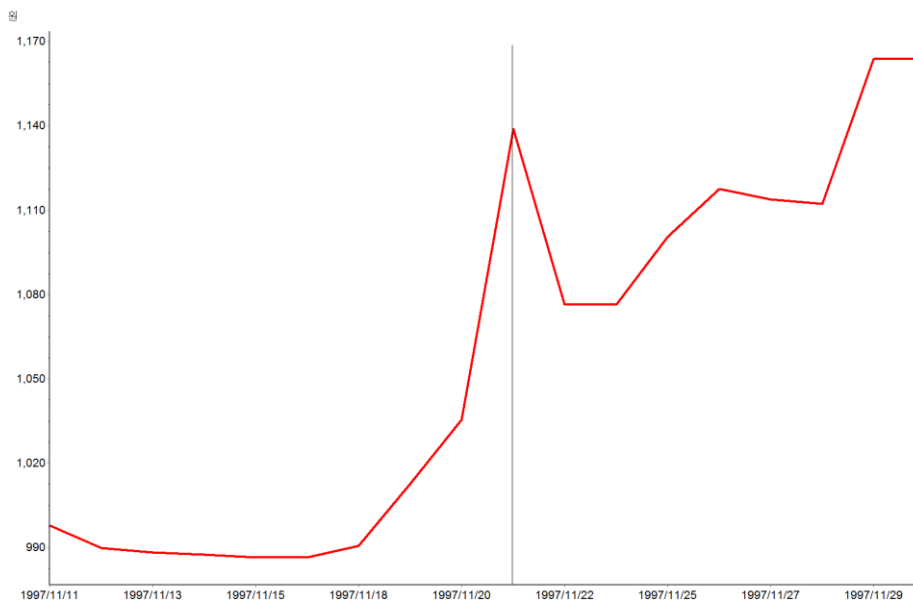
Thus, financial market integration would not have been possible without exchange rate stability. The so-called impossibility trinity theorem, however, states that individual efforts will not be enough to stabilize exchange rate. Moreover, the cost of intervening in exchange rate markets is huge and intervention itself can be dangerous as witnessed in 1997 and the more recently global financial crisis. Indeed, emerging countries like Korea are ever more vulnerable to ebbs and flows in capital flows, which can be caused by investors' whims. For these reasons, international economic crises can be predicted to occur in the future as they have in the past.

While collective action for self-protection is a possible alternative to crisis in the current world of financial integration, such action requires one pre-condition: In case of

financial turbulence, central banks need to acquire an emergency fund. One fundamental question in this regard is whether a special role for regional financial arrangement exists in addition to international systems such as the IMF. The onset of the current global financial crisis underscored the limits of the IMF as an international lender of last resort as the IMF's financial resource were limited to 250 billion US dollars and liquidity provisions coordinated by IMF came after the system's collapse as opposed to preempting large currency swings. Finally, harsh conditionality was another factor making access to the IMF very difficult.

Indeed, the stigma that only those Asian nations that failed in their economic policies borrowed from the IMF in the past now prevents these countries from utilizing similar funds to stabilize their economies. Korea's recent experience is a good example. In Korea, IMF emergency fund did not serve to stabilize the exchange market. In contrast, the October 2008 bilateral swap concluded by the Bank of Korea with the FRB in response to the global currency crisis proved to be more appropriate and effective.

<Figure 5> IMF loan (27 Billion \$) to Korea



<Figure 6> Korea-US Currency Swap (30 Billion \$)



At the G20 summit meeting held in London on April 2, 2009, the consensus was reached to reform the lending and conditionality framework of the IMF, increasing the financial resources of the organization to 750 billion dollars and introducing Flexible Credit Line as a new lending facility. Notwithstanding these measures, however, it is not apparent whether East Asian countries should continue to rely on the IMF. At least three arguments can be provided for a regional lender of last resort in East Asia. One is that international activity is not speedy enough to nip problems in the bud before crisis ensues. Furthermore, transaction costs in arranging a cooperative response may be lower at the regional level because the number of participating governments is smaller and the countries involved are more cohesive in nature. When significant problems appear within a region, these problems are often clustered because of intra-regional interdependence and regional institutions could redirect necessary resources more efficiently than an international institution with a broader range of tasks. Secondly, financial assistance from an international organization is usually not ample enough to achieve what ought to be achieved. For example, as evidenced by the recent global crisis, there was a shortage of disposable funds at the IMF, which eventually led to urgent increases in funding through the G-20 meetings. Thirdly, the activities and procedures of international institution are based on general rules and fail to give appropriate attention to regional peculiarities. To the extent that the unique characteristics of East Asian economies matter, a case can be made for regional arrangements (Eichengreen (2001)).

