Asian Financial Market Integration and the Role of Chinese Financial Market

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Abstract:
This paper uses panel unit root test and panel cointegration test to examine whether there are common trends among Asian financial markets, and if there are common trends, are they stationary or not. Asian stock market integration is an important issue in the midst of ever increasing goods and service trades. Despite the recent progress, the degree of intra-regional financial integration appears to lag behind the increase in trades in the region. Empirical evidence shows that financial market returns among Asian countries are all stationary in itself and panel unit root tests reinforces this conclusion. Asian financial markets generally move together, and they could be integrated in a statistical point of view. China appears to be an outlier in this analysis, and her financial market is not in sync with any other Asian financial markets in the sample.

JEL codes: C22, F21, F36
Keywords: Asian financial market integration, Panel unit root test, Panel Analysis of Nonstationarity in the Idiosyncratic and Common components (PANIC)

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1 Introduction

There has been a growing interest among Asian countries to stabilize financial markets in the midst of uncertainty surrounding the world financial conditions. Since the first Asian financial crisis of 1997-1998, there have been several initiatives among Asian countries to improve the financial market stability in the region. The first significant attempt was the Chiang Mai Initiative (CMI) in May 2000 to create a network of bilateral swap arrangements among ASEAN+3 countries[1] to address short-term liquidity difficulties in the region. CMI has been expanded to cover multilateral agreement by creating a self-managed reserve pool governed by a single contractual agreement that allows its members to tap a regional pool of foreign exchange reserves to better fend off a financial crisis. Besides the CMI, two important capital market initiatives aiming to help develop regional bond markets and enhance financial resilience for the region are in place. The first is the Asian Bond Market Initiative (ABMI) launched in August 2003. ABMI focuses on the following two areas: (i) facilitating access to the market through a wider variety of issuers and types of bonds and (ii) enhancing market structure to foster bond markets in Asia. The second one, Asian Bond Fund (ABF) initiative, launched in 2002, lays the foundation for promoting the development of regional and domestic bond markets in the Asian region by developing regional bond funds. Phylaktis (1999), Yang, et. al. (2003), Click and Plummer (2005), Guillaumin (2009), Yu, et. al. (2010) investigated financial market integration issues in Asia.

The issue of financial integration has double-edged implication for financial stability among regional markets. On the one hand, as Umutlu, et. al (2010) have shown, financial integration would benefit the region through more efficient allocation of capital, a higher degree of risk diversification, a lower probability of asymmetric shocks and a more robust market framework. These effects would help improve the the capacity of economies to absorb external shocks and foster stable economic

[1]The ASEAN+3 countries include 10 members of Association of Southeast Asian Nations (ASEAN): Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam, plus 3 countries in the Northeastern Asia: China, Japan and South Korea.

growth. On the other hand, Beine, et al., (2010) shows that intensified financial linkages in a world of high capital mobility may also harbor the risk of cross-border financial contagion, in particular when the region's economies become more interdependent through coordinated financial tools. In other words, financial instability in one country, small or large, could be transmitted to neighboring economies more rapidly. Amornthum and Bonham (2011) investigate the real interest parity (RIP) among Asian markets.

Figure 1 shows the monthly standard deviation of financial market returns and Hodrick-Prescott (HP) filtered trend line among 10 ASEAN+3 sample countries[2] and US for the period September 1994 to December 2013. It measures the dispersion and volatility of financial market returns among regional financial markets. This measure has peaked during the first Asian Financial Crisis, from the middle of 1997 to early 1998. It has then steadily decreased until the middle of 2005, and started to increase again reaching the second peak in early 2008 during the recent U.S. housing bubble and the Great Recession. Since then, it has been very steady and reached its lowest level of volatility in recent years.

Table 1 shows pairwise simple correlation among financial market for the same period. It shows several interesting correlations among regional financial markets. First, among Asian countries, stock market returns from Japan, Hong Kong and Singapore are most closely correlated with the US returns, while Chinese market returns are least correlated with the US returns. This finding is not surprising that Japan, Hong Kong and Singapore all have relatively well developed financial market system and the international capitals move relatively freely in those markets. Therefore, they are all closely in sync with US market behavior. Second, among Asian countries, however, Hong Kong and Singapore are mostly correlated with other Asian country markets. Their average correlations among other Asian markets are 0.52 and 0.55, respectively. Interestingly, Japan and China show the least correlation among Asian countries with correlation coefficients of 0.39 and 0.19, respectively. Even though Japan and China are two dominant economies in the region, their financial market returns are least correlated with other Asian countries. For Japan,

