

**Asia-Pacific Financial Forum  
Interim Report to the APEC Finance Ministers**

**ANNEX I  
Volatilities in the Financial Market and Global Imbalances  
(Institute for International Monetary Affairs Paper)**



## **Volatilities in the Financial Market and Global Imbalances**

3 June, 2014

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### **Summary**

In recent years, economists have been raising their interest in the implications that the investor sentiments can have on the financial market. More and more researches have been conducted by many economists in many countries on the relationship between indices representing investor sentiments and the volumes of cross-border transactions or prices of risk-involving financial assets.

The Institute for International Monetary Affairs (IIMA) started in October 2013 to publish an index (IIMA-GMVI) that is intended to comprehensively indicate the movement of investor sentiment (or appetite) for the risks in the global financial market. This index is a composite of daily volatilities calculated from the daily movements in stock indices, government bond yields, and foreign exchange rates on major markets in the world and we try to measure the investors' risk appetite from the magnitude of the volatilities shown by this index.

This report is intended to consider if or not we can control the spillover effect of financial shocks by analyzing the characteristics of the volatilities in the index the IIMA has developed. More precisely, we would like to examine this by focusing on the relationship between volatility index and global imbalances (i.e., accumulation of imbalances in the macro-economy).

In Chapter 1, using our IIMA-GMVI, I will examine what the risk indicators, including the volatility index, which would represent the investor sentiments are like and what the movement of those indices would suggest.

In Chapter 2, I will try to define the global imbalance and examine what kind of situation the imbalance would represent. At the same time, I will briefly introduce the scheme of the Macroeconomic Imbalance Procedure developed by the European Commission.

In Chapter 3, I will examine the relationship between the risk indicators and global imbalances and confirm that there is a correlation between investor sentiment on the financial market and an imbalance in the macro-economic indicators, and finally point out the possibility that a prolonged period of low volatility in the financial market, which represents continued favorable investor sentiment for investment, might lead to an unwanted accumulation of macroeconomic imbalance.

### **1 . IIMA's Attempt for IIMA Global Market Volatility Index**

The IIMA started to compile and publish in October 2013 IIMA Global Market Volatility Index (IIMA-GMVI) to provide a measurement for risk appetite that the global investors have toward the financial products in the markets<sup>1</sup>. The index is a composite of measurements calculated from the

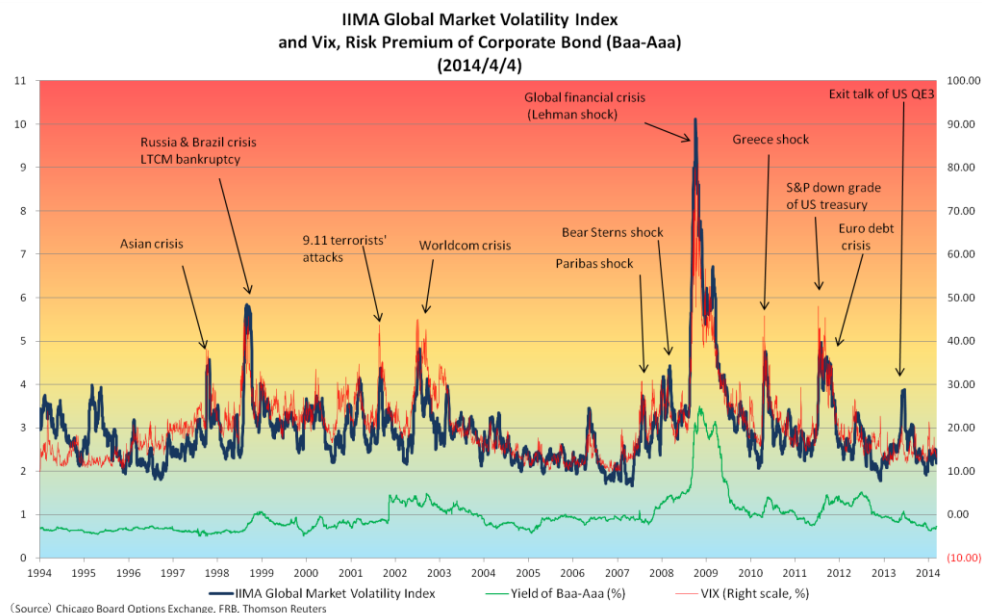
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<sup>1</sup> The index is published on the website of the IIMA (<http://www.iima.or.jp/research/ppp/index.html> ). Refer to Takenaka & Inoue (2013) for its background and the ways of calculation.

volatilities (standard deviation of daily changes in preceding 20 business days) of the prices of equities, bonds, and foreign exchanges in the major financial markets in the world which are adjusted for the average of each category's volatilities since January 1994 to be equal to 1 (to show 3 in the overall index). The larger is the index value, it suggests the more volatile and unstable market where investors are more inclined to avoid risk-taking. On the other hand, the smaller value reflects the more stable market where investors are more inclined to take risks.

Chart 1 shows the movement of the IIMA-GMVI since January 1994. It has shown high values every time the world financial markets were tossed by such unexpected crises as the Asian currency crisis, LTCM bankruptcy, WorldCom scandal, the 9.11 terrorist attacks in the United States, global financial crisis, Greece shock, European sovereign crisis, start of exit talk of the US QE3, etc. The highest value was recorded on October 31 of 2008 when the financial markets were in the midst of the global financial crisis following the Lehman shock. After the global financial crisis, the index recorded the highest value on August 30 of 2011 when the market participants were worried about the downgrading of the US government bonds and the contagion of the European sovereign crisis to Italy and Spain.

**Chart 1 IIMA Global Market Volatility Index**

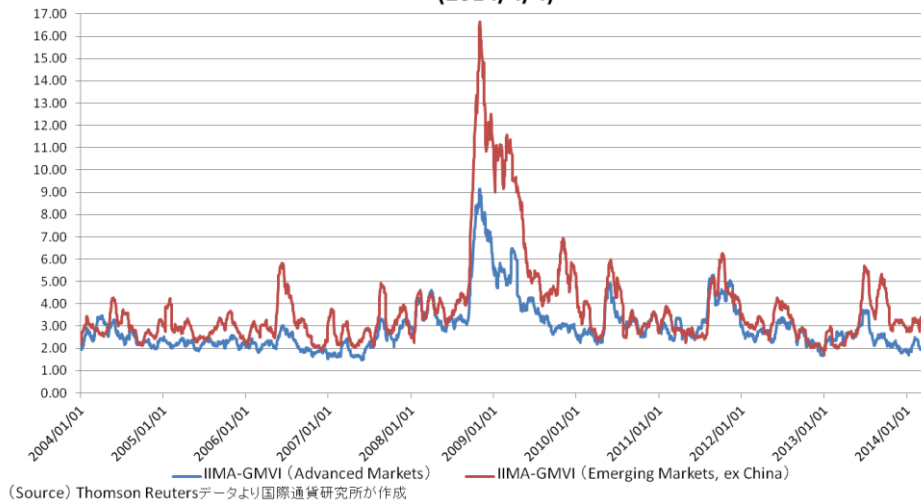


Source: Institute for International Monetary Affairs

The initial intention of the IIMA for compiling IIMA-GMVI was to comprehensively assess the risk appetite of investors in the global financial markets, but since the index is based on the volatilities in the individual markets, the IIMA decided to compile sub-indices as IIMA-GMVI (Advanced Markets) and IIMA-GMVI (Emerging Markets) to sense the different attitudes of investors, if any, toward the advanced and emerging countries, and started to publish them from January 2014.

