Evidence from China equity market to Hong Kong and other markets*

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Introduction

Since 2018, China has been intensifying its foreign direct investment in the United States and China. Over the 12 years from 2010 to 2021, the amount of FDI from Japan exceeded the amount of FDI from Japan by four. In China, the amount of foreign direct investment exceeds the amount of inward direct investment (UNCTAD, 2022) five times in the seven years from 2015.

In addition, the RMB has been included in the SDR component currency of the IMF since 2016. Although the fluctuation of the yuan was narrow and short-term capital movements were restricted in principle, various deregulations continued gradually (Kogen 2023).[1]

In the capital markets, the Shanghai and Hong Kong stock exchanges began on November 17, 2014, and the Shenzhen and Hong Kong stock exchanges began on December 5, 2016.[2] On June 20, 2017, MSCI, a U.S. stock index company, announced that it would incorporate mainland China A into the company's emerging stock index from June 2018.

The question of this study is, therefore, how does the stock markets in Shanghai and Shenzhen spill over into the Hong Kong stock markets as stock exchanges begin? For this reason, we use the vector autoregression (VAR) model to test for coincidence and causality in the daily data (bivariate) of stock indices in the four stock markets.

The stock indices used in the analysis are the Shanghai Composite Index and the Shenzhen Composite Index in China, and the Hansen Index and the Hansen China Corporate Index in Hong Kong.

The structure of this study is as follows. First, we conduct a survey of prior research on the correlation between stock prices. Next, the analysis method is described. The data on stock prices in each country are described, time-series transitions and basic statistics are examined, and unit root tests are performed to check the stability of the data. In addition, we analyze the variance decomposition of each country's markets and examine the correlation between stock prices in China, Hong Kong, and Southeast Asia. Finally, we consider the results of empirical analysis.

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[1] A study using daily data (closing prices) from January 1992 to March 2021 in six stock markets: China (Shanghai), Hong Kong, Singapore, Malaysia, Thailand, and Indonesia. The second half of this period is October 17, 2014, one month prior to the start of the Shanghai Hong Kong cross-trade.

[2] Shanghai-Hong Kong Stock Connect (SHSC) in English.

2. Literature review

First, we survey a prior study on the correlation of stock markets using the VAR model.

Soydemir [2000] tested the VAR model as having the potential to respond simultaneously to global shocks. The period is a total of 297 weeks from the last week of December 1988 to the second week of September 1994. Emerging markets are Argentina, Brazil, Mexico, Latin America and the Caribbean, and developed markets are the United States, Germany, Japan, and the United Kingdom. The three emerging markets used the International Finance Corporation's monthly and weekly stock market indices. The U.S. uses the S&P 500 index and the other three developed markets use the Financial Times Actualies World Indices (FTAWI). It is denominated in local currency.

The study was estimated by a four-variable VAR model to determine how much equity market movements, primarily in the U.S. market, are communicated to three Latin American stock markets.

The results of the impulse response function (IRF) are consistent with the variance decomposition (VDC) and are consistent with the tests of the copolymerization and unconditional correlation. In all emerging markets, "unique" shocks are communicated within the first week. Among Argentina, Brazil, and Mexico, Mexico was the most affected by the United States.

Sheng and Tu [2000] used the multivariate sum test and error correction model of Johansen [1988] to analyze the extent to which stock market volatility in each country is influenced by the Asian currency crisis using Granger's causality test. The index covers 12 stock indices, including the U.S. S. S&P 500 and Japan's Nikkei 225, the Hong Kong Hansen Index, the Singapore Straight Times (STI), Australia (ASX All Ordinaries), the Korea Composite Index (KOSPI), the Taiwan Composite Index (TWSE), the Kuala Lumpur Composite Index, the Bangkok Composite Index, the Jakarta Composite Index, and the Shanghai B Stock Index. The period is from July 1, 1996 to June 30, 1997 before the Asian currency crisis, and the period from July 1, 1997 to June 30, 1998 is defined as the period of the Asian currency crisis. Daily data were taken as natural logarithms. Holidays were closing prices on the previous day. According to Granger's causality test, the U.S. market plays a major role in the Asian financial crisis after South Korea. On the other hand, only three Asian markets (Hong Kong, Korea, and China) provided feedback to the U.S. market, and the Asian financial crisis was not an intra-regional crisis that only affected the East Asian stock market.

