Financial Integration in East Asia
--Toward Regional or Global Integration?

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Introduction

- *Closer regional financial Integration*
  - Commitments to financial cooperation and deregulation of financial markets
  - Financial rates of return appear to move more closely together.
- *But the region is also moving toward global integration*
  - More susceptible to global shocks
  - Co-movements of financial returns of local markets

The Data (I)

- *10 economies in East Asia:*

  China (CN), Hong Kong (HK), Indonesia (ID), Japan (JP), Malaysia (MY), Singapore (SG), South Korea (KR), the Philippines (PH), Thailand (TH), and Taiwan (TW)

- *Daily equity returns* (adjusted for daily changes in exchange rates) in each local market *from 1993 to 2011*

- *US equity return represents the source of global shock*

The Data (II)

Equity Market Weights of East Asian Economies

	CN	HK	ID	JP	KR	MY	PH	SG	TH	TW
1993	0.009	0.091	0.008	0.689	0.033	0.052	0.010	0.032	0.030	0.046
1994	0.006	0.055	0.010	0.734	0.039	0.039	0.012	0.028	0.026	0.051
1995	0.006	0.062	0.014	0.728	0.037	0.044	0.012	0.031	0.028	0.038
1996	0.014	0.096	0.019	0.645	0.030	0.066	0.017	0.033	0.021	0.059
1997	0.034	0.125	0.009	0.656	0.013	0.028	0.009	0.032	0.007	0.087
1998	0.036	0.096	0.006	0.683	0.032	0.027	0.010	0.027	0.010	0.073
1999	0.027	0.096	0.010	0.692	0.048	0.022	0.006	0.031	0.009	0.059
2000	0.067	0.128	0.006	0.651	0.031	0.023	0.005	0.032	0.006	0.051
2001	0.085	0.130	0.006	0.580	0.050	0.030	0.005	0.030	0.009	0.075
2002	0.084	0.127	0.008	0.571	0.059	0.034	0.005	0.028	0.012	0.072
2003	0.069	0.137	0.010	0.568	0.057	0.031	0.004	0.028	0.023	0.073
2004	0.051	0.139	0.012	0.576	0.063	0.029	0.005	0.035	0.019	0.071
2005	0.037	0.135	0.010	0.588	0.092	0.023	0.005	0.033	0.016	0.061
2006	0.095	0.178	0.014	0.478	0.087	0.024	0.007	0.040	0.015	0.062
2007	0.267	0.192	0.015	0.314	0.081	0.023	0.007	0.039	0.014	0.048
2008	0.192	0.179	0.013	0.421	0.064	0.026	0.007	0.036	0.014	0.048
2009	0.245	0.208	0.019	0.299	0.075	0.026	0.008	0.044	0.016	0.060
2010	0.209	0.208	0.028	0.294	0.084	0.031	0.012	0.050	0.021	0.063
2011	0.207	0.198	0.034	0.290	0.088	0.035	0.015	0.053	0.024	0.056

Correlation Matrix (I)

Correlation Matrix of Daily Equity Returns (1993~2011)

(nonsynchronous US trading effect adjusted)

	CN	HK	ID	JP	KR	MY	PH	SG	TH	TW	US
CN	1.000										
HK	0.162	1.000									
ID	0.070	0.379	1.000								
JP	0.086	0.419	0.249	1.000							
KR	0.095	0.430	0.292	0.360	1.000						
MY	0.071	0.404	0.441	0.237	0.281	1.000					
PH	0.064	0.359	0.374	0.269	0.279	0.331	1.000				
SG	0.119	0.635	0.461	0.388	0.414	0.476	0.381	1.000			
TH	0.076	0.404	0.406	0.251	0.339	0.404	0.322	0.491	1.000		
TW	0.103	0.380	0.255	0.312	0.379	0.255	0.257	0.398	0.269	1.000	
US	0.066	0.381	0.209	0.400	0.276	0.232	0.333	0.291	0.186	0.269	1.000

Correlation Matrix (II)

Correlation Matrix of Daily Equity Returns (1993~2011)