East Asian countries have endeavored to set up such arrangement. Known as the Chiang Mai Initiative (CMI), Asian countries have decided to initiate a swap arrangement between central banks in the region. The current Chiang Mai swap arrangement, however, is too limited to play an independent role apart from the IMF in helping Asian countries stabilize their currencies and defend speculative attacks. The IMF, moreover, controls 80% of the CMI's funds, thereby making the provision and distribution of funds impossible without prior IMF approval. It implies that the CMI is far from being a sovereign institution, and the recent agreement on CMI multi-lateralization, which may re-label the CMI as the CMIM or AMF, is only an intermediary step towards eventually establishing an effective regional lender of last resort.

Regional lender and global institutions can co-exist. The benefit of having a regional monetary institution is two-fold. First, it will free East Asian countries from the IMF's current monopoly over emergency loans. This competition would almost assuredly have valuable effects, as demonstrated by Europe's two parallel systems for supplying liquidity: The European Central Bank and the IMF. Second, the presence of a regional body would surely solidify the positions of individual Asian countries in international financial institutions. It should be noted, however, that the establishment of regional systems calls for a clear division of labor and responsibilities with the IMF. It would be desirable for the IMF to coordinate and supervise the financial authorities of each country while regional institutions focus more on supplying liquidity (See for example Wing Thyo Woo (2008))

V. Conclusion

This paper examines financial integration in East Asia by measuring money market interest rate differences among 10 East Asian countries. Generally speaking, we could say interest rate convergence is gradually occurring in East Asia, although this trend was momentarily disrupted by the 1997 currency crisis. Korea's post-1997 experience was particularly interesting as Korea dramatically moved to open the capital account following the crisis, which led to burgeoning short-term capital inflows and interest arbitrage by foreign bank subsidiaries and domestic banks as well as some non-residents. All these contributed to financial market integration in Asia.

Nevertheless, there is considerable room for further regional financial integration since the degree of integration in East Asia remains far lower than that of Europe. The main impediment preventing future progress in East Asia is exchange rate volatility, which suggests that exchange rate stability is an important precondition for successful money market integration. In the present world of financial globalization, however, individual efforts to stabilize exchange rate will not be enough and collective action for self-protection will be the only possible alternative. This collective action is above all to establish a regional monetary institution. Through it, Asian countries could acquire an emergency fund in case of financial crises and a regional lender of last resort would be a desirable if not essential system coexistent with global institutions such as IMF. Europe's two systems for supplying liquidity, the European Central Bank and the IMF, could be a good model for East Asia to consider.

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Annex: Table for transforming the S&P ratings into numerical values

AAA	9.00	B	4.00
AA+	8.33	B-	3.66
AA	8.00	CCC+	3.33
AA-	7.66	CCC	3.00
A+	7.33	CCC-	2.66
A	7.00	CC+	2.33
A-	6.66	CC	2.00
BBB+	6.33	CC-	1.66
BBB	6.00	C+	1.33
BBB-	5.66	C	1.00
BB+	5.33	C-	0.33
BB	5.00	D/SD	0.00
BB-	4.66		
B+	4.33		

Financial Market Integration in East Asia: Status and Options

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I. Introduction

- East Asian countries have experienced growing intra-regional trade as their economies have become increasingly
- Along with this real integration, financial linkages have also been established at an accelerating rate, especially in response to financial liberalization and capital market.
- Largely based on this European experience, many studies were conducted to measure the extent of financial market integration (See for example Adams et al. (2002), Baele et al. (2004) and Laura Vajanne (2006)).
- However, studies examining East Asian financial markets have been relatively rare.