Analysis of time series of stock and financial markets continues to improve using analytical methods and data.

Investors are usually concerned about the downside rather than the upside risk. Lu[2014] uses binary response models to analyze the impact of extreme downside risk on US S&P 500 and Nikkei 225 average stock prices on extreme downside risk in six markets: Australia (ASX All Ordinaries), China (Shanghai Composite Index), Hong Kong, Korea, Singapore, and Taiwan. The period is from 4 September 2000 to 17 April 2009, using daily (logarithmic) data converted to U.S. dollars. The analysis shows that the extreme downside risks in both Japan and the United States have an important capability to predict the possibility of extreme losses in all six markets in the Asia-Pacific region. Australia has the highest sensitivity in the Asia-Pacific region to the extreme downside risk of the S&P 500, but Singapore is most vulnerable to the extreme downside risk of the Nikkei average. In contrast, mainland Chinese markets were considered to be least affected by the extreme downside risks in the U.S. or Japanese markets.

The data to be analyzed began in the 1980s on an annual, monthly, and weekly basis, and the correlation between financial markets has increased, and high-speed transactions have been expanding due to the sophistication of computers. Datastream, Bloomberg, Reuters, S&P, and other databases are also widely used. In developed markets such as Europe, the United States, and Japan, tick data are also provided in milliseconds. There are still many daily and weekly studies in Asia and emerging markets.

Komatsubara et al. (2017) examined the correlation between January 2, 1995, and January 30, 2013 in a copula-GARCH model, targeting three markets: the Shanghai Composite Index, the Hansen Index, the Nikkei 225 Average Stock Index, and the Korea Composite Index (denominated in local currencies). The following three variables were created using daily starting and closing data. (1) is the previous day's difference in the logarithm used in other previous studies, (2) is the difference between the closing price and the first price on the same day (one day's movement), and (3) is the difference between the first and last day's closing price. In particular, the variable in (3) takes into account the impact of the closing of the Asian market.

RCCt=logCPt−logCPt−1 (1)

ROCt=logCPt−logOPt (2)

RCOt=logOPt−logCPt−1 (3)

This study will also use (1) and (2) to confirm changes in the long-term relationship between China and Hong Kong.

According to Li et al. [2022], Shanghai and Hong Kong trade is divided into two parts: the Northbound (Shanghai) and the Northbound (Hong Kong). Major stocks, not all listed stocks, are included. The stocks covered by the Northern Stock Exchange include those that comprise the Shanghai Stock Exchange 180 and 380 indices and those that are listed on the Shanghai Stock Exchange where Hong Kong investors can trade freely. In the other southern bank transaction, the Hansen Composite Large-Cap Stock Index and the Hansen Composite Medium-Cap Stock Index, as well as A + H overlapping stocks, are included. On November 17, 2014, Northbound transactions were repeated with 568 companies and Northbound transactions with 268 companies. In December 2019, Northbound transactions were repeated with 576 companies and Northbound transactions with 328 companies.

From 2014 to 2019, Li et al. [2022] used stock price synchronization (Stock Price Synchronity), which is the relative stock price of individual stocks relative to stock index and sector returns, to analyze the impact on stock prices of stocks traded between Shanghai and Hong Kong by comparing the stocks traded and those not traded. Data frequency is weekly. Stock Price Synchronity is used as an indicator to analyze that emerging markets such as mainland China tend to be more affected by stock prices than by individual stock performance because of information asymmetries than developed markets. For this reason, we regression analyzed the total assets (logarithmic values), liabilities, logarithmic values of total assets, ROA, shareholding ratio of the largest shareholding, state-owned enterprises dummy, major auditing firms dummy, and industrial dummy for the stocks subject to the mutual transactions, including the corporate governance index. Shanghai-listed stocks subject to reciprocal trading have confirmed the effect of reducing Stock Price Synchronity.