Nonsynchronous Trading Effects Not Adjusted

	Region	US
Region	1.000	
US	0.088	1.000

Nonsynchronous Trading Effects Adjusted

	Region	US
Region	1.000	
US	0.422	1.000

σ -Convergence (I)

- Also known as *cross-sectional volatility or dispersions*
- It measures the degree of integration:

$$\sigma_t = \sqrt{\sum_{i=1}^{n} w_{i,t} \left(r_{i,t} - r_t \right)^2}$$

  - Decrease in σ_i indicates increases in the degree of integration.
  - A full integration is reached if $\sigma_t = 0$

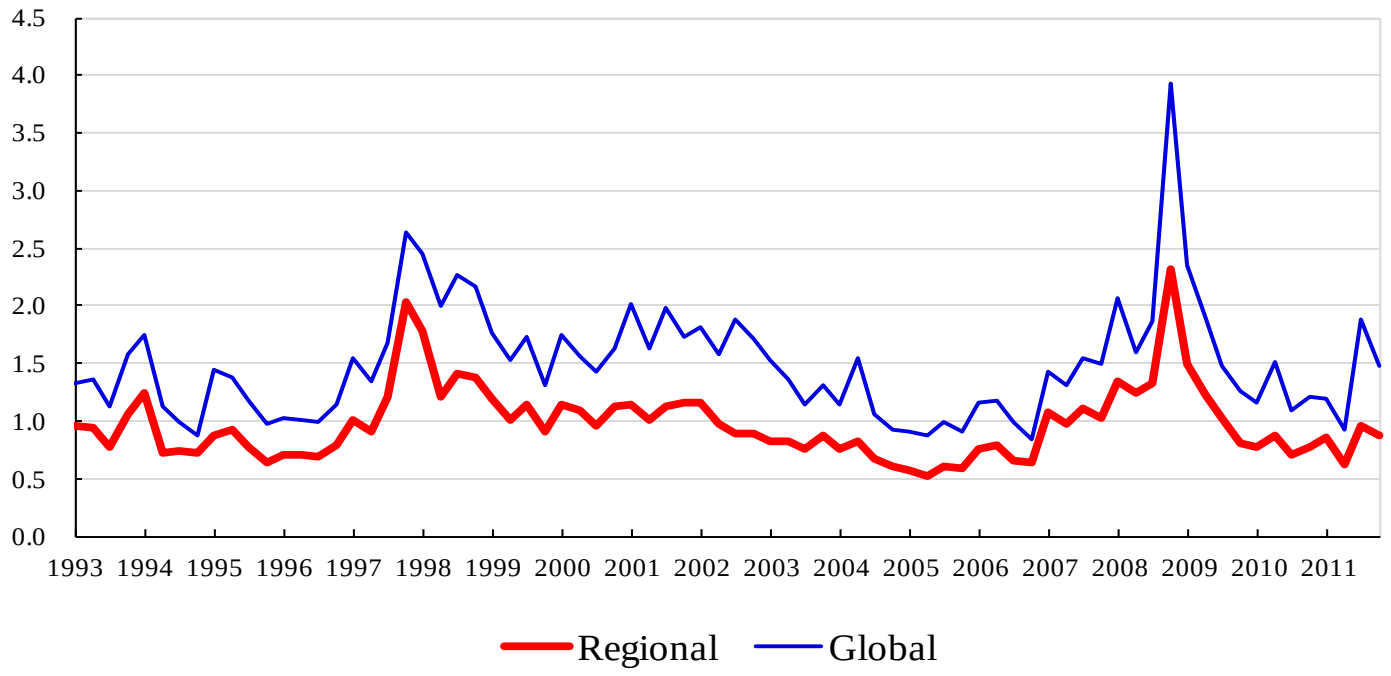
σ -Convergence (II)

Degree of Financial Integration (σ-Convergence)

	Regional	Global
1993	0.931	1.347
1994	0.858	1.182
1995	0.801	1.242
1996	0.723	1.043
1997	1.286	1.802
1998	1.444	1.215
1999	1.061	1.579
2000	1.081	1.589
2001	1.104	1.840
2002	0.977	1.743
2003	0.817	1.335
2004	0.715	1.166
2005	0.571	0.920
2006	0.711	1.047
2007	1.042	1.446
2008	1.554	2.361
2009	1.140	1.745
2010	0.783	1.241
2011	0.827	1.369
Average	0.970	1.485

σ -Convergence (III)

Degree of Financial Integration (σ-Convergence)



Volatility-Spillover Model

- *A news-based model to measure regional financial integration*
  - Study how information revealed in one market has impacts on other markets
  - Equity return is affected by three sources of orthogonal shocks: *global, regional, and local ones*
  - If markets in the region become more integrated, regional factor should play an increasing role in movements of equity returns relative to global or local shocks.