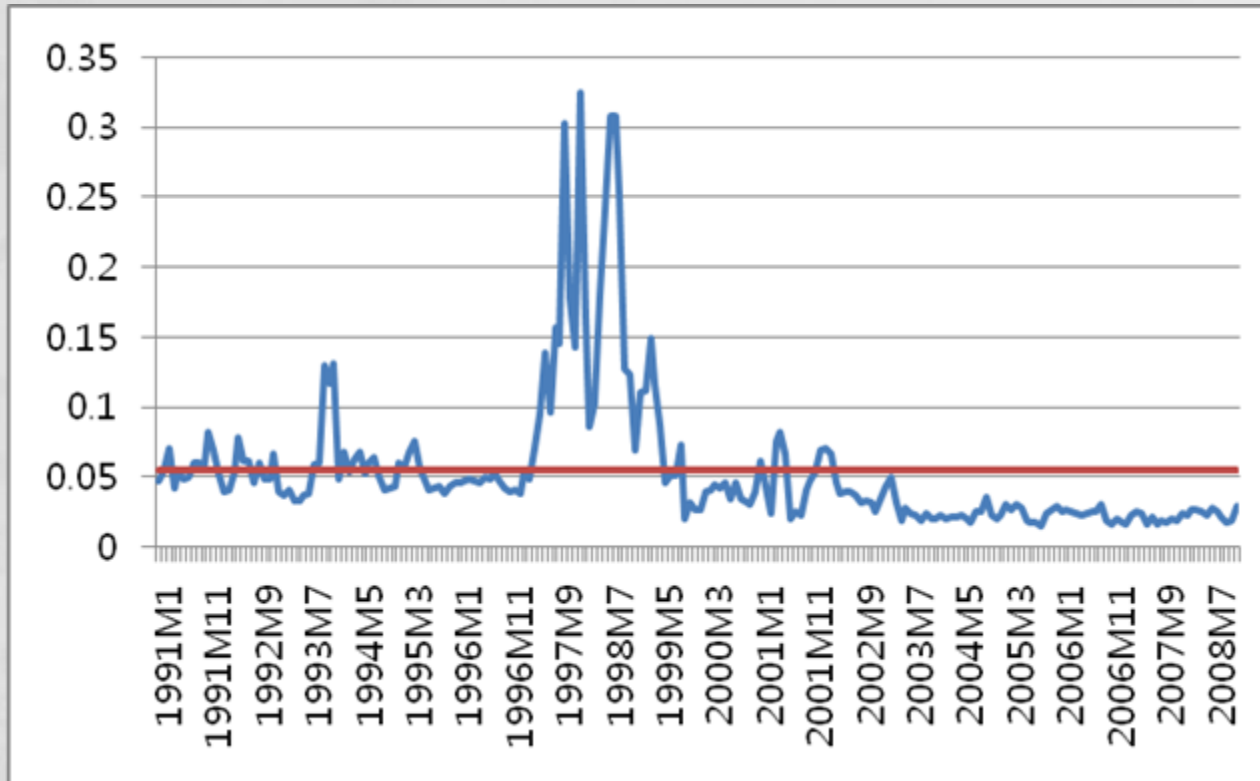
- This paper aims to examine the extent of financial market integration in East Asia, particularly focusing on money market interest rate differentials.
- Then, this paper examines factors that can explain such interest rate differentials and draws implications for future efforts in monetary cooperation.

II. Interest differentials in East Asia

- Define the interest differential between country i and country j at time t , $Dif(i, j, t)$, by the absolute value of $\ln R(i, t) - \ln R(j, t)$ with $R(i, t) = (1 + r_{it}) * S_{it} / F_{it}$
- Then, $Dif(i, j, t) = |\ln R(i, t) - \ln R(j, t)|$
$$= |(r_{it} - f_{it}) - (r_{jt} - f_{jt})|$$
where $f_{it} = (S_{it} - F_{it}) / F_{it}$ and $f_{jt} = (S_{jt} - F_{jt}) / F_{jt}$

- We could also measure the overall degree of money market integration in East Asia by taking the average value of 45 interest differentials among 10 East Asian countries.
- $AD(t) = \sum \sum Dif(i,j,t) / 45$
- This methodology was first used by Pasely & Wei (2001) to measure goods market integration and subsequently expanded upon by Moon & Yoon (2006).

