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Business Cycle Co-movements and Economic Integration in East Asia

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Introduction

- Current situation in East Asia:
  - East Asia countries have achieved rapid economic growth.
  - A closer relationship in trade and investment and numbers of FTAs.

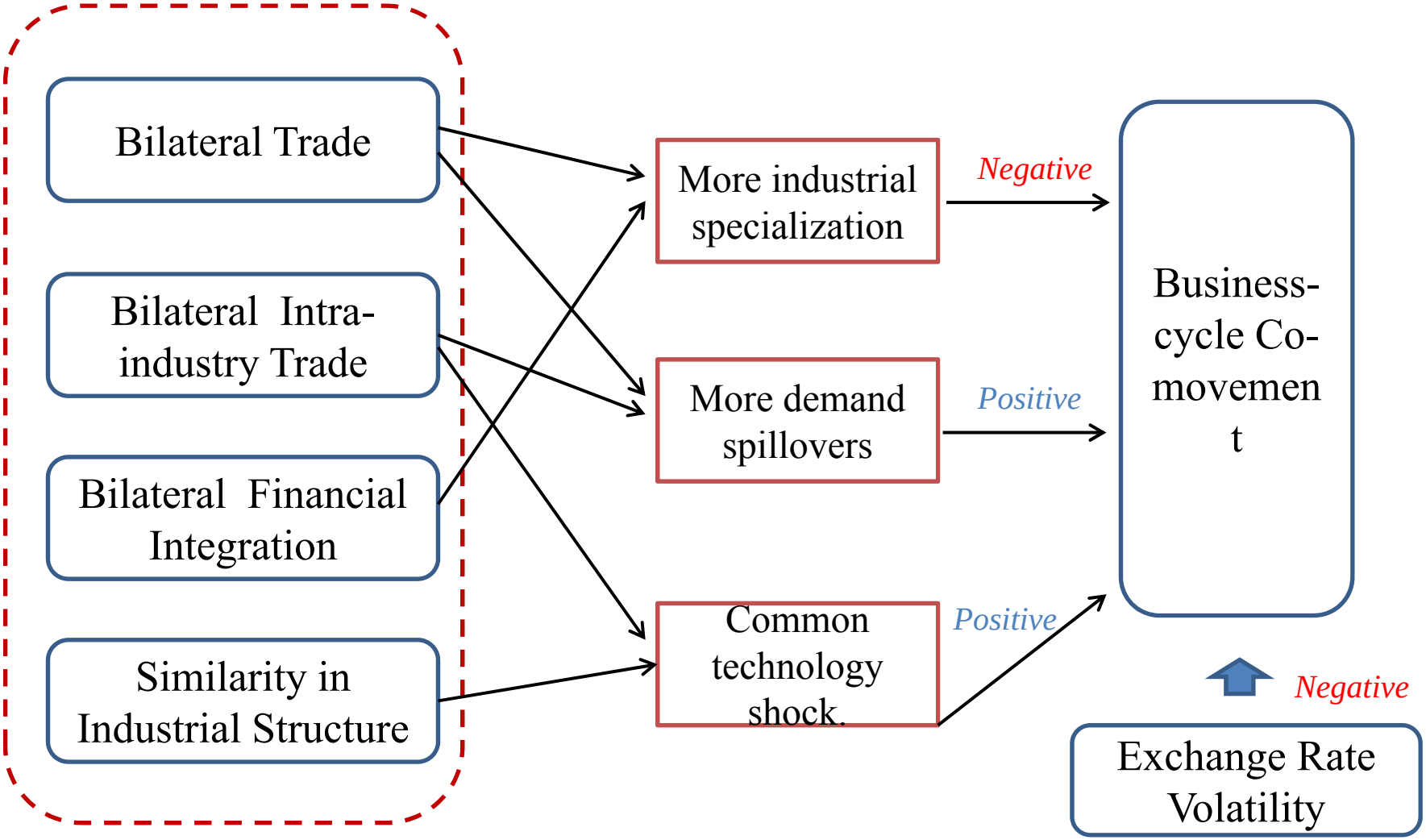
- The growing attention on monetary integration …
  - Facilitate trade and investment in the region
  - Prevent the recurrence of financial crisis