Core Equations

- The unexpected rate of local return ($\varepsilon_{i,t}$) is explained by unexpected rate of US return ($\varepsilon_{us,t-1}$) and unexpected rate of regional return ($e_{ea,t}$):

$$\varepsilon_{i,t} = \delta_i^{us}\varepsilon_{us,t-1} + \delta_i^{ea}e_{ea,t} + e_{i,t}$$

- Under the assumption that shocks of the US ($\varepsilon_{us,t-1}$), regional market ($e_{ea,t}$), and economy i ($e_{i,t}$) are uncorrelated:

$$E_{t-1}\ \varepsilon_{i,t}^2\ = \sigma_{i,\varepsilon,t}^2 = \ \delta_i^{us\ 2}\sigma_{us,t-1}^2 + \ \delta_i^{ea\ 2}\sigma_{ea,t}^2 + \sigma_{i,t}^2$$

Variance Ratios

Global variance ratio: $\dfrac{\delta_i^{us\ 2}\sigma^2_{us,t-1}}{\sigma^2_{i,\varepsilon,t}}$

Regional variance ratio: $\dfrac{\delta_i^{ea\ 2}\sigma^2_{ea,t}}{\sigma^2_{i,\varepsilon,t}}$

Local variance ratio: $\dfrac{\sigma^2_{i,t}}{\sigma^2_{i,\varepsilon,t}}$

The Model (I)

- The Model for US Rate of Return

$$r_{us,t} = \alpha_{us} + \beta_{us} r_{us,t-1} + \varepsilon_{us,t}$$

$$E_{t-1}\ \varepsilon_{us,t}^2\ = \sigma_{us,t}^2 = \delta_{us,0} + \delta_{us,1}\varepsilon_{us,t-1}^2 + \delta_{us,2} I\ \ \varepsilon_{us,t-1} < 0\ \ \varepsilon_{us,t-1}^2 + \delta_{us,3}\sigma_{us,t-1}^2$$

- The Model for Regional Rate of Return

$$r_{ea,t} = \alpha_{ea} + \beta_{ea} r_{ea,t-1} + \varepsilon_{ea,t}$$

$$\varepsilon_{ea,t} = \delta_{ea}^{us}\varepsilon_{us,t-1} + e_{ea,t}$$

$$E_{t-1}\ \ e_{ea,t}^2\ \ = \sigma_{ea,t}^2 = \delta_{ea,0} + \delta_{ea,1} e_{ea,t-1}^2 + \delta_{ea,2} I\ \ e_{ea,t-1} < 0\ \ e_{ea,t-1}^2 + \delta_{ea,3}\sigma_{ea,t-1}^2$$

The Model (II)

- The Model for Local Rate of Return

$$r_{i,t} = \alpha_i + \beta_i r_{i,t-1} + \varepsilon_{i,t}$$

$$\varepsilon_{i,t} = \delta_i^{us} \varepsilon_{us,t-1} + \delta_i^{ea} e_{ea,t} + e_{i,t}$$

$$E_{t-1}\ e_{i,t}^2\ = \sigma_{i,t}^2 = \delta_{i,0} + \delta_{i,1} e_{i,t-1}^2 + \delta_{i,2} I\ e_{i,t-1} < 0\ e_{i,t-1}^2 + \delta_{i,3} \sigma_{i,t-1}^2$$