[2] 10 Asian countries are described in Section 3.1

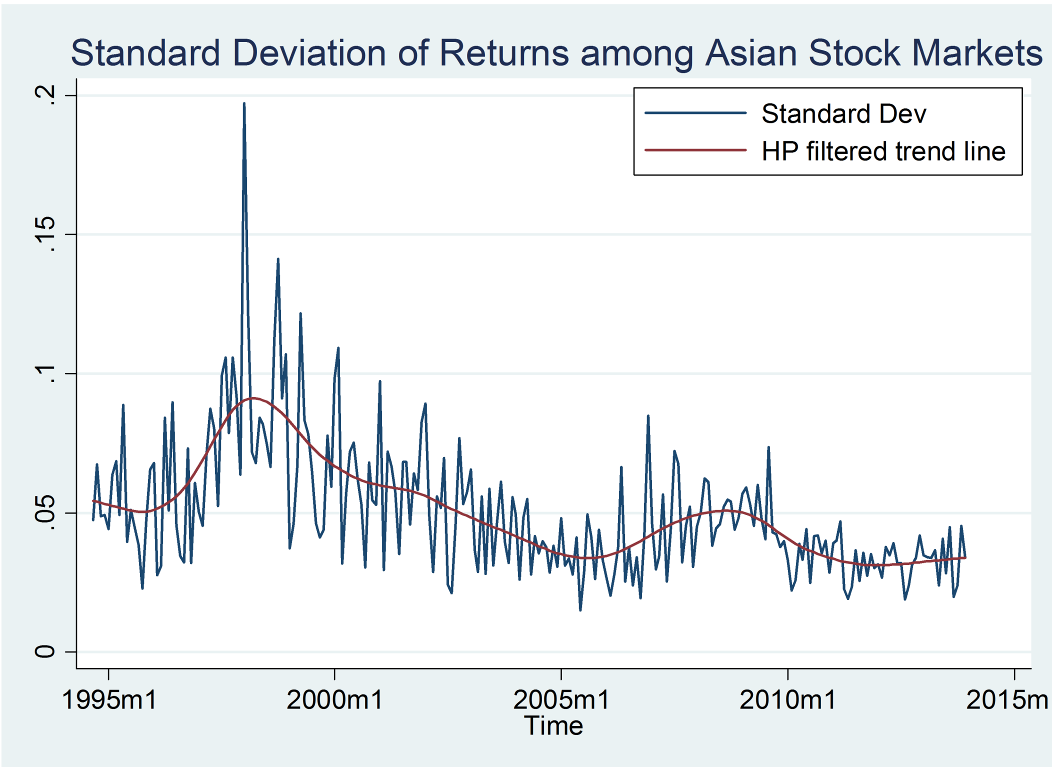

Figure 1: Standard Deviation of Returns among Asian Stock Markets

	JP	CH	HK	TW	KR	SG	MY	TH	ID	PH	US
JP	1.00	0.20	0.46	0.42	0.48	0.47	0.24	0.41	0.45	0.35	0.56
CH	0.20	1.00	0.26	0.31	0.19	0.16	0.20	0.10	0.16	0.11	0.19
HK	0.46	0.26	1.00	0.53	0.49	0.78	0.56	0.54	0.47	0.56	0.65
TW	0.42	0.31	0.53	1.00	0.47	0.53	0.44	0.47	0.34	0.37	0.48
KR	0.48	0.19	0.49	0.47	1.00	0.51	0.38	0.61	0.51	0.43	0.47
SG	0.47	0.16	0.78	0.53	0.51	1.00	0.65	0.62	0.56	0.67	0.63
MY	0.24	0.20	0.56	0.44	0.38	0.65	1.00	0.53	0.53	0.54	0.40
TH	0.41	0.10	0.54	0.47	0.61	0.62	0.53	1.00	0.60	0.64	0.48
ID	0.45	0.16	0.47	0.34	0.51	0.56	0.53	0.60	1.00	0.61	0.48
PH	0.35	0.11	0.56	0.37	0.43	0.67	0.54	0.64	0.61	1.00	0.48
US	0.56	0.19	0.65	0.48	0.47	0.63	0.40	0.48	0.48	0.48	1.00
Average[1]	0.40	0.19	0.53	0.44	0.45	0.56	0.45	0.50	0.47	0.48	0.48
Average[2]	0.39	0.19	0.52	0.43	0.45	0.55	0.45	0.50	0.47	0.48	

Average 1 is the average of all 11 markets while Average 2 is among Asian countries excluding the US returns.

Table 1: Pairwise Return Correlations among Asian Financial Markets

her financial market is more closely tied to the US markets while Chinese financial market is pretty much its own, not showing close relations to any other Asian financial markets.

While there are numerous institutional and legal issues and its implications on the Asian financial market integration, this paper studies on the statistical evidence on the feasibility of the Asian financial market integration. This paper uses panel unit root test and panel cointegration test to examine whether there are common trends among Asian financial markets, and if there are, are they stationary or not. Asian stock market integration is an important issue in the midst of ever increasing goods and service trades among Asian countries. Despite the recent progress, the degree of intra-regional financial integration appears to lag behind the increase in trades in the region.

2 Econometric Model

There has been a growing number of panel unit root test developed. The first generation of panel unit root test assumes that idiosyncratic terms are independent across cross-sectional observations. Levin, Lin and Chu (2002) tests homogeneous panel structure of each panel having the same serial correlation coefficient, and Im, Pesaran and Shin (2003) extends homogenous panel into the heterogeneous panel allowing different serial correlation coefficient. However, assumptions on the first generation panel unit root test are rather unrealistic for most of international macroeconomic data. More commonly used international macroeconomics data such as exchange rates, consumption volatility, economic growth rates are all closely interrelated across countries. Therefore, the second generation panel unit root test relaxes cross-sectional independence assumption.

Second generation panel unit root test uses common factor structure to allow cross-sectional dependency. Perron and Moon (2004, Econometric Reviews), Pesaran (2003, Trinity College Working Paper), Phillips and Sul (2003, Econometric Journal) and Bai and Ng (BN, 2004, Econometrica) proposed dynamic common factor structure to allow cross-sectional dependence. This paper uses Bai-Ng's (2004) Panel Analysis of Nonstationarity in the Idiosyncratic and Common Components (PANIC) to test the financial market integration among Asian countries. Amornthum and Bonham (2011) investigate the real interest parity (RIP) using PANIC procedure among Asian financial markets. Consider the following model:

$$y_{it} = D_{it} + \lambda_i' F_t + \epsilon_{it} \tag{1}$$

where y_{it} is the cross-sectional time series of interest, such as the rate of return for each financial market i at time t, D_{it} is non-stochastic polynomial trend function, and F_t is $(r \times 1)$ common factors with factor loading λ_i, and $\lambda_i' F_t$ is the common component. The common factor F_t allows strong cross-section interdependence while the idiosyncratic term ϵ_{it} can only be weakly correlated. Series y_{it} is non-stationary if either one or more F_t is non-stationary, or ϵ_{it} is non-stationary or both. This test can be applied to two unobserved components, F_t and ϵ_t. PANIC can potentially resolve three econometric problems associated with the unit root test. First, size distortion: Existing tests tends to over-reject the non-stationary hypothesis when the series is the sum of weak $I(1)$ component and strong $I(0)$ component. Second, cross-sectional independence: Idiosyncratic term can only be weakly correlated across i by design. $y_{i,t}$ will be strongly correlated if data obey the factor structure through F_t. Thus, the pooled test based on the ϵ_{it} are more likely to satisfy the cross-sectional independence assumption required for pooling. Third, lack of power: Pooled test exploits cross-sectional information and are more powerful than the univariate unit root tests.