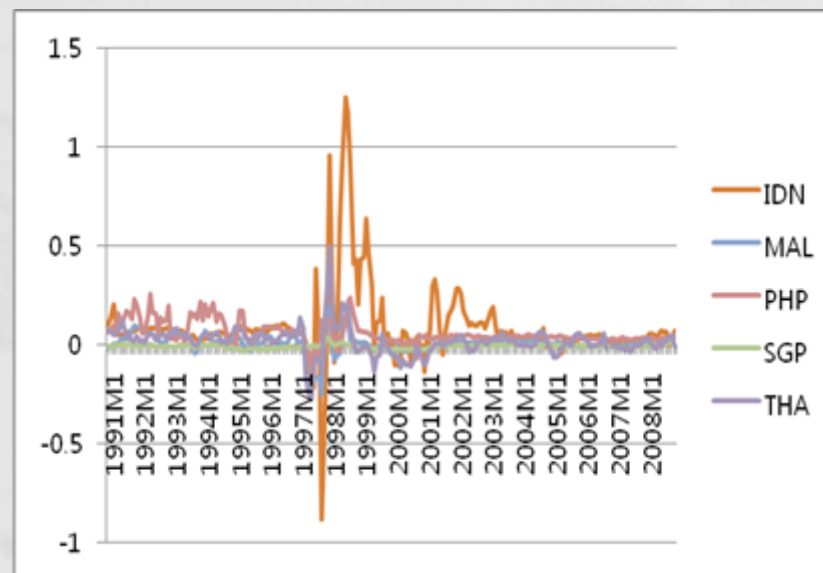
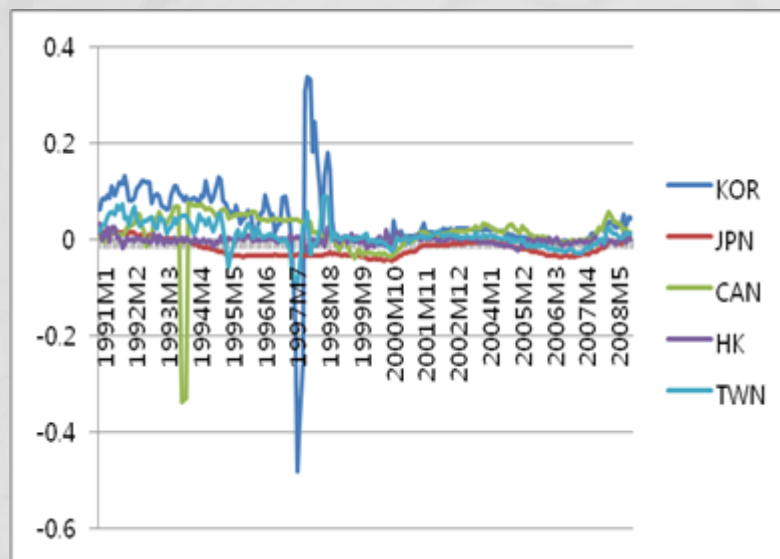
Figure 1 Interest Rate Differentials in 10 Asian countries



- Three facts are worth noting.
- First, there are considerable gains to be reaped through financial arbitrage in East Asia as the average interest differential from 1991 to 2008 on a monthly money market rate basis was 5.4% (0.053).
- Secondly, the interest rate differentials between East Asian countries were greatly affected by the financial crisis and resultant exchange rate volatilities.
- Thirdly, despite the currency crisis, interest differential seemed to be decreasing over time, thereby suggesting the possibility of interest rate convergence in East Asia.