3. Data Analysis

The period of the stock index used in the analysis is from January 1992 to March 2021. For each national holiday, the closing price before the national holiday is used. The analysis is logarithmic. The two sections were divided into two sections after October 17, one month prior to the commencement of Shanghai Hong Kong reciprocal transactions (November 17, 2014). That is, from January 1, 1992 to October 16, 2014, and from October 17, 2014 to March 31, 2021.

In the chart, the figures are basically shown in three digits: Shanghai = CHN, Hong Kong = HKG, Singapore = SGS, Malaysia = MYS, Thailand = THA, Indonesia = IDN, and ISO.

(1) Descriptive Statistics

The descriptive statistics of stock indices for each market are shown in the table1,2,3. Specifically, Table 1 shows the baseline statistics for the entire sample period (January 1, 1992 to March 31, 2021), Table 2 shows the baseline statistics before the exchange of stocks between Shanghai and Hong Kong (January 1, 1992 to October 16, 2014), and Table 3 shows the baseline statistics after the exchange of stocks between Shanghai and Hong Kong (October 17, 2014 to March 31, 2021).

Compared to pre-stock exchanges in Shanghai and Hong Kong (January 1, 1992 to October 16, 2014), the average post-stock exchange in Shanghai and Hong Kong (October 17, 2014 to March 31, 2021) was 9.7% in China, 6.5% in Hong Kong, 4.6% in Singapore, 7.9% in Malaysia, 11.6% in Thailand, and 25.0% in Indonesia, respectively.

(2) Unit root test: ADF test and PP test

When models are constructed between economic variables with unit roots, there is a possibility that a "spurious regression," in which significant t-values or coefficients of determination are observed even if they are uncorrelated with each other, will occur. Therefore, estimation using such non-stationary variables is not meaningful in time-series analysis.[1]

For this purpose, the unit root test is used. This paper uses the ADF (Extended Dickey-Fuller) test and the PP (Phillips-Perron) test in two ways: the case with a trend term and a constant term, and the case with only a constant term. The order of the optimum lag was automatically selected according to the SIC criteria.

The null hypothesis that there is a unit root is rejected in China and Hong Kong at the 1% significance level in the "Trend- and constant-term cases" of the ADF test and the "Trend- and constant-term cases" of the PP test. China also rejected the null hypothesis that there is a unit root at a 5% significance level in the ADF test and the PP test's "numbered case" and Hong Kong at a 10% significance level in the ADF test and the PP test's "numbered case."

However, all other variables do not reject the null hypothesis that the unit root exists at the 10% significance level in all cases.

In addition, the unit root test is performed by taking the difference on the first floor. The null hypothesis that the unit root exists at the 1% significance level for all variables (Table 5) was rejected. The stability of all data is satisfied, and each variable can be regarded as the sum I(1) of the order 1. In this analysis, the first floor difference of the data is taken in order to satisfy the steady state of the data used.

(3) Cointegration Test

Here, we will use the Johansen test to perform a repositioning test.[2] To confirm the long-term equilibrium relationship of each stock index, we use a co-sum test.

The null hypothesis was rejected for the entire period from January 1, 1992 to March 31, 2021 (Table 6), for the period from January 1, 1992 to October 16, 2014 (Table 7) prior to the commencement of the Shanghai and Hong Kong stock exchange, and for the period from October 17, 2014 to March 31, 2021 (Table 8) after the commencement of the Shanghai and Hong Kong stock exchange.

(4) Impulse response function

The impulse response function was divided into two sections one month before the start of the Shanghai Hong Kong cross-trade. That is, from January 1, 1992 to October 16, 2014, and from October 17, 2014 to March 31, 2021. We are lagging in the twentieth quarter.

The impulse response function of China in the first half of the term is 0.0236 for one period, 0.0243 for two periods, and 0.0241 for three years and later for one standard deviation autoshock. It is extremely low against shocks in other markets. 0.0000 for the first period, 0.0003 for the second period, 0.0004 for the third period, 0.0000 for the first period, 0.0002 for the second period, and 0.0003 for the third period in Hong Kong (Figure 1).

The impulse response function of China in the latter half of the term is 0.0142 for one period, 0.0147 for two periods, and 0.01 for the third period and thereafter. 0.0000 per period, 0.0005 per period, 0.0005 per period, 0.0005 per period, 0.0005 per period, and 0.0003 per period, 0.0000 per period, 0.0004 per period, and 0.0003 per period, respectively, in Hong Kong (Figure 2).