PANIC test separates the common factor, F_t, and the idiosyncratic term ϵ_{it} from y_{it}, and tests the nonstationarity of F_t and ϵ_{it}, separately. PANIC test first estimates λ_i consistently regardless whether ϵ_{it} is stationary or not using the first differenced data and accumulating the estimated factors. The first differenced model is

$$\Delta y_{it} = \lambda_i^{'} f_t + \triangle \epsilon_{it}, \text{ where } f_t = \triangle F_t \tag{2}$$

Non-stochastic term D_{it} is either constant or constant with time trend, and they can be appropriately differenced out. Principal component method estimates $\hat{f}_t$ and $\hat{\lambda}_i$, and obtain $z_{it} = \Delta y_{it} - \hat{\lambda}_i^{'} \hat{f}_t$, the estimated residuals from principal component estimation of Equation (2). Define

$$e_{it} = \sum_{s=2}^{t} z_{is}, \quad \text{for } t = 2, \ldots, T, \quad i = 1, \ldots, N \tag{3}$$

Then, estimate the number of common factors using the information criteria as

$$\begin{aligned} r \quad &= \underset{0 \le k \le k_{max}}{argmin}\, IC_2(k), \text{ where} \\ IC_2(k) \quad &= ln \left(\frac{1}{N} \sum_{i=1}^{N} \left(\frac{e_i^{'} e_i}{T} \right) \right) + k \times \left(\frac{N+T}{NT} \right) ln\left(min[N,T]\right) \end{aligned} \tag{4}$$

where N is the number of cross-sections (i) and T is the number of time-series observations (t). Bai and Ng proposed 3 different information criteria to select appropriate number of common factors, but we adopted the $IC_2(k)$ criteria to select the number of common factors. Once we determine the number of common factors, r, then, proceed to estimate the common factors, $\hat{F}_t$, as following.

$$\hat{F}_t = \sum_{s=2}^{t} \hat{f}_t, \text{ an } (r \times 1) \text{ vector} \tag{5}$$

Once we have $\hat{F}_t$, then, we can now separate y_{it} into common component $\hat{\lambda}_i' \hat{F}_t$ and idiosyncratic term e_{it}. PANIC test statistics to test $H_0 : \rho_i = 1 \forall\, i$ against $H_1 : \rho_i < 1$ for some i are:

$$P_e^c = \frac{-2\sum_{i=1}^{N} log\, p_e^c(i) - 2N}{\sqrt{4N}} \xrightarrow{d} N(0,1) \tag{6}$$

$$P_e^\tau = \frac{-2\sum_{i=1}^{N} log\, p_e^\tau(i) - 2N}{\sqrt{4N}} \xrightarrow{d} N(0,1)$$

where $p_e^c(i)$ and $p_e^\tau(i)$ are univariate p-values associated with $ADF_e^c(i)$ and $ADF_e^\tau(i)$, respectively.

There are three important features of PANIC. First, the tests on factors can be performed without knowing whether ϵ_{it} is stationary or nonstationary. Second, unit root test for ϵ_{it} is valid whether $\epsilon_{jt},\ j \neq i$ is $I(0)$ or $I(1)$, and in any event, such knowledge is not necessary. Third, the test on ϵ_{it} does not depend on whether F_t is $I(0)$ or $I(1)$. In fact, the limiting distributions of $ADF_e^c(i)$ and $ADF_e^\tau(i)$ do not depend on the common factors. If ϵ_{it} is independent across i, then, tests for e_{it} are also independent across i asymptotically. This test is a modification of Maddala and Wu's (1999) Fisher-type test.

3 Empirical Analysis

3.1 Data

Data consists of 10 Asian countries, Japan, China, Hong Kong, Taiwan, South Korea, Singapore, Malaysia, Thailand, Indonesia, Philippines plus U.S., total 11 countries. Monthly stock market index and nominal exchange rates (end of the month in local currency terms) are collected from Datastream from January 1990 to December 2013 total 288 monthly observations. Monthly dividend yield is obtained from the Bloomberg for the sample period. However, as in Figure 2, Chinese financial market in early 1990 shows rather extreme behavior.[3] Therefore, we have to exclude the earlier period for econometric analysis, and the actual data analysis uses observations starting from September 1994 to December 2013, total of 232 monthly observations.

Financial market returns are measured in U.S. dollar terms. Each monthly financial index is divided by the nominal exchange rate of local currency price per U.S. dollar. Monthly dividend rate is also adjusted by the change of the nominal exchange rates. Monthly market returns are then calculated by adding financial index returns and dividend rates. After calculating monthly returns, we calculated the return differences of each market from U.S. return as,

$$y_{it} = Return_{it} - Return_{US,t}$$

where $i = 1$ to 10 for 10 Asian countries, and y_{it} is the variable that we used to perform any analysis in this paper.[4] Figure 2 plots 10 country's financial market return differences, y_{it}, from January 1990 to December 2013.

As explained in the footnote 3, Chinese market exhibits the highest volatility among all other markets, especially during early to middle 1990s. Therefore, we exclude these periods for further data analysis. Aside from Chinese market, all

[3]Chines stock market anomalies:

Monthly return of 178% on May 1992: On May 21st, 1992, the Chinese government revoked the limitation (only +/-1%) set in 1990 when the stock market started. Since then there was no limit for the movement of stock market. Until December 16th, 1996, they recovered the limitation and set it at +/-10% and has been used until now. The stock market price has fluctuated significantly during the period between 1992 and 1996.

Monthly return of 137% on August 1994: During February 1993 and July 1994, there have been an explosion of newly listed companies in the Shanghai stock market, and resulted in the over-supply of equities in the market, and the market price was driven down during this period. In order to save the market, on Aug. 1st, 1994, China's Securities Regulatory Commission suspended the issue of newly listed companies and carried out two other beneficial policies to stablize the stock market. Then, the price was driven up again in August 1994.