- In summary, it is an AR(1)-TGARCH (1, 1) Model

Estimations

- Estimated by the TGARCH method
- Regional rate of return: the weighted sum rates of return of the individual economies *excluding that of the individual economy under analysis* (so we have 10 sets of regional return)
- Two time dummies $D_{1,i}$ (September 2008 to December 2011) and $D_{2,i}$ (July 1997 to June 1998) are added to reflect major events：

$$\delta_i^{us} = \delta_{0,i}^{us} + \delta_{1,i}^{us} D_{1,i}$$

$$\delta_i^{ea} = \delta_{0.i}^{ea} + \delta_{1.i}^{ea} D_{2,i}$$

Empirical Findings (The Region I)

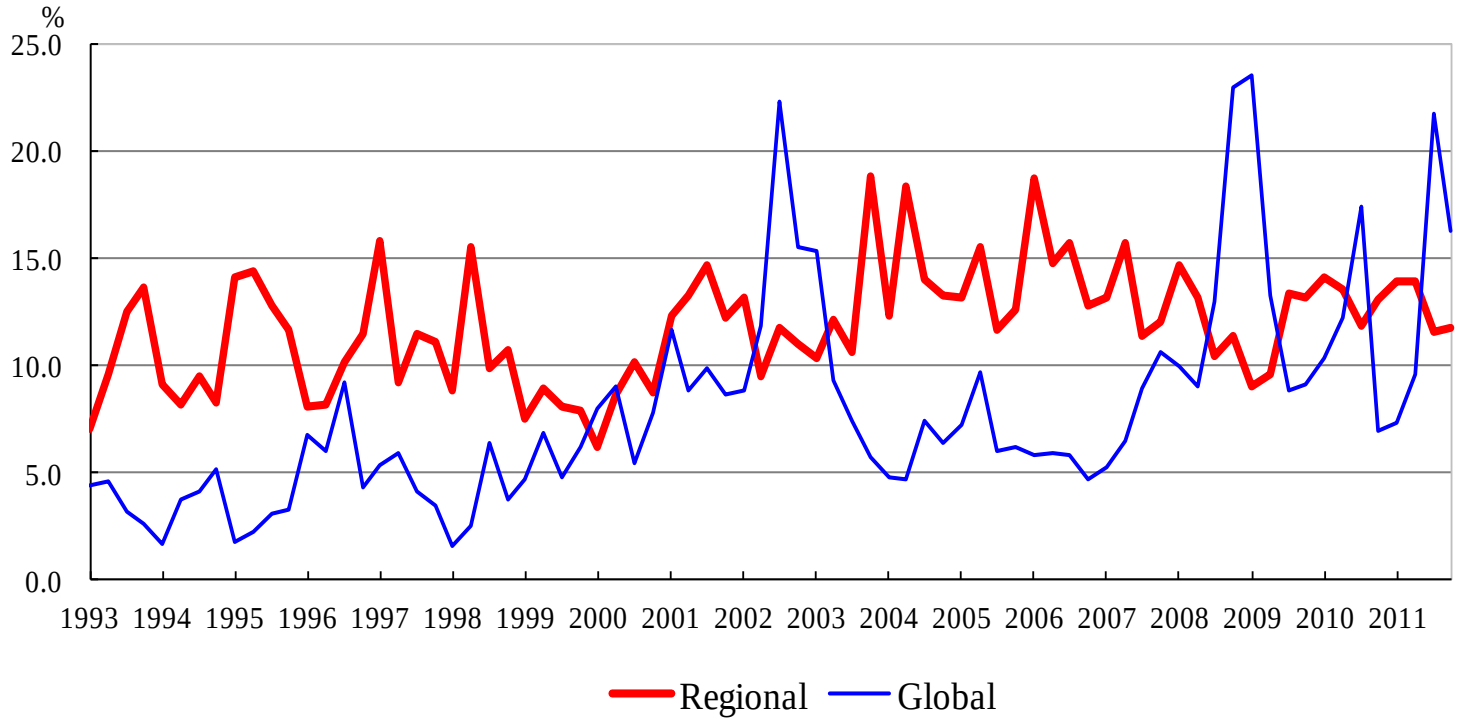
Degree of Financial Integration (Variance Ratios)