The impulse response function in Hong Kong in the first half is 0.00972 in one period, 0.0160 in two periods, and 0.0161 in three periods for one standard deviation of autoshock. About 0.0017 (Figure 3).

The impulse response function for the latter half of Hong Kong is 0.00972 for one period, 0.009728 for two periods, and 0.009629 for three periods for one standard deviation of autoshock. China, on the other hand, was 0.0061 for the first term, 0.0055 for the second term, and 0.0055 for the third term (Figure 4).

Next is Singapore in Southeast Asia.

The impulse response function for the first half of the Singapore is approximately 1.0097 for a 1 standard deviation autoshock. The value of self-shock is lower than that of China and Hong Kong (Figure 5).

Hong Kong is 0.0076 for the 1st term, 0.0084 for the 2nd term, and 0.0084 for the 3rd term. In addition, China's first quarter was 0.0014, the second quarter was 0.0011, and the third quarter was 0.0011.

The impulse response function for the latter half of Singapore is 0.0061 for one period, 0.0058 for two periods, and 0.0057 for three periods for one standard deviation of autoshock. Lower than the first half (Figure 6). Hong Kong was 0.0049 for the first term, 0.0052 for the second term, and 0.0051 for the third term, while China was 0.0030 for the first term, 0.0028 for the second term, and 0.0028 for the third term.

The impulse response function for Malaysia in the latter half is 0.0059 per period, 0.0057 per period, 0.0057 per period, and 0.0057 per period, respectively, for one standard deviation of autoshock. On the other hand, Hong Kong was 0.0031 for the 1st term, 0.0034 for the 2nd term, and 0.0034 for the 3rd term, while China was 0.0013 for the 1st term, 0.0013 for the 2nd term, and 0.0013 for the 3rd term (Figures 7 and 8).

The impulse response function for the latter half of Thailand is 0.0078 for one period, 0.0070 for two periods, and 0.0070 for three periods for one standard deviation autoshock. On the other hand, Hong Kong was 0.0039, 0.0040, and 0.0040 in the second and third periods, respectively, while China was 0.0023, 0.0021, and 0.0020 in the second and third periods, respectively (Figures 9 and 10).

The impulse response function for Indonesia in the latter half is 0.0091 for one period, 0.0095 for two periods, and 0.0094 for three periods for one standard deviation of autoshock. On the other hand, Hong Kong was 0.0035 for the 1st term, 0.0039 for the 2nd term, and 0.0039 for the 3rd term, while China was 0.0020 for the 1st term, 0.0021 for the 2nd term, and 0.0020 for the 3rd term (Figs. 11 and 12).

(5) Variance decomposition

Variance decomposition is an analytical method that can show how the variation in the predictive error of a variable is due to its own effect and how many other variables are responsible for it. The closing times at the time of the transaction are Shanghai followed by Hong Kong and Indonesia, Malaysia and Singapore, and Thailand (Figure 13). The lag length of the variance decomposition is 20 years.

In China, the rate of shocks in the domestic market is overwhelmingly higher than in other markets in two periods.

In the first half of the year, Hong Kong experienced a high rate of shocks in its own markets, but in the second half, the share of shocks in its own markets declined, making Hong Kong more susceptible to the effects of China.

Singapore's shocks declined while those in China and Hong Kong rose.

4.Implication

This paper attempted to analyze how developments in the Chinese stock market would affect the Hong Kong stock market and the Southeast Asian stock market (Singapore, Malaysia, Thailand, and Indonesia).

From January 1992 to March 2021, Shanghai and Hong Kong broke down their stock exchanges into a milestone on October 17, 2014, a month prior to the start of stock exchange transactions in Shanghai and Hong Kong. The Shanghai stock market, including Hong Kong, had only a small impact on other markets. The Shanghai stock market was found to have some impact on Singapore as well as Hong Kong. The impacts on Malaysia, Thailand and Indonesia are small.

In addition, for institutional investors such as pension funds and investment trusts, the representative equity benchmark MSCI classifies the world's stock markets into four categories: developed market, emerging market, frontier market, and stand-alone market.[3] Foreign institutional investors invest primarily in the first half of the year.