[4]We decided to use the return differences rather than return itself because Asian financial markets are heavily influenced by the U.S. financial market behaviors. It also provides the common comparison basis for each financial market performances.

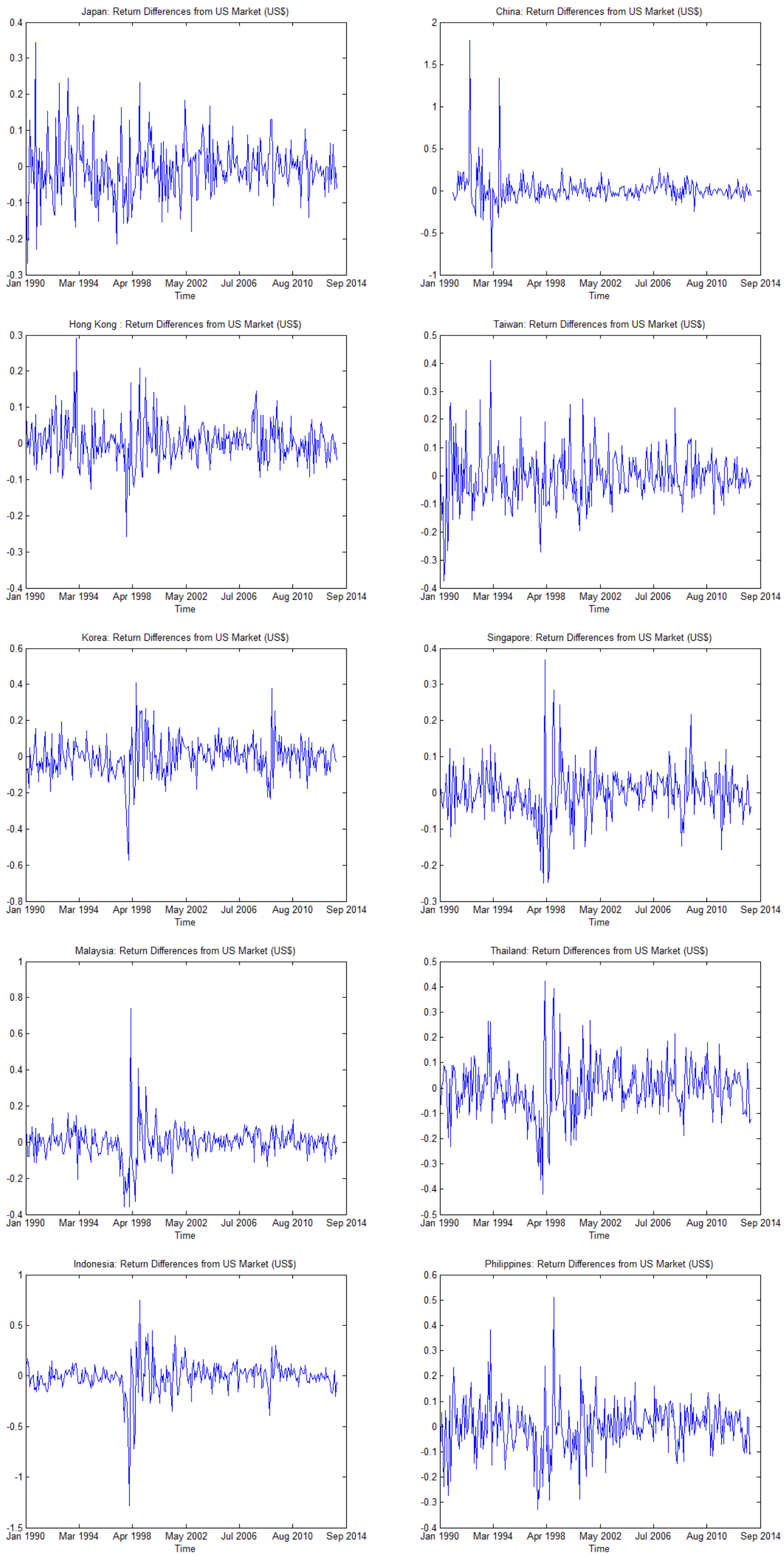

Figure 2: Return differences of each market from the U.S. returns

Number of Common Factors	0	1	2	3
All countries	-4.5904	-5.2128	-5.1554	-5.1181
Far NE Country Bloc	-4.8092	-7.3115	-5.9427	-5.2050
Chinese Economic Bloc	-4.5241	-6.1197	-5.5786	-5.2746
All except China	-4.5632	-5.3829	-5.2530	-5.1757

Table 2: IC_2 Criteria

other Asian markets show similar patterns: high volatility during the Asian financial crisis period of middle of 1997 to the middle of 1998, especially Malaysia, Indonesia, Thailand and South Korea. These are the countries hardest hit during the crisis period. Taiwan, Hong Kong and Japan have relatively mild impact on the markets during the same period. The second highest volatility occurs during the recent global financial crisis from late 2007 to early 2009. Interestingly, during the global financial crisis, South Korea and Singapore have the most impact on their financial markets compared to other markets.