**Chart 2 IIMA-GMVI(Advanced and Emerging Markets)**

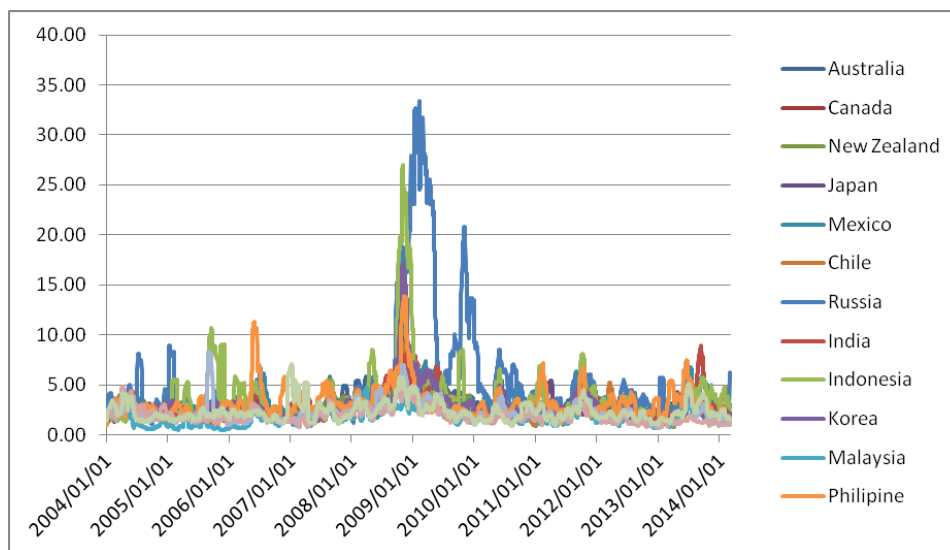
**IIMA Global Market Volatility Index (Advanced and Emerging Markets)  
(2014/4/4)**



Source: Institute for International Monetary Affairs

Although they are not openly published, the IIMA has also compiled volatility index by individual countries to watch and assess the movement in the individual markets, thus expanding the range of application of the IIMA-GMVI index.

**Chart 3 Volatility indices for individual markets(trial calculation)**



Source: Calculated and compiled by author by using Thomson Reuters data

There are other indices than IIMA-GMVI that represent the investors' appetite to take risks for financial products. Most widely used in the world is the VIX index which is calculated from the implied volatility of S&P500 Options prices in the U.S., and yield differentials published by the FRB between the Aaa rated and the Baa rated corporate bonds in the United States.

Both the VIX and the IIMA-GMVI make indexation of volatilities. While the VIX deals with the implied volatility, the latter calculates historical volatilities. In addition, as compared to the VIX which covers only stock prices in the US, the IIMA-GMVI covers the equities, bonds, and foreign exchanges of world's 22 countries, thus making it possible to assess the conditions of the world financial markets more comprehensively than the VIX.

Chart 4 shows correlations between famous risk indices and volatility indices for individual countries (composite index of volatilities of stocks, bonds, and foreign exchange rates against the US dollar).

**Chart 4: Correlations between famous risk indices and volatility indices for individual countries**

The Correlations between each Volatility Index

	Australia	Canada	New Zealand	Japan	Mexico	Chile	Russia	India	Indonesia	Korea	Malaysia	Philippine	Singapore	Taiwan	Thailand	VIX	IIMA-GMVI	Spread	Developed	Emerging
Australia	1.00	0.94	0.94	0.77	0.81	0.81	0.65	0.68	0.77	0.90	0.63	0.55	0.72	0.65	0.49	0.89	0.95	0.76	0.94	0.88
Canada	0.94	1.00	0.89	0.70	0.76	0.74	0.73	0.65	0.75	0.89	0.60	0.51	0.71	0.66	0.44	0.91	0.96	0.80	0.95	0.90
New Zealand	0.94	0.89	1.00	0.74	0.79	0.78	0.67	0.66	0.70	0.86	0.65	0.53	0.71	0.68	0.48	0.84	0.92	0.75	0.90	0.87
Japan	0.77	0.70	0.74	1.00	0.65	0.59	0.49	0.55	0.62	0.76	0.53	0.60	0.59	0.56	0.41	0.64	0.76	0.56	0.75	0.69
Mexico	0.81	0.76	0.79	0.65	1.00	0.74	0.61	0.68	0.74	0.82	0.47	0.60	0.62	0.48	0.44	0.71	0.82	0.62	0.77	0.84
Chile	0.81	0.74	0.78	0.59	0.74	1.00	0.49	0.61	0.67	0.75	0.61	0.54	0.77	0.69	0.64	0.73	0.79	0.64	0.76	0.73
Russia	0.65	0.73	0.67	0.49	0.57	0.49	1.00	0.60	0.51	0.66	0.47	0.27	0.47	0.42	0.28	0.74	0.77	0.83	0.71	0.88
India	0.68	0.65	0.66	0.55	0.68	0.61	0.60	1.00	0.54	0.65	0.62	0.45	0.56	0.48	0.55	0.64	0.72	0.68	0.66	0.77
Indonesia	0.77	0.75	0.70	0.62	0.74	0.67	0.51	0.54	1.00	0.82	0.33	0.59	0.65	0.49	0.43	0.67	0.76	0.61	0.71	0.77
Korea	0.90	0.89	0.86	0.76	0.82	0.75	0.66	0.65	0.82	1.00	0.54	0.59	0.70	0.68	0.48	0.83	0.91	0.75	0.88	0.89
Malaysia	0.63	0.60	0.65	0.53	0.47	0.61	0.47	0.62	0.33	0.54	1.00	0.40	0.60	0.57	0.53	0.60	0.66	0.57	0.64	0.60
Philippine	0.55	0.51	0.53	0.60	0.60	0.54	0.27	0.45	0.59	0.59	0.40	1.00	0.43	0.44	0.41	0.46	0.56	0.39	0.52	0.54
Singapore	0.72	0.71	0.71	0.59	0.62	0.77	0.47	0.56	0.65	0.70	0.60	0.43	1.00	0.58	0.49	0.64	0.72	0.57	0.71	0.67
Taiwan	0.65	0.66	0.68	0.56	0.48	0.69	0.42	0.48	0.49	0.68	0.57	0.44	0.58	1.00	0.43	0.58	0.65	0.45	0.63	0.58
Thailand	0.49	0.44	0.48	0.41	0.44	0.64	0.28	0.55	0.43	0.48	0.53	0.41	0.49	0.43	1.00	0.38	0.49	0.38	0.45	0.48
VIX	0.89	0.91	0.84	0.64	0.71	0.73	0.74	0.64	0.67	0.83	0.60	0.46	0.64	0.58	0.38	1.00	0.92	0.82	0.92	0.87
IIMA-GMVI	0.95	0.96	0.92	0.76	0.82	0.79	0.77	0.72	0.76	0.91	0.66	0.56	0.72	0.65	0.49	0.92	1.00	0.84	0.98	0.94
Spread	0.76	0.80	0.75	0.56	0.62	0.64	0.83	0.68	0.61	0.75	0.57	0.39	0.57	0.45	0.38	0.82	0.84	1.00	0.81	0.86
Developed	0.94	0.95	0.90	0.75	0.77	0.76	0.71	0.66	0.71	0.88	0.64	0.52	0.71	0.63	0.45	0.92	0.96	0.81	1.00	0.88
Emerging	0.88	0.90	0.87	0.69	0.84	0.73	0.88	0.77	0.77	0.89	0.60	0.54	0.67	0.58	0.48	0.87	0.94	0.86	0.88	1.00