unit:%

Year	Global	Regional	Local
1993	3.72	10.70	85.57
1994	3.69	8.77	87.54
1995	2.61	13.27	84.12
1996	6.59	9.48	83.93
1997	4.70	11.89	83.41
1998	3.58	11.23	85.19
1999	5.64	8.13	86.22
2000	7.58	8.44	83.97
2001	9.78	13.15	77.07
2002	14.67	11.40	73.94
2003	9.46	13.00	77.54
2004	5.84	14.49	79.66
2005	7.30	13.26	79.44
2006	5.60	15.53	78.87
2007	7.85	13.11	79.05
2008	13.74	12.43	73.83
2009	13.68	11.29	75.04
2010	11.75	13.17	75.09
2011	13.75	12.83	74.42
1993~1995	3.34	10.91	85.74
1996~1999	5.13	10.18	84.69
2000~2003	10.37	11.50	78.13
2004~2007	6.65	14.10	79.25
2008~2011	13.23	12.43	74.34
1993~2011	7.98	11.87	80.15

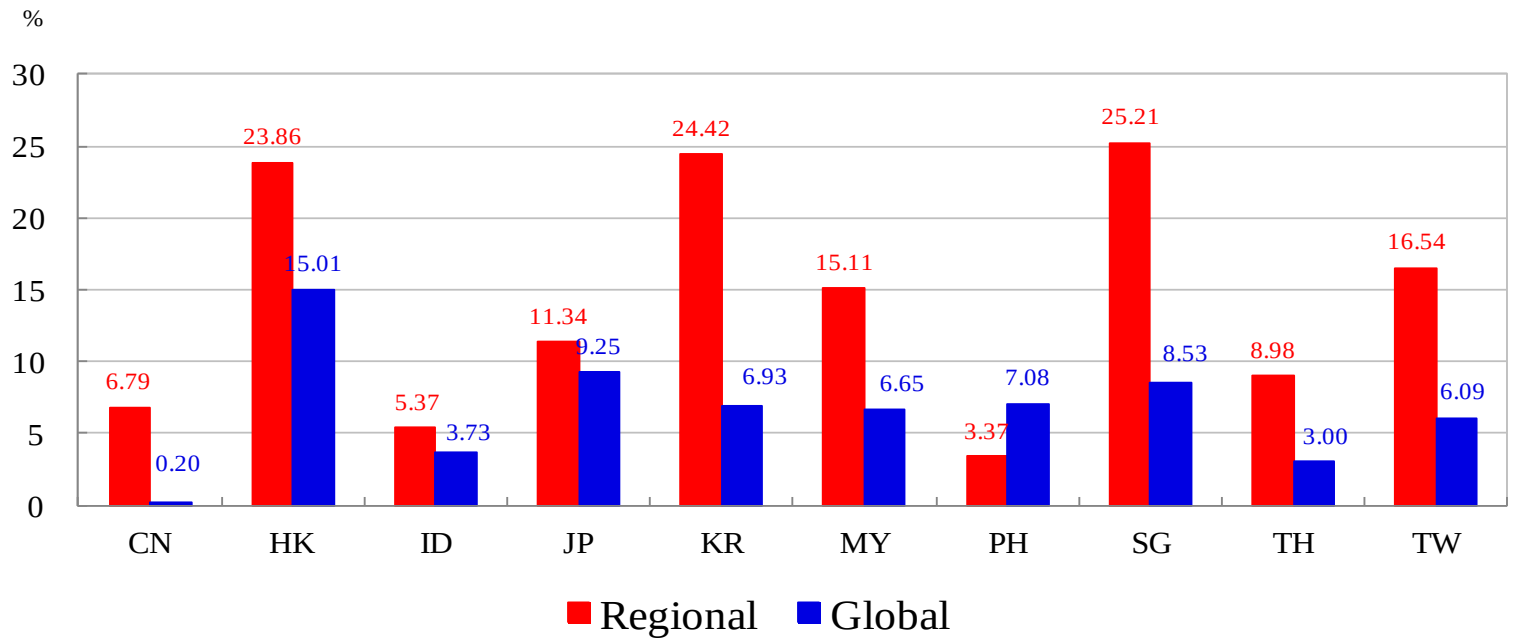
Empirical Findings (The Region II)