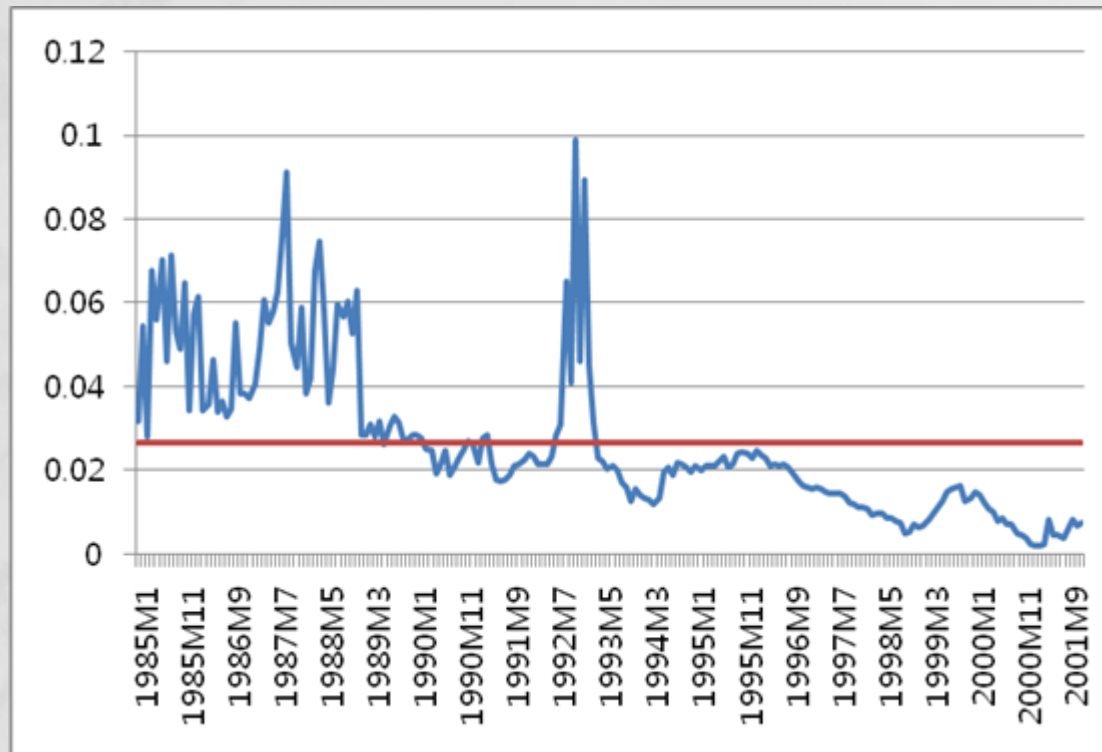
- East Asian countries not only deepened financial links among themselves but also expanded their links to the United States.

Figure 3: Interest Rate Differentials of East Asia with the US 1990-2008



- To comprehend how extensively money markets in East Asia are integrated, we also compare interest rate differentials in Asian and European countries.
- Financial market integration was much deeper in Europe compared to East Asia. The average interest differential for the 10 EU countries was 2.6% (0.0266), less than half of the average differential for the 10 Asian countries.
- Also, the interest differentials appeared to rapidly decrease over this period and nearly approached zero by the end of 2001.
- The comparison with the Europe suggests that exchange rate stability may be the most critical factor in accelerating financial market integration.

Figure 4: Interest rate differentials in Europe 1985-2001



III. Determinants of Interest Differentials

- To identify the determinants of the interest differentials in East Asia and see how the interest differentials were determined, we consider the following model.

- $$Dif(i,j,t) = c + \beta_1(exvol(i,j,t)) + \beta_2(infla(i,j,t)) + \beta_3(IP(i,j,t)) + \beta_4Dis(i,j) + \beta_5rating(I,j,t) + \beta_6Crisis + \beta_7Time$$

- Data was collected from 1990 Q1 to 2008 Q4 and a detailed description for the data used is as follows.
- Interest differentials were calculated on the basis of three month money market rates or call rates.
- Data for exchange rates were obtained from Bloomberg.
- Data for credit rating scores of Standard and Poor's Corporation for each Asian country were obtained from Bloomberg.
- Figures for distance were acquired from the website of John Haveman.
- Inflation differentials and industrial production differentials were calculated based on monthly growth rates for consumer price and industrial production indices, which were obtained from Global Insight