\* period: 2004-2013

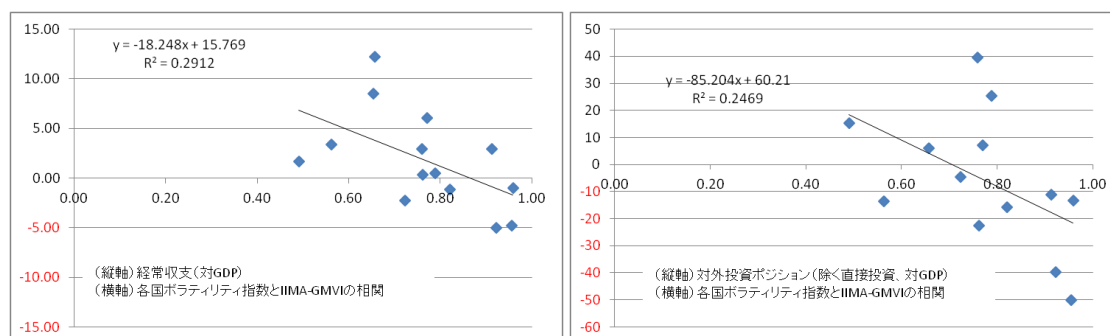
Source: Calculated and compiled by author by using Thomson Reuters data

If there exists a high correlation between the IIMA-GMVI and the volatility index in an individual country, it can be interpreted that the market sentiment in an individual country and its volatility tends to be more affected by the movement of the global market sentiment and its volatility.

Chart 5 shows that the correlation is stronger in such advanced countries as Australia, Canada, New Zealand where capital transactions are liberalized and current accounts are in deficit, and also in emerging countries like Korea and Indonesia which have a large net indebted position in external investment excluding direct investment. On the other hand, the correlation is small in the current account surplus countries in South East Asia like the Philippines and Thailand (Chart 5).

There is a possibility that in these countries, some inherent factors such as capital controls may have affected the volatilities in their financial markets.

**Chart 5: Individual Volatility Indices and their correlations with IIMA-GMVI and current accounts (left) /external investment positions(right)**



Source: Compiled by the author based on data from the IIMA and the IMF

※ Averages of 2004-2013 for both current accounts (in % of GDP), and external investment positions (in % of GDP) for

Australia, New Zealand, Canada, Japan, Mexico, Chile, Russia, India, Indonesia, Korea, Malaysia, the Philippines, Thailand, and Taiwan (current account only)

## 2. Efforts of the European Commission in the Macroeconomic Imbalance Procedure

Time and again, financial crises have occurred since the capitalism has prevailed in the world economy. Various reasons can be offered, but one of the main reasons could be the accumulation of macroeconomic imbalances. Therefore it is critical to monitor the macroeconomic imbalances in order to prevent a financial crisis, or to minimize the pains from it at least.

Frankel and Salaveros (2010) introduced the cases where many economists have tried in the past to use various economic indicators as a leading indicator to detect a possible financial crisis. They pointed out that, among others, foreign exchange reserves and overvaluation of the real effective exchange rates had affected the magnitude of the shocks.

The Macroeconomic Imbalance Procedure (MIP) introduced by the European Commission after the European sovereign debt crisis is one of the frameworks to monitor the macroeconomic imbalances that may lead to a financial crisis<sup>2</sup>. The MIP was introduced in 2011 and, based on the common scoreboard of macroeconomic indicators, it works as a mechanism to identify and monitor the macroeconomic imbalances and competitive gaps of the member countries. Using the various economic indicators on the scoreboard, the European Commission comprehensively assesses the existence/non-existence of an excessive external imbalance or the loss of competitiveness in each member country. Those indicators include 5 indicators for external imbalance and 6 indicators for domestic imbalance that cover both flow and stock aspects. Each country's achievements in these indicators are reviewed every year and complimented by other supplementary indicators. Much progress has been made to prevent a recurrence of financial crises such as seen in the past. The scoreboard of indicators also plays a role of important communication between the Commission and member states and a threshold value is given to each indicator based on the experiences learned from the past economic crises.

**Chart 6: MIP Scoreboard**

External Imbalance		Internal Imbalance	
Indicators	Threshold Point	Indicators	Threshold Point
Current Account Balance as % of GDP (3 year backward moving average of )	-4%/+6%	Deflated House prices (y-o-y % change)	+6%
Net International Investment Position as % of GDP	-35%	Private Sector Credit Flow as % of GDP	15%
Real Effective Exchange Rate (% change (3 years))	±5% (Euro Area) ±11% (Non-Euro Area)	Private Sector Debt as % of GDP	160%
Export Market Share (% change (5 years))	-6%	General Government Debt as % of GDP	60%
Nominal Unit Labor Cost (% change (3 years))	+9% (Euro Area) +12% (Non-Euro Area)	Unemployment Rate (3 year backward moving average)	10%
		Total Financial Sector Liabilities (y-o-y % change)	+16.5%

Source: Compiled by the author based on European Commission data

<sup>2</sup> Refer to European commission (2012) for Macroeconomic Imbalance Procedure.

### **3. Relationship between Risk indicators and Macroeconomic Imbalances**

Many researchers in the world find that the improvement of investor sentiments (risk appetite) in the financial markets tend to increase cross-border capital transactions. Rey (2013) verified that the stability of the VIX, one of the risk indicators, tends to stimulate cross-border capital transactions regardless of the exchange rate regimes, and therefore free capital transactions and stability of the foreign exchange rate with discretionary monetary policies are mutually incompatible. She argues that the trilemma of the international finance does not actually exist in the world of global capital flows, and that it has been transformed into a dilemma where “discretionary monetary policies are possible only if the capital account is managed.”

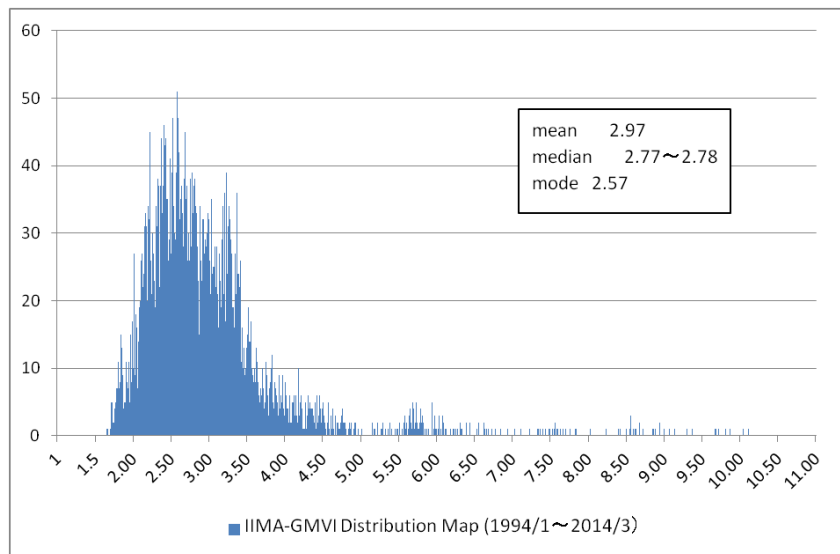
In this report, I would like to examine the process in which the improvement (meaning stability) of risk indicators would encourage investors to invest in risk assets, and eventually excessive investment in such risk assets would lead to an accumulation of macroeconomic imbalances, which will be then reflected in the macroeconomic indicators. For this purpose, I will use the data in IIMA-GMVI for the past 20 years to see the investor sentiment reflected and the same kinds of macroeconomic indicators as adopted in the MIP I introduced in the previous chapter.