Degree of Financial Integration (Variance Ratios)



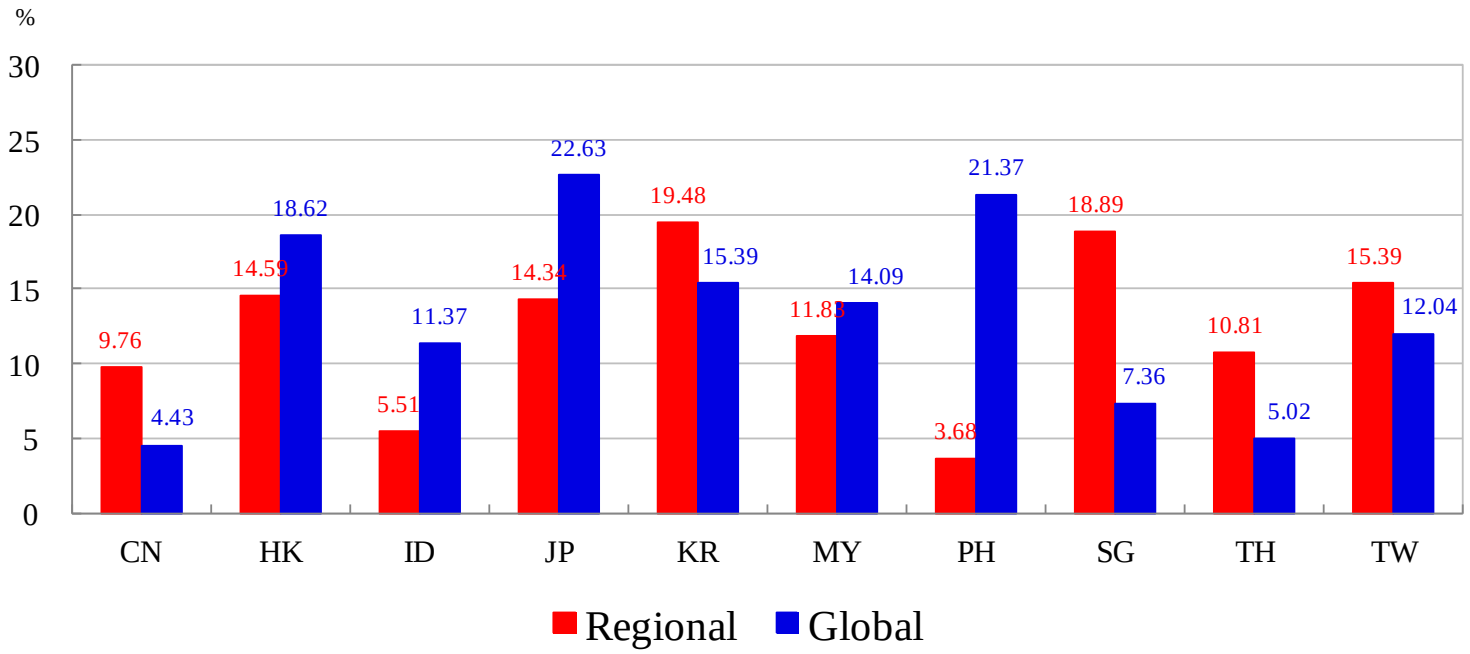
Empirical Findings (Individual Economy I)

Regional and Global Variance Ratios (2004~2007)



Empirical Findings (Individual Economy II)

Regional and Global Variance Ratios (2008~2011)



Conclusion (I)

- *After year 2000 degrees of regional integration were quite stable*
  - Higher regional integration achieved when both global and regional financial conditions were favorable and relatively stable
  - East Asian economies were susceptible to negative prolonged global shocks
  - *Broader regional financial stability mechanisms* may be needed to shield against global shocks

Conclusion (II)

- Degree of financial integration of the economies in the region is quite *diversified*
- Efforts should be made to bridge the gaps among different economies
  - ➢ *Foster equity market development to improve market resilience* could contribute to a greater degree of regional integration.

Limitations

- Constant parameter in mean equations
  - unable to deal with coefficients change over time
- European equity return not included
  - European debt crisis was devastating to equity markets in East Asia