Introduction(cont'd)

- The role of the business-cycle co-movement in forming a monetary union.
  - Bringing benefits but losing independence of monetary policy
  - Higher business-cycle co-movement → Less costly to form a monetary union

- What is the determinants of the business-cycle co-movement?

Determinants of Business-cycle Co-movement



Novelty of this paper

- New dataset of intra-industry trade
  - Database of Nicita and Olarreaga (2001) is up to 1999, ISIC rev.2.
  - From 1982 to 2008, following ISIC rev.3.

- Re-verifying the impacts of all the determinant extending the sample period to 2008.
  - SI is not considered in the studies on East Asia countries.

- Exchange rate volatility
  - Exchange rate volatility deteriorates international trade (e.g. Clark, 2004; Chit, 2010; Hayagawa, 2009) and then have a negative effect on business cycle co-movements.

Empirical Methodology

- Regression Equation

$$COY_{ijt} = c_0 + c_1 IT_{ijt} + c_2 IIT_{ijt} + c_3 FI_{ijt} + c_4 SI_{ijt} + VOL_{ijt} + a_t + u_{ijt},$$

- COY_{ijt}: the extent of business-cycle co-movement
- IT_{ijt}: bilateral trade
- IIT_{ijt}: bilateral intra-industry trade
- FI_{ijt}: financial integration
- SI_{ijt}: similarity in industrial structure
- VOL_{ijt}: volatility of bilateral exchange rate
- $a_{t:}$ period-specific effects
- GMM-IV estimation

Definitions of Variables

- Business-cycle Co-movement:
  - Lee and Shin (2004); Shin and Shon (2006)

$$\Delta \ln(Y_{it}) - \Delta \ln(Y_{jt})$$
$$= a_0 + a_1(\Delta \ln(Y_{it-1}) - \Delta \ln(Y_{jt-1}) + a_2(\Delta \ln(Y_{it-2}) - \Delta \ln(Y_{jt-2})) + u_{ijt}^{y}.$$

$$CoY_{ijt} = -\left|u_{ijt}^{y}\right| \times 100$$

  - Real output growth rate
  - Hodrick-Prescott (HP) filter to extract the cyclical components of the annual real GDP

- Bilateral Trade: following Frankel and Rose (1998)

$$IT_{ijt} = \frac{x_{ijt} + m_{ijt} + x_{jit} + m_{jit}}{X_{it} + M_{it} + X_{jt} + M_{jt}}$$

- $x_{ijt}(x_{jit})$: total exports from country i (j) to country j (i)
- m_{ijt} (m_{jit}): total imports from country j (i) to country i (j)
- X_t: total global exports
- M_t: total global imports

- Bilateral Intra-industry Trade: Grubel and Lloyd's Index (1975)

$$IIT_{ijt} = 1 - \frac{\sum_{k=1}^{N} \left| x_{ijt}^{k} - m_{ijt}^{k} \right|}{\sum_{k=1}^{N} \left(x_{ijt}^{k} + m_{ijt}^{k} \right)}$$

- k stands for industry, following ISIC rev.3 2 digit.
- The value of IIT will be closer to 1 as intra-industry trade increases.