<Table 2> Basic Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
constant	0.0025 (0.14)	-0.0096 (-2.83)	-0.0151 (-4.29)	6.0406 (10.78)	6.0353 (10.77)	5.4430 (9.52)
exvol	1.4053 (30.40)	1.4026 (30.44)	1.3125 (32.47)	1.3185 (28.63)	1.3163 (28.68)	1.4423 (31.15)
Infla	0.5460 (11.37)	0.5450 (11.36)		0.5878 (12.44)	0.5869 (12.43)	
m			0.1743 (3.85)			0.1717 (3.85)
Dis	-0.0015 (-0.71)			-0.0012 (-0.58)		
IP	-0.0935 (-3.17)	-0.0919 (-3.66)	-0.0339 (-1.35)	-0.0719 (-2.90)	-0.0706 (-2.86)	-0.0102 (-0.41)
Rating	0.0107 (10.28)	0.0056 (10.32)	0.0120 (11.37)	0.0111 (10.87)	0.0111 (10.90)	0.0125 (12.00)
Crisis	0.0101 (4.96)	0.0101 (4.96)	0.0111 (5.35)	0.0106 (5.30)	0.0106 (5.30)	0.0116 (5.70)
Time				-0.0030 (-10.78)	-0.0030 (-10.79)	-0.0027 (-9.55)
R2	0.38	0.38	0.35	0.40	0.40	0.37

- As expected, the distance variable is not significant and implied that distance is not a meaningful proxy for transportation costs related to financial flows.
- The interest rate differential between two countries is significantly affected by their credit rating score difference and exchange rate volatility with correctly expected signs.
- The interest rate differential is also affected by inflation rate and production activity differences.
 - The coefficient of industrial production gap does not appear positive, although its significance is small.
 - For multi-collinearity or endogeneity problem, we use the growth rate difference of money stock.
 - Then, production growth difference lost its explanatory power

- In addition, two dummy variables were significant.
- The positive sign for the crisis dummy implied that countries experiencing currency crisis showed larger interest rate differentials.
 - In fact, in the case of Korea, there was a sharp rise in short term interest rate due to induce foreign capital and under such situation it is extremely difficult to expect a regular arbitrage transaction.
- Lastly, the time dummy appeared to be very significant and the negative coefficient for the dummy meant that interest rate differentials tended to decrease over time.