Before I get to the main point, I would like to consider on how to interpret the values calculated in the VIX and the IIMA-GMVI. In the first place, volatility is statistically represented by a standard deviation which is a measure how spread out the numbers are. Then you may wonder why these volatilities can represent the investor sentiment toward the financial market.

Prices for such financial assets as equities, bonds, and foreign exchanges are considered to be theoretically determined by the present values of the total expected cash flow that the asset will produce over the long term. The condition where the financial asset prices fluctuate in high volatility can be interpreted as the one where the investors’ forecast for the future cash flow from the asset is not decisive, or the investors have anxiety over the forecast for that future cash flow. When it is difficult to make assessment on the future cash flow of a financial asset, (or there is a greater risk in it), an investor would not be inclined to invest in a risk asset if he is a risk-averting investor. Actually, the past experiences show that volatilities rose in most cases when the prices of risk assets plunged. Conversely, the stability of the volatility can often be seen in the phase when the prices of risk assets are edging up. This is because the stability in the market enables the investors to have a clearer view on the future, offering them an environment easier to invest in risk assets.

Next, let’s confirm the past movement of the IIMA-GMVI. The distribution of its volatilities in the past 20 years is shown in Chart 7. It shows that they have a long tail to the right direction (higher volatility) but the distribution is heavily centered around the 2.50-2.60 values. From this distribution, it can be understood that the volatilities will sharply rise when a major risk emerges but except for that the volatilities in the global financial market will generally follow the mean reversion pattern.

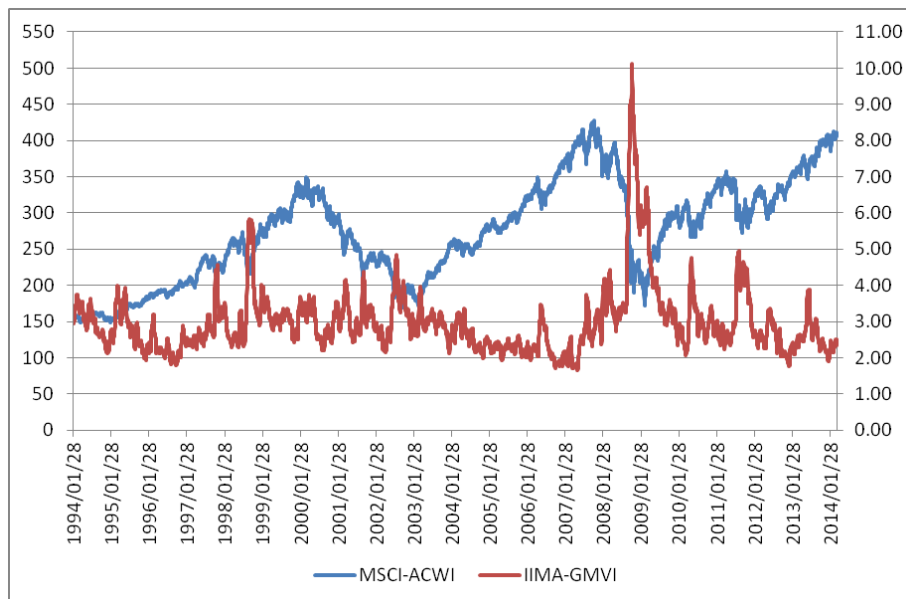
**Chart 7: Distribution of Volatilities in the IIMA-GMVI**



Source: Compiled by author by using data of Institute for International Monetary Affairs

Next, let us see whether a volatility index can be a leading indicator to the risk asset prices. Rise in the volatility indices such as the VIX is generally regarded as a signal for a fall in the risk asset prices, but there is no direct predictability of it since the index is nothing more than the indication of the variability of the recent financial asset prices. Nevertheless, the reason why the risk indicators like the VIX are closely watched in the financial market is because the past rising phases of the index coincided with the plunge of the risk asset prices. This suggests that there may exist some correlation between the variability in the financial asset prices and the investor sentiment toward the financial markets. In other words, if any shock happens in the market, a cyclical process will work in the way where the rise in the volatility will lower the risk appetite of investors, accelerating the selling off of high risk assets, which will cause the instability of prices and therefore higher volatilities in the market. In the serious case, that may develop into a financial crisis.

**Chart 8: MSCI-ACWI and IIMA-GMVI**



Source: Thomson Reuters, Institute for International Monetary Affairs



Looking back at the rising phase of the volatility indices, it is clear it often coincided with the developments for adjustments of macroeconomic imbalances, as well as big accidents such as the 9.11 terrorist attacks. When the macroeconomic imbalances increase to an unsustainable level, adjustments in the macroeconomic indicators would start to be seen, and the adjustment in the real economy would make it difficult for investors to forecast future cash flow, inducing the adjustment of risk asset prices, thus a rising in the volatility.

As the volatilities are low and stimulate the investors' incentives to invest, the continued investment tends to be excessive, inviting also an overheating of the macro economy. Therefore, prolonged low volatility has a possibility of such an overheating. In the final phase of the prolonged low volatility, it has often coincided with the time when the price rise in risk assets has peaked as it loses a momentum from a rising expectation for the economic growth. This situation can be judged as the stage that the economy has come to level off.

In order to explore the relationship between the low volatility and the macroeconomic indicators, let us see the past data of the changes of the investor sentiment and the developments in the macroeconomic indicators since 1994. To be more precise, I will compare the changes in the IIMA-GMVI data and macroeconomic indicators for the period from January 28, 1994 to March 31, 2014. Here I will define it as low volatility when the IIMA-GMVI shows the level of 2.50 or less and as low volatility period when the situation continues for longer than one month. The level under 2.50 covers approximately lower one third of the total values throughout the period.

Macroeconomic indicators used here in this report include the same 6 indicators as adopted in the MIP referred to in the previous chapter: namely, current account balance, real effective exchange rate, and net external investment positions to assess the external imbalance, and real housing price, private sector debt outstanding, and government debt outstanding to assess the domestic imbalance. As for the real housing price, the comparison is limited to only those countries that publish the data.

Chart 9 shows the low volatility periods seen in the IIMA-GMVI, among which the two periods of late 1995 –to middle of 1997 and late 2004 to middle 2007 lasted for much longer than the others. After the global financial crisis of 2008, there were less periods of low volatility that lasted for as long as it did before the crisis, partly because the European debt problems continued to smolder over a long period of time. Yet, it can be detected that low volatility lasted for some time before the Greece shock of May 2010 or just before the first reference to tapering of US quantitative easing in May 2013. Volatility declined on and off from March to July 2011 although that period was not picked up in the chart because the low volatility under 2.50 in the IIMA-GMVI did not last for more than a month. But it seems that this was a precursory development for a big adjustment of the financial market that occurred in August-October 2011.

**Chart 9: Period of Low Volatility and Macroeconomic Imbalances**

Low volatility periods	Macroeconomic Imbalance afterward
1995/10 – 1996/2	Asia Crisis Russia Crisis
1996/4 – 1996/12	
1997/1 – 1997/4	
2004/9 – 2004/12	Global Financial Crisis
2005/1 – 2005/7	
2005/7 – 2005/10	
2005/11 – 2006/5	
2006/8 – 2007/7	
2010/3 – 2010/4	Big current deficit in developing countries
2012/10 – 2013/4	
2013/10 –	?