Industry Classification

Table A1

ISIC.Rev3	Industry Classification
15	Food and Beverage
16	Tobabcoo
17	Textiles
18	Wearing Appeal, Fur
19	Leather, Footwear
20	Wood products (excl. furniture)
21	Paper and Paper products
22	Printing and Publishing
23	Coke, Refined Petroleum product
24	Chemicals and Chemical products
25	Rubber and Plastics products
26	Non-metallic Mineral products
27	Basic Metals
28	Fabricated Metal products
29	Machinery and Equipment n.e.c.
30	Office,Accounting and Computing Machinery
31	Electrical Machinery and Apparatus n.e.c.
32	Communication Equipment and Apparatus
33	Optical Instruments
34	Motor Vehicles, Trailers and Semi-trailers
35	Other Transport Equipment

- # Similarity in Industry Structure

Imbs (2003); Clark and van Wincoop (2001)

$$SI_{ijt} = 1 - \sum_{k=1}^{N} \left| s_{it}^{k} - s_{jt}^{k} \right|$$

- s_{it}^{k} (s_{jt}^{k}) stands for the output share of sector k in country i's (j's) aggregate GDP
- N=7 :

(1) Agriculture, hunting, forestry and fishing,
(2) Mining and utilities,
(3) Manufacturing,
(4) Construction,
(5) Wholesale, retail trade, restaurants and hotels,
(6) Transport, storage and communication,
(7) Other activities: finance, insurance, real estate and others.

- Bilateral Financial Integration: Ng (2010)
  - Using Ito and Chinn (2005) to sum pair-wise their individual indices for each country-pair

$$FI_{ijt} = I_{it} + I_{jt}$$

- Exchange Rate Volatility
  - Standard deviation of the first difference of the natural log of nominal monthly exchange rate (e.g. Clark, 2004; Chit, 2010; Hayagawa, 2009).

$$V_{ijt} = \sqrt{\sum_{t=1}^{m} \left(\Delta e_{ijt} - \Delta \bar{e}_{ijt} \right) / m}$$

Data Description

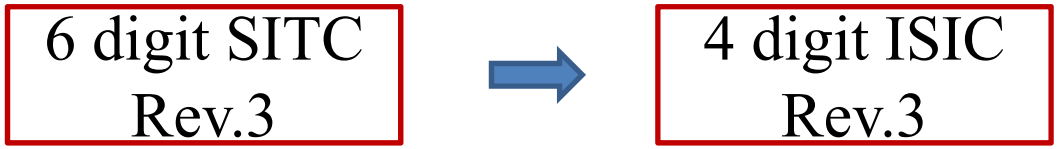
- Sample countries:
- Japan and 9 Emerging Asian Economies (China, Hong Kong, Korea, India, Indonesia, Malaysia, Philippines, Singapore, Thailand).

- Sample period:
- Annual: 1982-2008, excluding 1998-1999.
- Five period: 1982-1986 (period1), 1987-1991 (period2), 1992-1996 (period3), 1997-2003 (period4), 2004-2008 (period5).

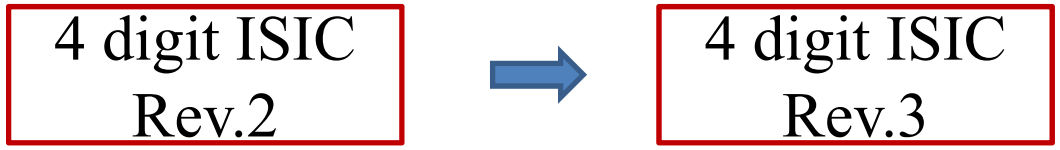
- Frequency of the data:
- IT,IIT,FI,SI: Annual data
- VOL: monthly nominal exchange rate

Calculation Process of the New dataset

- The first one we used is United Nations Comtrade Database. (1992-2008)



- The second database we used is Nicita and Olarreaga (2001). (1982-1991)



- The new database is from 1982-2008, ISIC rev.3.