3.2 Empirical Results

To investigate the financial market integration issue, we analyze return differences by diving sample countries into several different geographical and cultural economic blocs. First, (1) we used all 10 Asian countries, and present the results. Then, there are several sub-groups: (2) since China is such an anomaly and its financial market is tightly controlled until very recently, all Asian countries except China, (3) Chinese Economic Bloc: China, Hong Kong, Taiwan, Singapore and Malaysia, and (4) Far North Eastern country bloc which includes China, Japan, and South Korea,

We first estimate the number of common components using information criteria in Equation (4). For all country group and all other sub groups of countries, the number of common components is determined to be one using information criteria IC_2 from Equation (4). IC_2 criteria is presented in Table 1. Therefore, we proceed the PANIC procedure with one common component for all analysis. PANIC tests applied to test the panel unit root hypothesis when $(N, T) \to \infty$, and Bai and Ng (2004) shows

	y_{it}	ϵ_{it}	$y_{it}-\hat{\lambda}_i\hat{F}_t$	$\hat{\lambda}_i$	$Var\left(\hat{\lambda}_i' F_t\right)/Var\left(y_{it}\right)$
Japan	**-4.010**	**-4.400**	**-4.693**	-0.148	0.026
China	**-4.328**	**-2.847**	**-4.387**	0.012	0.000
Hong Kong	**-4.339**	-2.009	**-5.237**	-0.465	0.373
Taiwan	**-5.290**	**-3.167**	**-5.809**	-0.531	0.248
South Korea	**-3.967**	-1.144	**-4.895**	-0.759	0.253
Singapore	**-3.741**	-2.063	**-6.607**	-0.897	0.813
Malaysia	**-3.288**	**-5.798**	**-6.044**	-0.875	0.427
Thailand	**-3.289**	**-3.665**	**-4.280**	-1.133	0.588
Indonesia	**-4.194**	-2.568	**-6.004**	-2.279	0.878
Philippines	**-3.783**	**-3.102**	**-5.700**	-0.925	0.515
Pooled unitroot test for $\hat{F}_t$			**-3.500 (0.002)**		
Pooled unitroot test for (y_{it}, ϵ_{it})			**141.064 (0.000)**		**116.383 (0.000)**
Pooled co-int test for $\left(y_{it}, y_{it}-\hat{\lambda}_i\hat{F}_t\right)$			**101.751 (0.000)**		**167.336 (0.000)**

Bold: statistically significant at 1%. p-values in the parenthesis.
Pooled unit root test for $\hat{F}_t$ has standard normal distribution and pooled unit root test for (y_{it}, ϵ_{it}), and pooled cointegration test has χ^2_{20} distribution.

Table 3: All Asian countries

simulation results with $T = 100$ and $N = 40$. However, Gutierrez (2006) conducts Monte Carlo simulation with cross-section as small as $N = 10$, and concludes Bai and Ng's PANIC tests can also be fruitfully used for small panels to test the panel unit root hypothesis for common factors, original series, y_{it}, and idiosyncratic term ϵ_{it}. Test statistics are from Equation (6) for standard normal distribution, and Maddala and Wu (1999)'s Fisher-type χ^2 distribution.[5]

Table 3 presents univariate and panel unit root tests for all 10 sample Asian countries. y_{it} is return difference of country i from U.S. return, ϵ_{it} is a direct estimate of idiosyncratic term estimated from Equation (3), and the third column, $y_{it}-\hat{\lambda}_i\hat{F}_t$, is a de-factored series, an indirect estimate of idiosyncratic term subtracting common component from the original series y_{it}. $\hat{\lambda}_i$ is an estimate of factor loading for each country. The last column of Table 3 measures the proportion of the market volatility

[5]Maddala and Wu (1999) test pools p-values of univariate unit root tests to construct a statistic $-2\sum_{i=1}^{N} ln\left(p\left(i\right)\right) \sim \chi^2_{2N}$, where $p\left(i\right)$ is a p-value from univariate unit root test.

attributed to the volatility of common component, $Var\left(\hat{\lambda}_i' F_t\right)$, that is, it is the ratio of $Var\left(\hat{\lambda}_i' F_t\right)$ to $Var\left(y_{it}\right)$.

Univariate unit root tests carry out with cross-sectionally augmented Dickey-Fuller (CADF) test with $H_0 : \rho_i = 1 \, \forall \, i$ against $H_1 : \rho_i < 1$ for each i. Univariate CADF unit root tests for y_{it} show that we strongly reject $H_0 : \rho_i = 1 \, \forall \, i$ in favor of $H_1 : \rho_i < 1$. They are all stationary individually as well as combined in a panel data set. All countries have stationary return difference series, while the idiosyncratic components ϵ_{it} for some countries are nonstationary, especially Hong Kong, South Korea, Singapore, and marginally Indonesia at 1% level. Singapore, Thailand, Indonesia and Philippines have more than 50% of market volatility explained by the common component volatility closely followed by Malaysia, while Japan and China have negligible proportion of its market volatility explained by the common component volatility, 3% and 0%, respectively. This is in line with the simple pair-wise correlations among regional financial markets shown in Table 1. Chinese market has the lowest average correlations among other regional financial markets followed by Japanese market. Figure 3 plots common factor derived using all 10 countries together with HP filtered series starting from September 1994 to December 2013. Common factor is clearly showing a pattern of stationary process, and its test statistic, -3.50, rejects nonstationarity. Panel cointegration tests for the original series, y_{it}, and de-factored series, $y_{it} - \hat{\lambda}_i \hat{F}_t$, both reject null hypothesis of no-cointegration. Asian countries all together show statistical sign of cointegration among themselves.

Since Chinese financial market behaves rather out of sync with the rest of other regional markets, we also present the similar analysis excluding China. They are shown here as Table 4 and Figure 4. Even excluding China, among other Asian countries, there are similar patterns in their financial market behavior. Return differences are all stationary, and idiosyncratic terms are nonstationary for Hong Kong, South Korea, Singapore, and marginally Indonesia at 1% level as similarly shown in Table 3. Japanese market is the least affected by the common component volatility at only 3%, roughly the same as for all country analysis. Pooled tests also show that common factors, y_{it}, and idiosyncratic terms are all stationary. Common factors also appear to be almost identical as in Figures 3 and 4.