Source: Compiled by author by using data of Institute for International Monetary Affairs

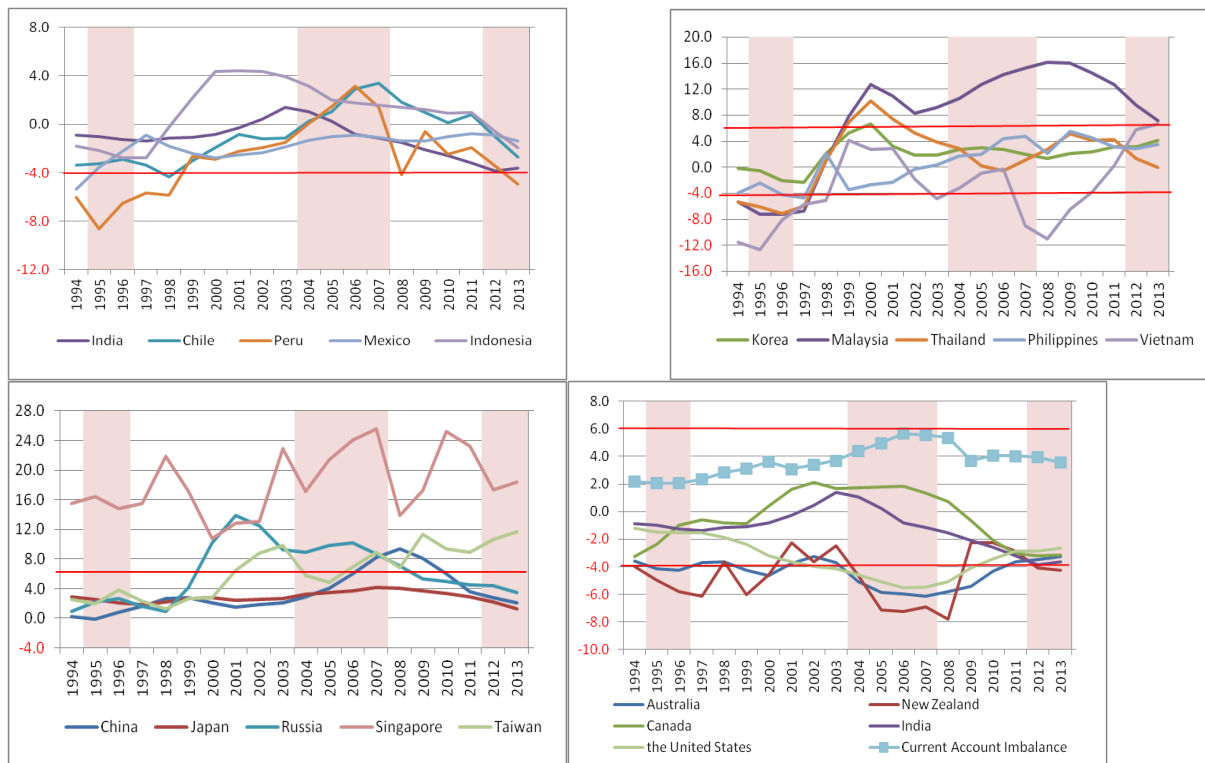
#### (1) Volatility Index and Current Account Balance

Current account balance is often used as the most effective indicator to assess the imbalance that a country may have. Let us examine whether the current account surplus or deficit of a country was expanding when the low volatility period in the IIMA-GMVI lasted for long.

Chart 9 compares the development of the IIMA-GMVI and the aggregated absolute value of the world's current account balance to GDP. It can be seen here that the current account imbalances were largely expanding from 2004 to 2008 in concert with the lowering volatility in the world financial markets since the latter half of 2004. In this period, the current account deficits expanded in the US and Southern European countries whereas the surpluses expanded in Germany and in the Asian countries including Japan and China.

On the other hand, in other periods of prolonged low volatility, there were no big global imbalances in the current account balance. In such period in the latter 1990s, the current account imbalances were rather limited to some of the Asian countries such as Malaysia, Thailand, Indonesia, the Philippines, and Korea (although in Malaysia and Thailand, the current account deficits expanded to exceed the threshold value of the MIP), while in the aftermath of the global financial crisis, the global imbalances were more or less restrained than in the middle of the 2000s as the current account deficits were largely reduced in the US from the level in the pre-crisis days. Since 2012, however, current account imbalances of emerging economies (especially of so-called “fragile 5” of Brazil, India, South Africa, Turkey and Indonesia) have newly become prominent, suggesting a glimpse of influence of the prolonged low volatility. This may include the concerns over the emerging economies that have continued to be seen since the middle of 2013.

**Chart 10: Current Account balances**



Source: Compiled by the author based on IMF data.

※ The world imbalance of current account balance is an aggregation of absolute values of the surpluses and deficits of individual countries and shown in %. Red lines on the Graphs indicate the threshold value given in the MIP, and shadows represent the period of low volatility.

## (2) Volatility Index and Real Effective Exchange Rate

Real Effective Exchange Rate (REER) is also considered useful as an indicator to detect the macroeconomic imbalances. The intention of the European Commission in its adoption of REER was mostly to measure the export price competitiveness of member countries, but in this report we would presume that the currency value itself could cause a macroeconomic imbalance. Let us examine whether or not an appreciation of the REER in a current account deficit country with high interest and high risk would accelerate the accumulation of its economic imbalances including the current account deficit.

Prolongation of the low volatility period tends to cause appreciation in the risk currencies (those of resource-rich countries, emerging economies, and current account deficit countries) and depreciation in the safe currencies (those of advanced countries, and current account surplus countries). Termination of a low volatility period often coincides with the beginning of adjustment in the currency.

Chart 10 compares the development of the REER in APEC member countries with the prolonged period of low volatility observed in the IIMA-GMVI. If the Purchasing Power Parity, which is regarded as a useful theory in determining the level of a foreign exchange rate in the long run, would hold, the REER should converge to the PPP. In this connection, it would be able to interpret that the appreciation of the REER would mean an overvaluation of the currency, while the depreciation an undervaluation of it. At a time when the investors' risk appetite is strong, the REER of a country with high interest rate is liable to appreciate as such a country (often with a current account deficit) tends to attract large inflow of funds.