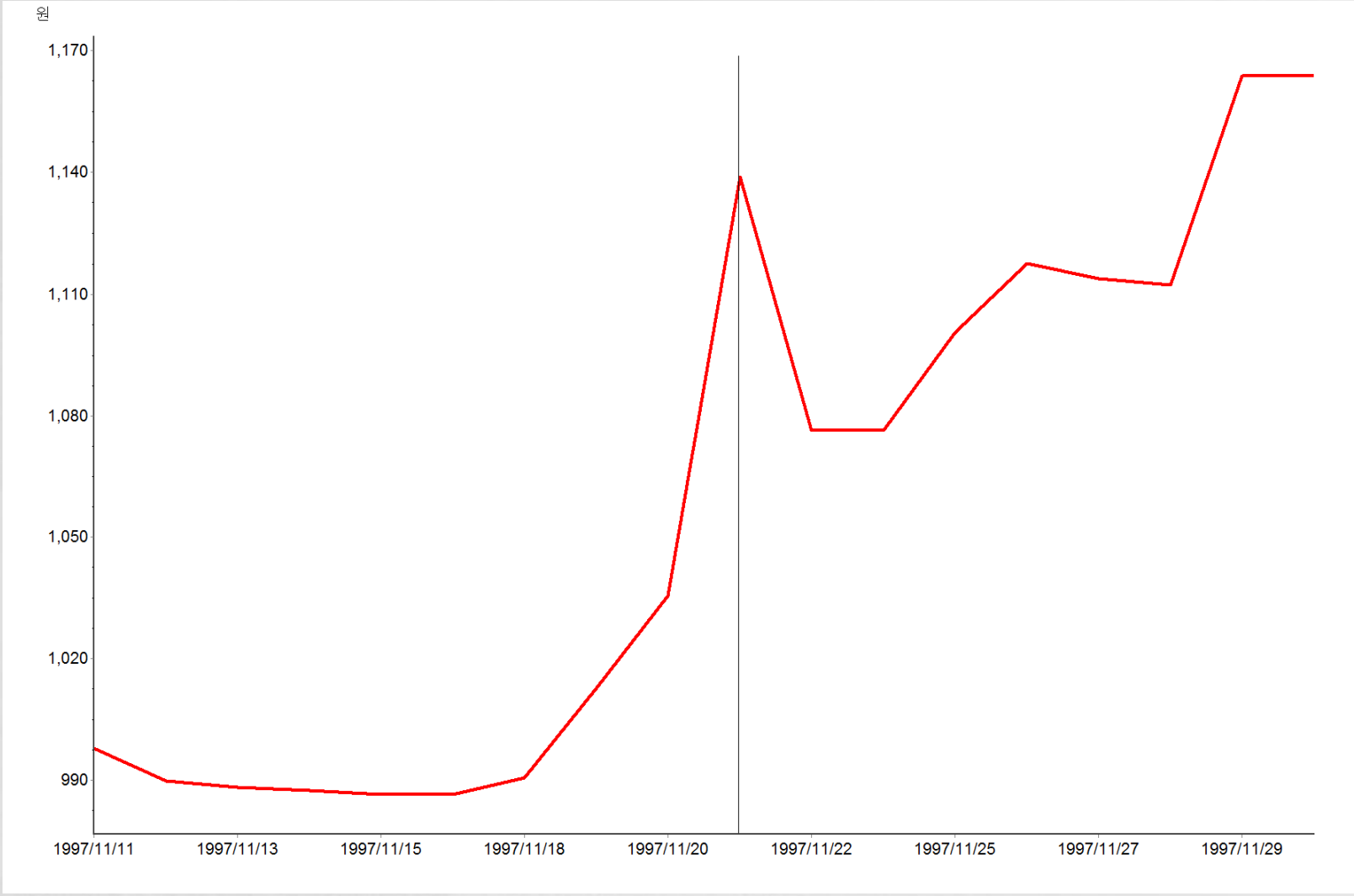
<Table 3> Non-linear Regression Results

	(1)	(2)	(3)	(4)
constant	5.9097 (10.66)	6.1121 (11.04)	5.4765 (8.96)	5.7934 (9.50)
exvol	2.2131 (19.79)	1.2949 (28.52)	2.2006 (19.83)	1.4042 (29.81)
(exvol)2	-4.4116 (-8.19)		-4.3457 (-7.66)	
Infla	0.6213 (13.25)	0.5966 (12.79)		
m			0.2607 (5.48)	0.2230 (4.75)
IP	-0.0694 (-2.84)	-0.0736 (-3.01)	-0.0054 (-0.21)	-0.0106 (-0.41)
Rating	0.0098 (9.64)	-0.0072 (-3.07)	0.0113 (10.59)	-0.0059 (5.18)
(Rating)2		0.0036 (8.63)		0.0036 (8.22)
Crisis	0.0096 (4.85)	0.0099 (5.03)	0.0101 (4.84)	0.0108 (9.51)
Time	-0.0029 (-10.69)	-0.0030 (-11.03)	-0.0027 (-9.00)	-0.0028 (-2.37)
R2	0.42	0.42	0.39	0.39