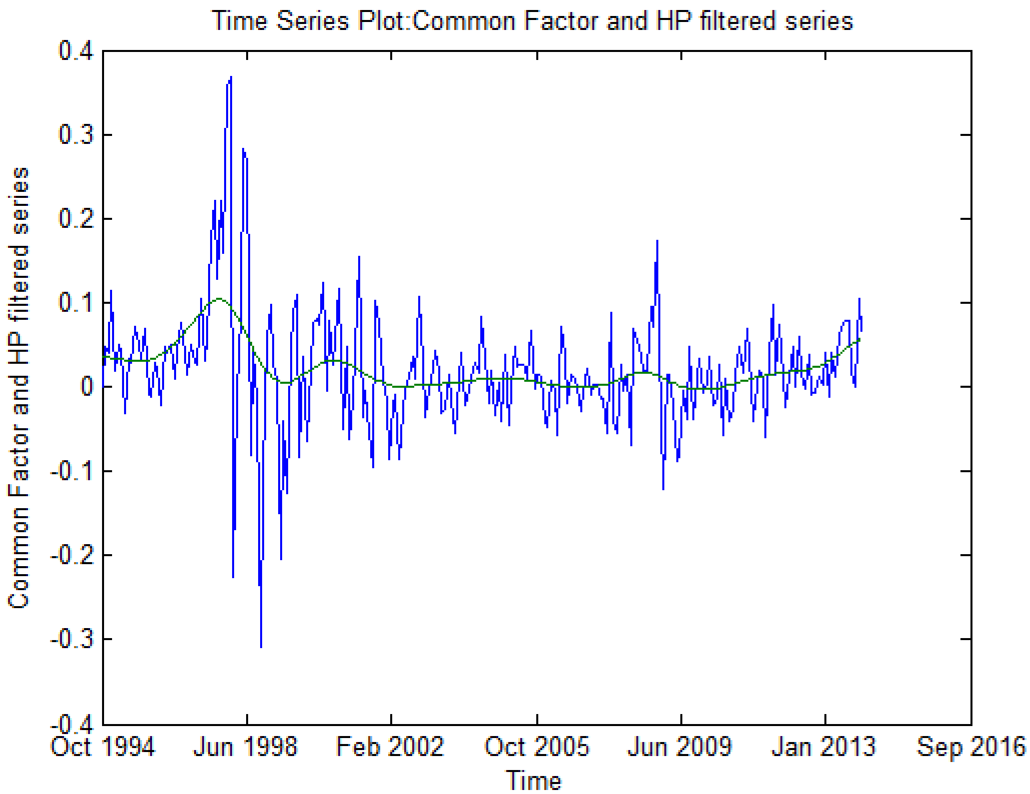

Figure 3: Common factor for All countries

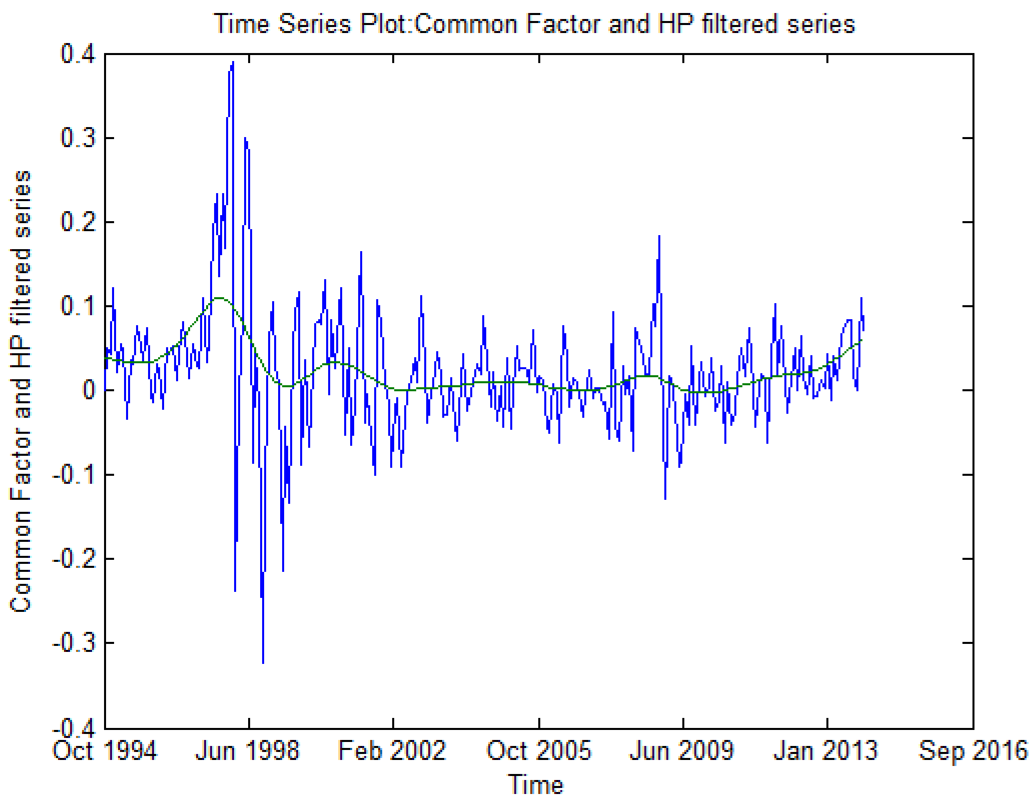

Figure 4: All countries except China Common Factor

	y_{it}	ϵ_{it}	$y_{it} - \hat{\lambda}_i \hat{F}_t$	$\hat{\lambda}_i$	$Var\left(\hat{\lambda}_i' F_t\right) / Var\left(y_{it}\right)$
Japan	**-4.010**	**-4.400**	**-4.693**	-0.140	0.026
Hong Kong	**-4.339**	-2.006	**-5.238**	-0.442	0.373
Taiwan	**-5.290**	**-3.168**	**-5.809**	-0.504	0.248
South Korea	**-3.967**	-1.144	**-4.893**	-0.720	0.253
Singapore	**-3.741**	-2.065	**-6.609**	-0.851	0.813
Malaysia	**-3.288**	**-5.803**	**-6.048**	-0.830	0.428
Thailand	**-3.289**	**-3.660**	**-4.278**	-1.075	0.588
Indonesia	**-4.194**	-2.565	**-6.007**	-2.162	0.878
Philippines	**-3.783**	**-3.098**	**-5.701**	-0.878	0.516
Pooled unitroot test for $\hat{F}_t$			**-3.500 (0.002)**		
Pooled unitroot test for (y_{it}, ϵ_{it})			**122.643 (0.000)**		**105.207 (0.000)**
Pooled co-int test for $\left(y_{it}, y_{it} - \hat{\lambda}_i \hat{F}_t\right)$			**89.512 (0.000)**		**153.885 (0.000)**

Bold: statistically significant at 1%. p-values in the parenthesis.
Pooled unit root test for $\hat{F}_t$ has standard normal distribution and pooled unit root test for (y_{it}, ϵ_{it}), and pooled cointegration test has χ^2_{18} distribution.