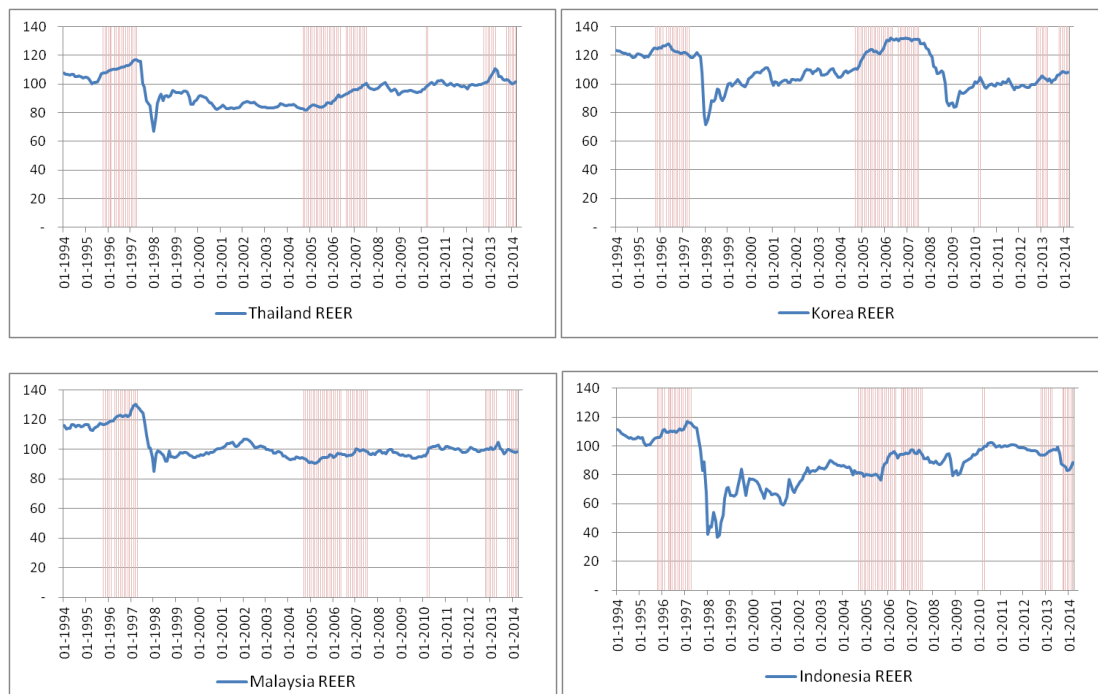
From Chart 11 it can be seen that in many cases an end of a low volatility period sent a signal to the change in the REER. Especially in the middle of 1997, when the low volatility period of late 1995 to early 1997 came to an end, such currencies that were severely hit by the Asian currency crisis, including Thai baht, Malaysian ringgit, Philippine peso, Indonesian rupiah and Korean won had simultaneously fallen sharply, paving the way for currency realignment thereafter. On the other hand, the Japanese yen had ended its depreciation period by the end of the low volatility period, and started to rebound. The same trend could also be seen in countries other than in Asia, such as those in the Oceania and Chile which are geographically close to Asia.

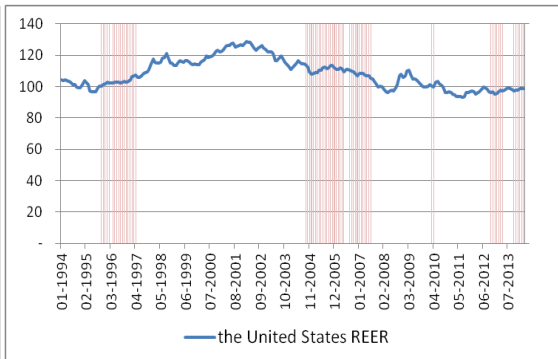
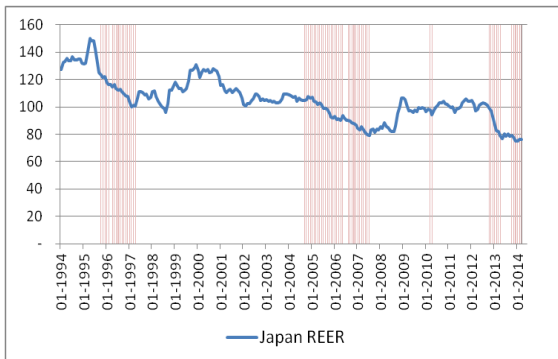
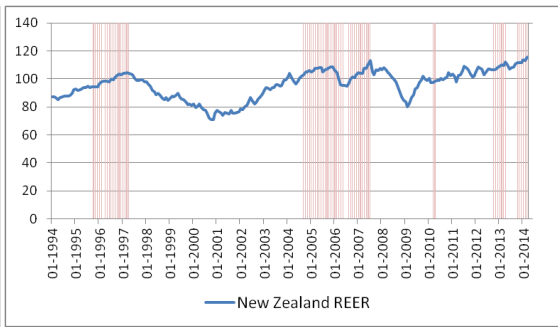
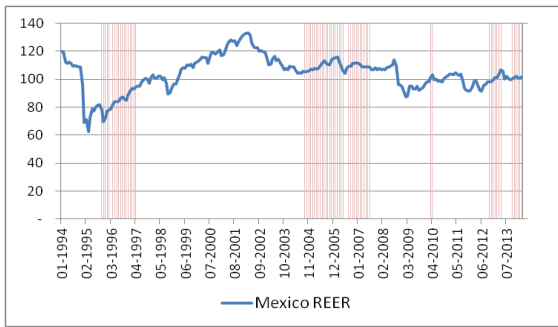
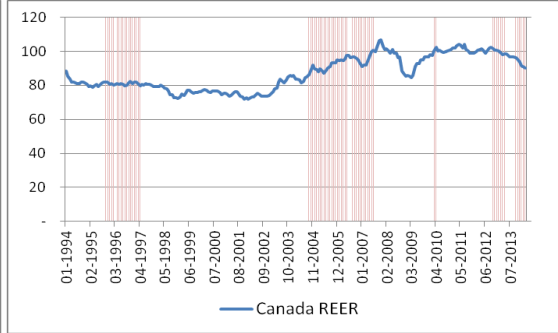
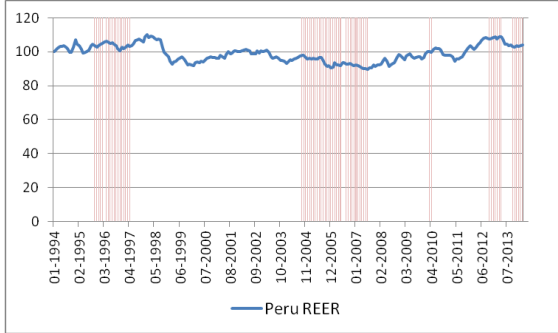
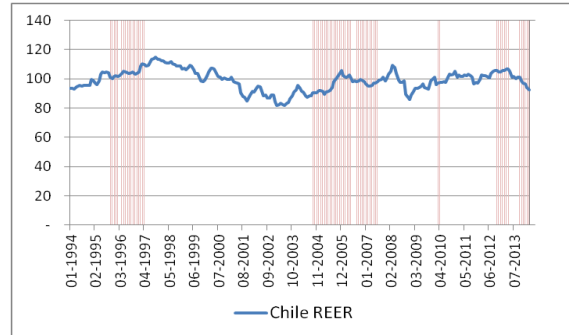
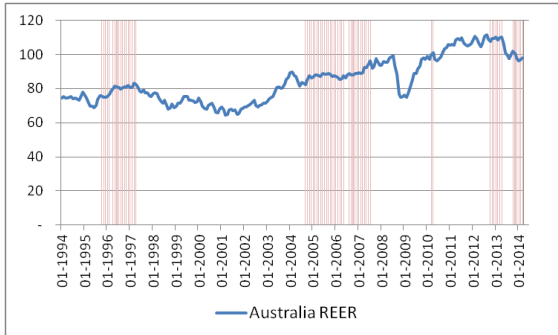
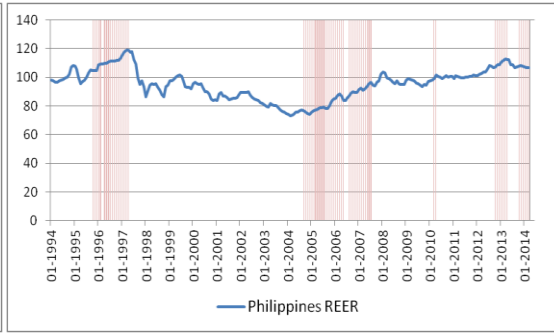
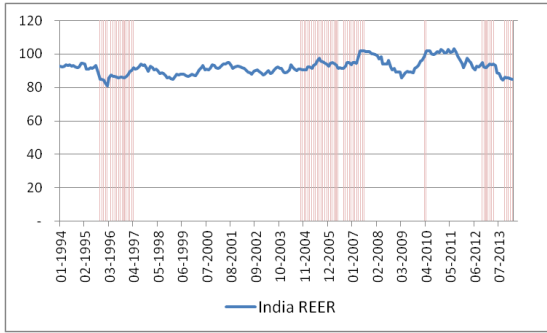
Similar movements in the foreign exchange rates can be seen before and after the low volatility period of latter of 2004 to the middle of 2007. In this period, the REER of Thai baht, Philippine peso, Indian rupee, Indonesian rupiah, and Korean won had peaked in the appreciation while the Japanese yen hit the bottom of decline. Other currencies in Oceania and those in the American Continent excluding the US dollar also hit the peak.