Data Source

Variables	Sources
Bilateral Business Cycle Co-movement (COY)	World Bank, *World Development Indicators*
Bilateral Trade (IT)	IMF, *Direction of Trade Statistics* (DOTS), CD-ROM
Bilateral Intra-industry Trade (IIT)	*United Nations Comtrade Database*.
	The database constructed by Nicita and Olarreaga (2001)
Bilateral Financial Integration (FI)	The database constructed by Ito and Chinn (2005)
Similarity in Industrial Structure (SI)	*United Nations National Accounts Main Aggregates Database*.
Bilateral Exchange Rate Volatility (VOL)	IMF, *International Financial Statistics* (IFS), CD-ROM
Instruments Variables (IV)	*World Bank database* complied by Nicita and Olarreaga (2006)
Conversion Code used in this paper	United Nations Statistics Division (UNSD) classification registry

Benchmark estimation results

Effects of deterninants of business cycle co-movement: GMM-IV estimation results

Explaining Variables	Dependent Variable: Bilateral Business Cycle Co-movement (COY1_Growth rate)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bilateral Trade (IT)	12.21*		6.944	10.99	13.24**	14.84**	5.418
	(6.70)		(6.06)	(7.00)	(5.91)	(6.40)	(4.63)
Bilateral Intra-industry Trade (IIT)		10.25***	3.784**	4.265***	3.786**	4.032***	2.559**
		(2.89)	(1.54)	(1.55)	(1.50)	(1.51)	(1.28)
Bilateral Financial Integration (FI)				-0.381		-0.241	-0.475**
				(0.27)		(0.26)	(0.21)
Similarity in Industrial Structure (SI)					4.908***	4.631***	2.206**
					(1.35)	(1.34)	(1.05)
Bilateral Exchange Rate Volatility (VOL)							-28.75***
							(2.87)
Period fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Endogeneity test of regressors							
C statistics (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Over-identification test							
Hansen J statistics (p-value)	0.451	0.153	0.684	0.982	0.659	0.746	0.858
Sample size	221	224	221	221	221	221	221
R-squared	0.048	0.064	0.102	0.091	0.136	0.132	0.411

Notes:

Standard errors are in parentheses. * Shows 10% significance. ** Shows 5% significance. *** Shows 1% significance. The measure of the business cycle co-movement depends on the year-on-year GDP growth rate. All the variables are period average excluding the bilateral exchange rate volatility.

Robustness check

Effects of deterninants of business cycle co-movement: GMM-IV estimation results

Explaining variables	Dependent variable: Bilateral Business Cycle Co-movement (COY2_HP-filtered)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bilateral Trade (IT)	13.37**		8.596*	13.17**	11.44**	14.53**	8.811*
	(5.24)		(5.09)	(5.75)	(5.28)	(5.71)	(5.02)
Bilateral Intra-industry Trade (IIT)		9.756***	3.645***	4.160***	3.669***	4.052***	3.150***
		(2.32)	(1.26)	(1.21)	(1.25)	(1.20)	(1.15)
Bilateral Financial Integration (FI)				-0.467**		-0.409**	-0.540***
				(0.21)		(0.20)	(0.18)
Similarity in Industrial Structure (SI)					2.284**	1.832	0.376
					(1.10)	(1.12)	(0.96)
Bilateral Exchange Rate Volatility (VOL)							-16.45***
							(2.52)
Period fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Endogeneity test of regressors							
C statistics (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Over-identification test							
Hansen J statistics (p-value)	0.153	0.506	0.328	0.877	0.444	0.838	0.563
Sample size	221	224	221	221	221	221	221
R-squared	0.057	0.064	0.124	0.119	0.127	0.127	0.281

Notes:

Standard errors are in parentheses. * Shows 10% significance. ** Shows 5% significance. *** Shows 1% significance. The measure of the business cycle co-movement depends on the de-trend method of HP-filter. All the variables are period average except for the bilateral exchange rate volatility.