Table 4: All Countries Except China

Since China is one dominating economic power in the region aside from Japan, it is also interesting to investigate further how Chinese economic bloc, loosely defined as Chinese cultural similarities, behaves within each other in the area. We define the Chinese economic bloc as a group of countries consisting of China, Hong Kong, Taiwan, Singapore and Indonesia. These countries are geographically close, and they all share common Chinese culture and heritage. Table 5 and Figure 5 shows unit root tests and its common factor plot. Again, similar pattern emerges. Even within Chinese economic bloc, common component explains very little to the Chinese financial market volatility. Indonesia and Singapore have the most of their volatility due to the common component volatility, virtually none of the Chinese market volatility is attributed to the common component volatility. In conclusion, Chinese financial market is in its own universe.

Interestingly, common factor plot for Chinese economic bloc is complete opposite to all other common factors presented here. This is apparently due to the sign flipping of the factor loadings, $\hat{\lambda}_i$. We need a further investigation of this issue. We cannot

	y_{it}	ϵ_{it}	$y_{it} - \hat{\lambda}_i \hat{F}_t$	$\hat{\lambda}_i$	$Var\left(\hat{\lambda}_i' F_t\right)/Var\left(y_{it}\right)$
China	**-4.328**	**-2.825**	**-4.377**	-0.064	0.004
Hong Kong	**-4.339**	**-2.604**	**-5.652**	0.356	0.289
Taiwan	**-5.290**	**-2.935**	**-6.072**	0.342	0.136
Singapore	**-3.741**	-1.633	**-5.989**	0.671	0.602
Indonesia	**-4.194**	-2.232	**-6.072**	2.074	0.963
Pooled unitroot test for $\hat{F}_t$			**-4.019 (0.000)**		
Pooled unitroot test for (y_{it}, ϵ_{it})			**85.172 (0.000)**		**44.499 (0.000)**
Pooled co-int test for $\left(y_{it}, y_{it} - \hat{\lambda}_i \hat{F}_t\right)$			**62.076 (0.000)**		**85.921 (0.000)**

Bold: statistically significant at 1%. p-values in the parenthesis.
Pooled unit root test for $\hat{F}_t$ has standard normal distribution and pooled unit root test for (y_{it}, ϵ_{it}), and pooled cointegration test has χ^2_{10} distribution.

Table 5: Chinese Economic Bloc

understand why sign of factor loading estimates are reversed for this particular group of countries.

We now turn to our attention to the Far North Eastern Asian 3 countries, China, South Korea and Japan. These three countries are located geographically close and economically tightly linked with each other, especially in recent years. We are interested in to investigate if their financial markets show any sign of co-movement or integration among these countries. Idiosyncratic terms from Japanese market is nonstationary while all other univariate and panel pooled tests show stationary property. Close to 97% of South Korean financial market volatility is attributed to the volatility of the common component, while Chinese market is least affected by the common component volatility only around 2%. Common factor shows similar pattern to all country common factor, but it is less volatile than all country common factor volatility.

4 Conclusion

This paper investigates the Asian financial market integration issue using monthly data from 1994 to 2013 using Panel Analysis of Nonstationarity in the Idiosyncratic