Also in the periods of March to April, 2010, and October 2012 to April 2013, the REERs of individual countries peaked. In these periods, the peak time and low volatility period were aligned, with a turnaround in the exchange rate and the start of rising in the volatility index happening at the same time.

There was some difference in the low volatility period after October 2013. In this period, as was seen in the divergence in the two sub-indices of IIMA-GMVI for advanced markets and emerging markets, volatility was low in the index for advanced markets that have heavier weights and high in the index for emerging market that have smaller weights in the total index. Although the total IIMA-GMVI has shown relatively low level in this period, the REERs in the emerging markets continue to show a directionless movement.

**Chart 11 Real Effective Exchange Rates and Low Volatility Periods**



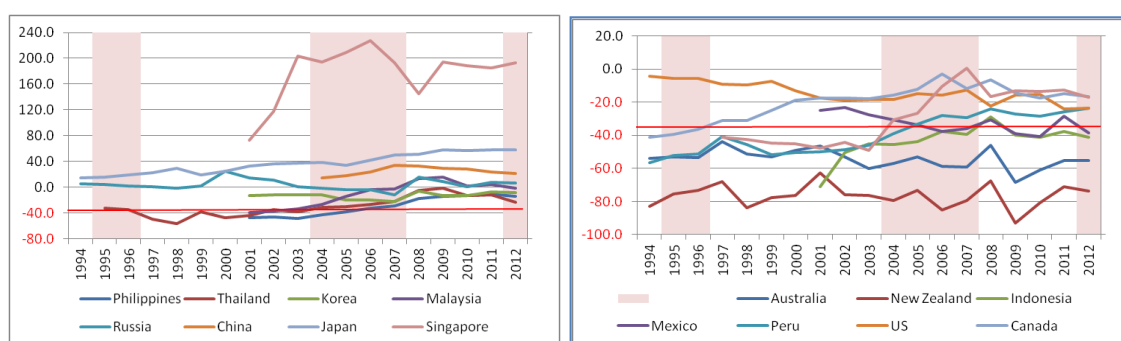


Source: Compiled by the author based on BIS data.

### (3) Volatility Index and External Investment Position

There is no clear and firm relationship between the low volatility period in the IIMA-GMVI and external investment positions in these countries. This may be attributable to the fact that the external investment position of a country is affected in two ways through the accumulated current account balance and the change in asset prices. Therefore, the change of investor sentiment toward the financial market will emerge in various aspects. For instance, in the export oriented emerging countries, even if the current account surplus increased in line with the improvement of the world economy, thus improving their external investment position from a flow aspect, there may be a case where the large inflow of foreign investment pushes up the domestic asset prices, thus causing a deterioration in the external investment position from a stock aspect. Investor sentiment will affect both the external assets and liabilities that include equities, bonds, lending and others, and their impacts on prices will vary accordingly. Therefore, the influence of investor sentiment on their external investment positions will much depend on the circumstances of the countries.

**Chart 12: External Investment Position**



(Source) compiled by the author based on IMF data.

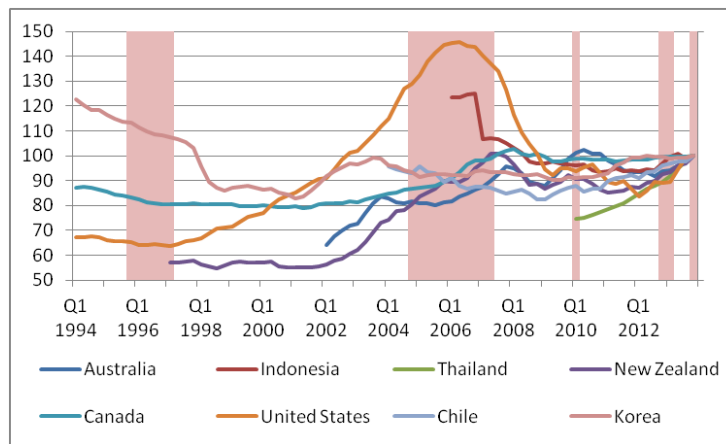
※ Red lines on the Graphs indicate the threshold value given in the MIP, and shadows represent the periods of low volatility.

### (4) Volatility Index and Real Housing Price

Some correlation can be seen between the low volatility period in the IIMA-GMVI and the development of real housing prices. Rising real housing price has a tendency to stimulate investment and consumption through the improvement in sentiment by wealth effect and an increase in borrowings supported by the increased value of collaterals.

This tendency may confirm an existence of a strong relationship between the housing prices and the investor sentiment toward the financial market. Just around the end of the low volatility period ahead of the global financial crisis of 2008, the real housing prices had peaked out mainly in the advanced countries. After the financial crisis, however, the housing prices have been rising even during the low volatility period after the end of 2012 in such Asian countries as Indonesia, Thailand, and Malaysia as well as in New Zealand. Since the middle of 2013, appreciation rates in housing prices are increasing in such advanced countries as Australia, the US, and the UK.

**Chart 13: Real Housing Prices and Low Volatility Periods**



Source) compiled by the author based on Thomson Reuters.

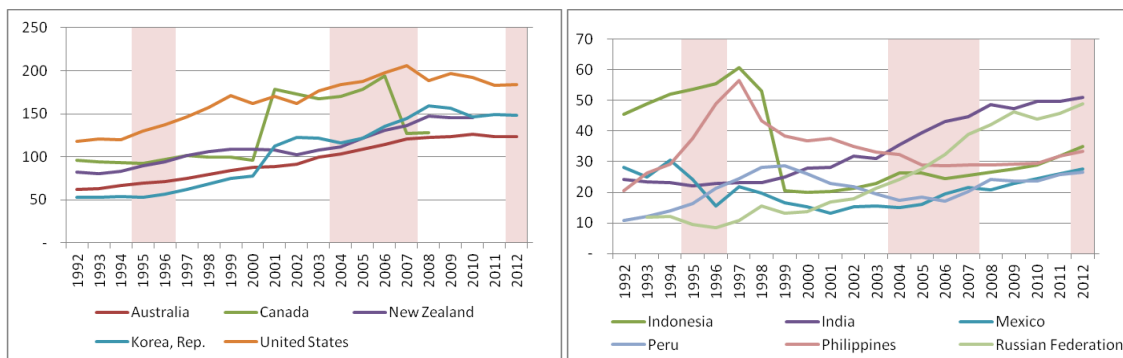
※Shadows represent the periods of low volatility. Real Housing prices are calculated by deflating housing prices by CPI. As for Real housing Prices, the values in 2013 Q4 are regarded as 100.