VI. Implication for Regional Monetary Cooperation

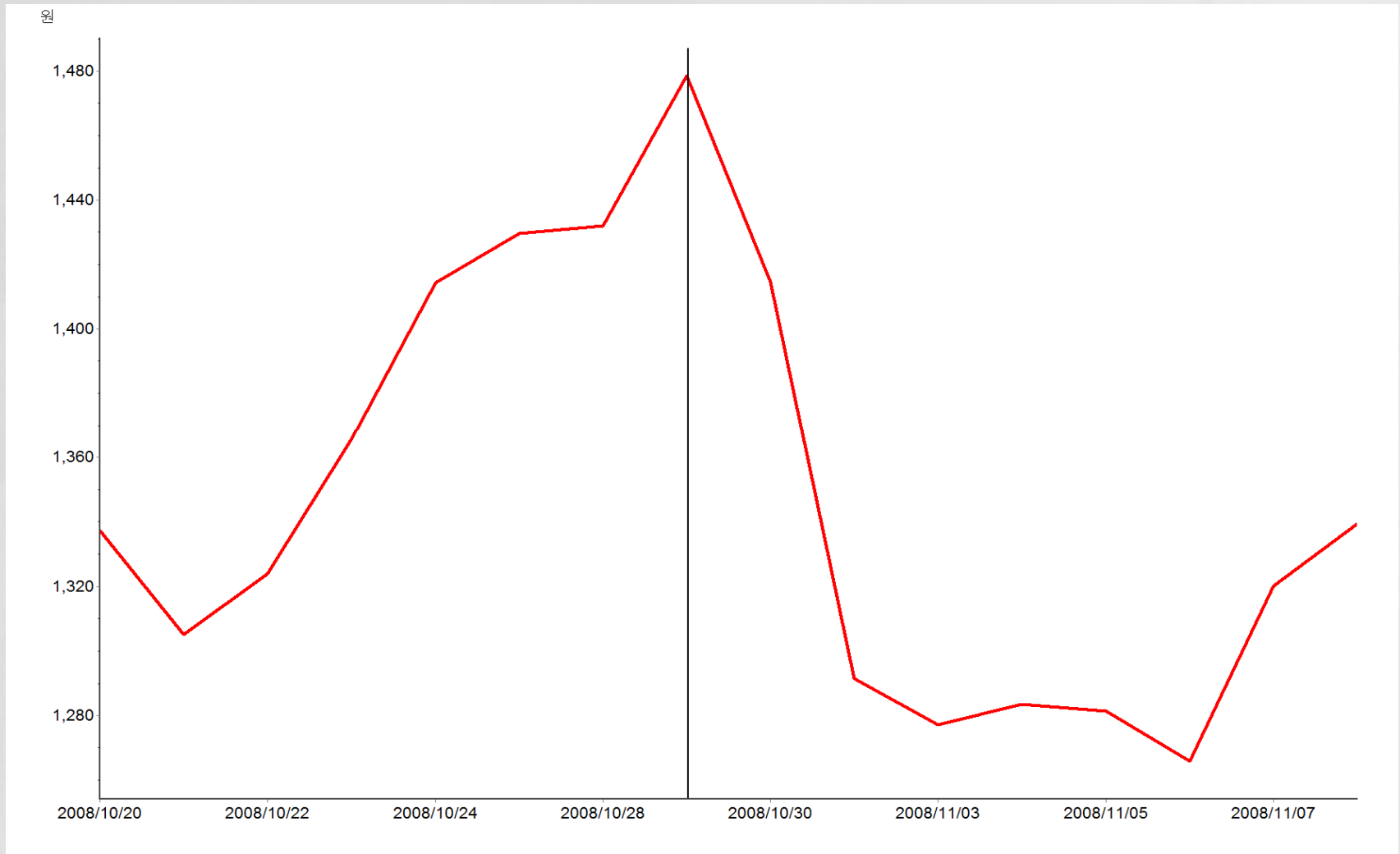
- The preceding results suggest that East Asia economies have become increasingly integrated with one another as well as to world markets, and highlight the general importance of exchange rate stability
- Then what will be the institution needed to stabilize the exchange rates? IMF or central bank swaps?

Fig. 1: IMF loan (27 Billion \$)



November 21, 1997

Fig. 2: Kor-US Currency Swap (30 Billion \$)



October 29, 2008

- East Asian countries have endeavored to set up regional swap arrangement.
- The current Chiang Mai swap arrangement, however, is too limited to play an independent role apart from the IMF in helping Asian countries stabilize their currencies and defend speculative attacks.
- The IMF, moreover, controls 80% of the CMI's funds, thereby making the provision and distribution of funds impossible without prior IMF approval.
- It implies that the CMI is far from being a sovereign institution, and the recent agreement on CMI multi-lateralization, which may re-label the CMI as the CMIM or AMF, is only an intermediary step towards eventually establishing an effective regional lender of last resort.

- Regional lender and global institutions can co-exist. The benefit of having a regional monetary institution is two-fold.
- First, it will free East Asian countries from the IMF's current monopoly over emergency loans. This competition would almost assuredly have valuable effects, as demonstrated by Europe's two parallel systems for supplying liquidity: The European Central Bank and the IMF.

- Second, the presence of a regional body would surely solidify the positions of individual Asian countries in international financial institutions.
 - It should be noted, however, that the establishment of regional systems calls for a clear division of labor and responsibilities with the IMF.
 - It would be desirable for the IMF to coordinate and supervise the financial authorities of each country while regional institutions focus more on supplying liquidity (See for example Wing Thyo Woo (2008))