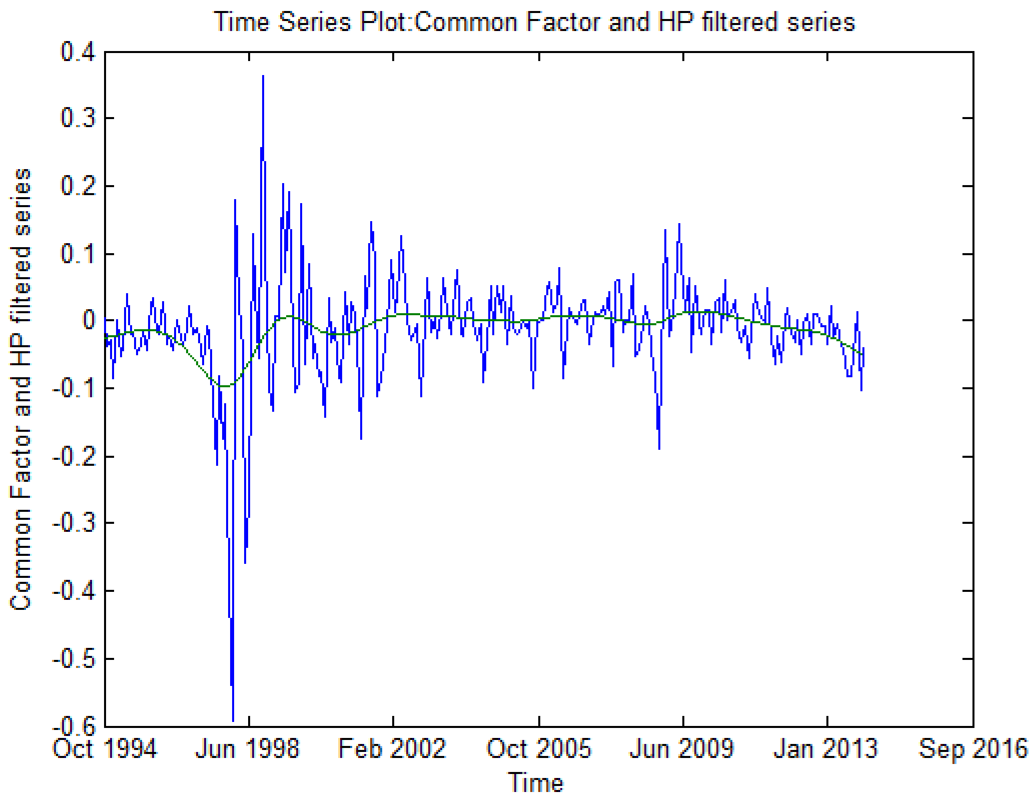

Figure 5: Chinese Economic Bloc Common Factor

	y_{it}	ϵ_{it}	$y_{it} - \hat{\lambda}_i \hat{F}_t$	$\hat{\lambda}_i$	$Var\left(\hat{\lambda}_i' F_t\right) / Var\left(y_{it}\right)$
Japan	**-4.010**	-2.048	**-4.964**	-0.475	0.219
China	**-4.328**	**-3.563**	**-4.267**	-0.191	0.021
South Korea	**-3.967**	**-2.893**	**-5.175**	-1.655	0.966
Pooled unitroot test for $\hat{F}_t$			**-3.943 (0.000)**		
Pooled unitroot test for (y_{it}, ϵ_{it})			**45.322 (0.000)**		**31.017 (0.000)**
Pooled co-int test for $\left(y_{it}, y_{it} - \hat{\lambda}_i \hat{F}_t\right)$			**31.713 (0.000)**		**48.330 (0.000)**

Bold: statistically significant at 1%. p-values in the parenthesis.
Pooled unit root test for $\hat{F}_t$ has standard normal distribution and pooled unit root test for (y_{it}, ϵ_{it}), and pooled cointegration test has χ^2_6 distribution.

Table 6: Far North Eastern Countries

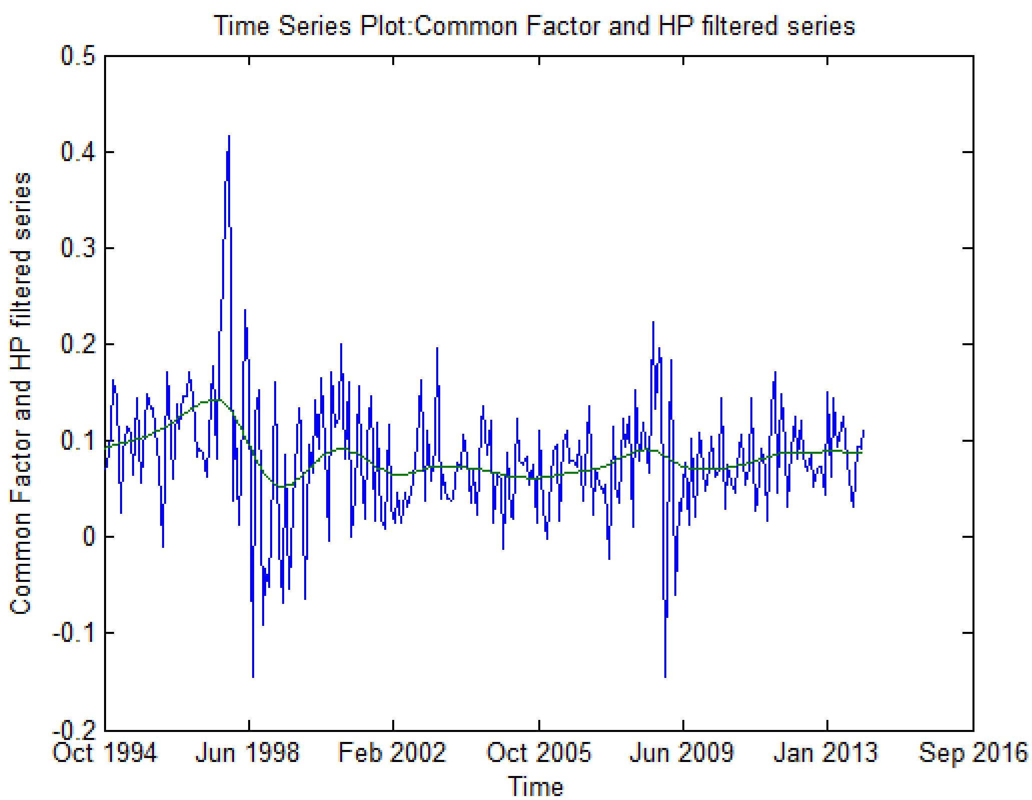

Figure 6: Far North Eastern Asian Countries' Common Factor

and Common Components (PANIC) procedure. We use panel unit root test and panel cointegration test to examine whether there are common trends among Asian financial markets, and if there are common trends, are they stationary or not. The issue of Asian stock market integration is important in the midst of ever increasing goods and service trades. Despite the recent progress, the degree of intra-regional financial integration appears to lag behind the increase in trades. While there are numerous institutional and legal issues and its implications on the Asian financial market integration, this paper studies on the statistical evidence on the feasibility of the Asian financial market integration.

Empirical evidence shows that financial market returns among Asian countries are all stationary in itself and panel unit root tests reinforces this conclusion. Common factors for all sample countries and various subgroups of countries also are stationary. Therefore, Asian financial markets generally move together, and they could be integrated in a statistical point of view. Among those countries, however, China appears to be a clear outlier in this analysis. Even if China has surpassed Japan to become the number two country in the world only behind U.S. in total GDP measure and soon to surpass U.S., its financial market is not in sync with any other Asian countries in the sample.

Aside from China and Japan, other Asian countries share a large portion of market volatility from the common factor volatility. Singapore, Malaysia, Thailand and Indonesia all have high proportion of market volatility attributed to the common factor volatility, while Hong Kong, Taiwan and South Korea shares less proportion of common factor volatility. These are the signs of market co-movement among Asian countries, and common factors are stationary. This is a sign that financial markets among these countries could move in sync in the long-run with possible short-run deviations from the long-run trend. Financial market integration among Asian markets are difficult due to institutional and other external factors, but they could be integrated into one big market in a statistical point of view.

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