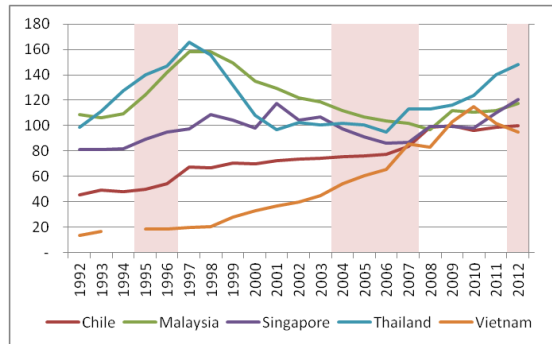
(5) Volatility Index and Private and Government Debt Outstanding

Prolonged period of low volatility in the IIMA-GMVI has often been accompanied by the expansion in private borrowings. This is seen from the comparison of the low volatility periods in the IIMA-GMVI and the credit outstanding offered to the private sector. Debt outstanding in the private sector especially increased rapidly in ASEAN countries (Indonesia, the Philippines, Thailand, Malaysia, etc) in the low volatility period of 1995-1997, and in the advanced countries and BRICs in the low volatility period of 2004-2007, indicating an overheating risk appetite among the investors. The increase in the private debt outstanding occurred around the same time as the overheating housing market, suggesting that there is a strong connection between them. On the other hand, no clear relation was seen in the government debt outstanding by itself and the low volatility period.

The European Commission (2012) notes that inclusion of the general government debt outstanding in the scoreboard was intended to assess the total amount of debt the member states had. However, there is no clear connection between the low volatility period and total debt outstanding of the nations.

**Chart 14: Private Debt Outstanding (% of GDP)**

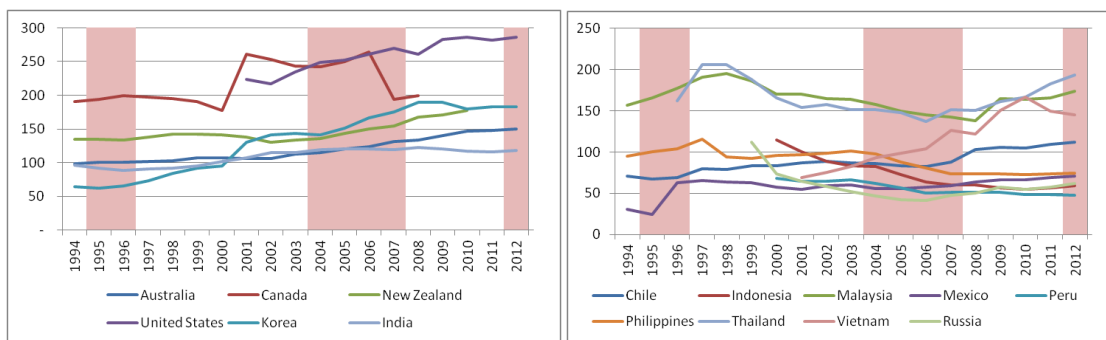




Source: Compiled by author based on IMF and World Bank data.

\* Shadows represent the periods of low volatility.

**Chart15 Overall Debt Outstanding (% of GDP)**



Source: Compiled by author based on IMF and World Bank data.

※ Overall debt outstanding (% of GDP) is the aggregation of private and government debt outstanding (% of GDP). Shadows represent the periods of low volatility.

As was seen above, the prolonged period of low volatility has the following characteristics as summarized in Chart 16. Lowering of volatility in the asset prices in the financial market brings an increase in the investors' risk appetite, which will be translated into the expansion of financial leverage as is seen in the rise of real housing prices and the increase in private debt outstanding. That expansion increases the inflow of money into the high interest rate countries that are highly expected for their growth potentialities, creating big imbalances on their current account balances and excess changes in their REERs, which in turn tend to lead to a rise in the price of risk assets such as reflected in the stock index, real housing price index, and REER.

**Chart 16 Investor Sentiment and Conditions in the Financial Market**

	Volatility of asset prices	Risk appetite of investors	Financial leverage	Capital flow to developing countries	Risk asset prices
Low Volatility	Fall	Rise	Expansion	Increase	Rise
High Volatility	Rise	Fall	Reduction	Decrease	Fall

Source: Compiled by author

If the investor sentiment toward the financial market that is shown in the volatility index changes at around the same time as the changes in the macroeconomic indicators, the volatility index can be seen as a leading indicator to the macroeconomic indicators. The IIMA-GMVI of this institute is calculated on a daily base, thus providing more timely information than the other macroeconomic indicators which take time in their publication, although they may indicate the imbalances more precisely and deeply.



## **5. Further Challenges**

So far we have seen that the long period of the low volatility in the IIMA-GMVI could be a signal of a possible imbalance in the macro economy. But it is also true that the mere prolonged period of the low volatility in the index cannot fully explain the occurrence of macroeconomic imbalances. There is no clear threshold value to judge how long the low volatility period should continue before we can detect the accumulation of the macroeconomic imbalances that could trigger a crisis.

Furthermore, since the volatility index simply measures the fluctuations in the prices, it is inevitable to take a low value for the controlled prices. Especially in the case of foreign exchange rate, there are many countries that adopt managed exchange rate system with limitations for daily rate changes or actively intervene in the market to control the rate. In these countries, the volatility index would record small values, indicating the possibility that it does not correctly reflect the investor sentiment toward the financial market in those countries.

As is pointed out in the discussion of trilemma of international finance, managed prices may by themselves produce the macroeconomic imbalances, so there will be no problem in taking the low volatility period as a leading indicator.

## **6. Conclusion**

Volatility Index is an indicator that shows the magnitude of the fluctuation in the financial market. A rise in the volatility index often creates an environment that may induce a fall in risk asset prices or capital withdrawal, since it deteriorates the sentiment of the investors toward the financial market by giving concerns over the outlook for the macro economy and corporate incomes that underlie the risk asset prices. A fall of the index, on the other hand, indicates a lowering of fluctuations in the financial market, and it suggests edging up of risk asset prices, an increase in borrowing and influx of money to emerging countries since it improves the investor sentiment by making it easier to forecast the future prospect on the macro economy and corporate incomes.

With such a mechanism, the lowering of the volatility index for a longer term is liable to trigger a macroeconomic imbalance. As we have seen in Chapter 3, the period of a continued low volatility in the IIMA-GMVI coincided with the time of accumulated imbalances in such indicators as the current account balance, real effective exchange rate, real housing price, and private debt outstanding which are effective indicators to assess the macroeconomic imbalance both in domestic and external sectors. Since the magnitude of the index reveals the degree of the influence to the shocks, it is also possible to examine spillover effects among the individual financial markets by making various sub-indices as we have tried in this institute.

Risk indicators that include volatility indices can play an important role in assessing an accumulation of macroeconomic imbalances and spillover effects of a shock to the global financial markets. Since they provide more timely information than the macroeconomic indicators, which need some time before their publication, the development of the volatility index can be used as a meaningful leading indicator to the other macroeconomic indicators.

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*ARE LEADING INDICATORS OF FINANCIAL CRISES USEFUL FOR ASSESING COUNTRY VULNERABILITY? EVIDENCE FROM THE 2008-09 GROBAL CRISIS*, Jeffrey A. Frankel & George Saravelos

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