Conclusion

Determinants of Business-cycle Co-movement

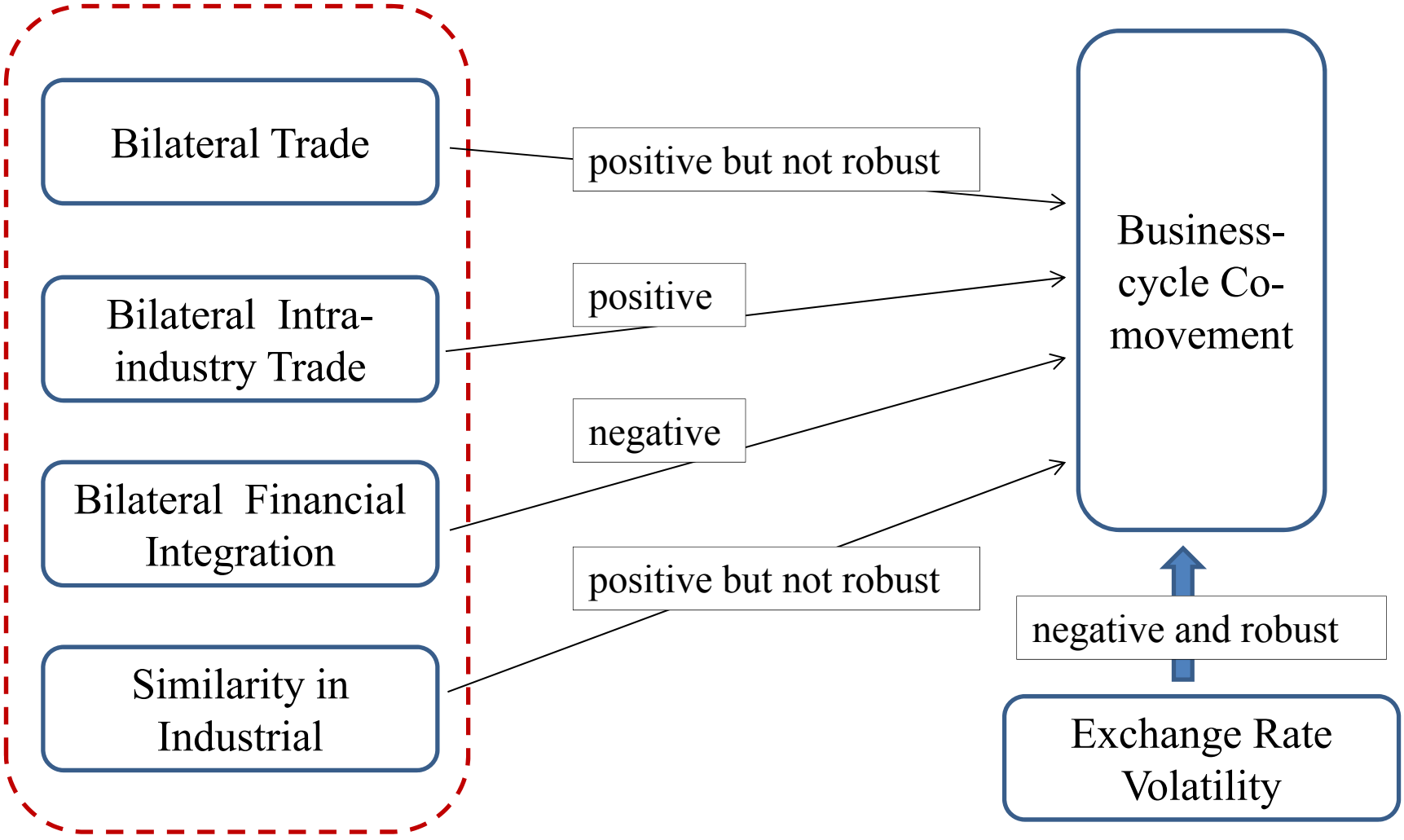
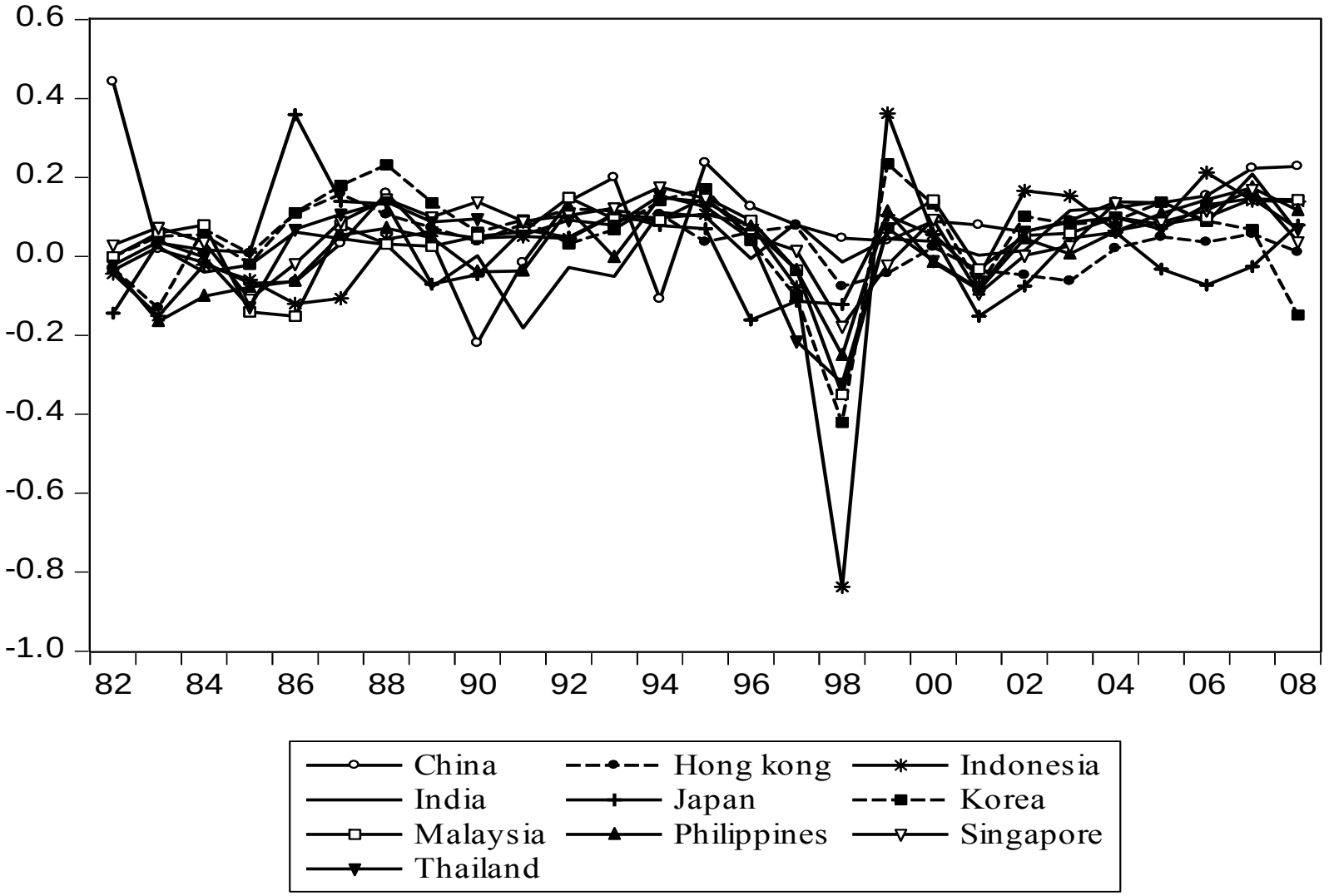


Fig.1 Real GDP Growth Rate



Notes: Fig.1 represents the year-on-year growth rate for each Asian economics.
Source: IMF, *International Financial Statistics*, CD-ROM, author's calculation.