Developed markets in Asia are Japan, Hong Kong, and Singapore. In one of the World Bank's GNI, South Korea and Taiwan are high-income economies, but they have remained in emerging markets for many years. On the other hand, Chinese stock A was newly adopted in emerging markets in 2017, and together with the "Chinese stock" listed on the Hong Kong Stock Exchange, it accounts for the largest share of the emerging market index.

Has Singapore, a developed market with a small market capitalization, become more susceptible to the effects of China? In order to clarify this point, Japan needs to be included in the analysis.

The daily data are used for analysis, but precipitation using other analytical models such as GARCH will be an issue for the future.

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Table 1 Basic Statistics: January 1, 1992-March 31, 2021

	CHN	HKG	SGP	MYS	THA	IDN
Mean	7.4948	9.6638	7.7562	6.9986	6.7387	7.2725
Median	7.6086	9.7094	7.7750	7.0119	6.7716	7.1927
Maximum	8.7147	10.4089	8.2509	7.5471	7.5170	8.8083
Minimum	5.6960	8.3680	6.6909	5.5710	5.3342	5.5145
Std. Dev.	0.5665	0.4464	0.3026	0.3906	0.5479	1.0807
Skewness	-0.5916	-0.5202	-0.5773	-0.3751	-0.5003	0.0328
Kurtosis	2.8501	2.4181	2.5109	2.1634	2.0988	1.3669
Observations	7628	7628	7628	7628	7628	7628

Table 2 Basic Statistics: January 1, 1992-October 16, 2014

	CHN	HKG	SGP	MYS	THA	IDN
Mean	7.3378	9.5271	7.6785	6.8785	6.5708	6.8916
Median	7.3609	9.5279	7.6768	6.8547	6.5955	6.4970
Maximum	8.7147	10.3621	8.2509	7.5457	7.4695	8.5653
Minimum	5.6960	8.3680	6.6909	5.5710	5.3342	5.5145
Std. Dev.	0.5442	0.4087	0.2960	0.3594	0.5047	0.9153
Skewness	-0.3090	-0.3782	-0.2868	-0.0753	-0.2840	0.4723
Kurtosis	3.0296	2.4802	2.4556	2.4668	2.0613	1.7498
Observations	5944	5944	5944	5944	5944	5944

Table 3 Basic Statistics: 17 October 2014-31 March 2022

	CHN	HKG	SGP	MYS	THA	IDN
Mean	8.0492	10.1464	8.0304	7.4227	7.3313	8.6169
Median	8.0432	10.1559	8.0584	7.4257	7.3530	8.6369
Maximum	8.5499	10.4089	8.1929	7.5471	7.5170	8.8083
Minimum	7.7365	9.8157	7.7113	7.1064	6.9319	8.2783
Std. Dev.	0.1177	0.1191	0.0952	0.0659	0.1011	0.1156
Skewness	0.8962	-0.3196	-0.6345	-0.9343	-0.6950	-0.3932
Kurtosis	5.5239	2.4912	2.5568	4.8107	3.3862	2.1137
Observations	1684	1684	1684	1684	1684	1684

表4　単位根検定：レベル

変数	ADF検定		PP検定	
	トレンド項＋定数項	定数項	トレンド項＋定数項	定数項
CHN	-4.1003***	-3.0007**	-4.1074***	-3.0409**
ラグ	3	1	14	13
HKG	-4.1052***	-2.6145*	-4.1038***	-4.1052*
ラグ	0	0	2	7
SGP	-2.6357	-1.9784	-2.7217	-2.0288
ラグ	1	1	14	14
MYS	-2.2795	-1.8229	-2.2987	-1.8055
ラグ	6	6	4	6
THA	-1.5711	-1.0496	-1.6679	-1.1554
ラグ	2	2	23	23
IDN	-1.9218	-1.0021	-1.8470	-0.9806
ラグ	1	1	12	12

***は1%、**は5%、*は10%水準でそれぞれ単位根が存在するという帰無仮説が棄却されることを示す。ADF検定はSIC、PP検定はBartek.lett kerrnelによる。

表5　単位根検定：1階の階差

変数	ADF検定		PP検定	
	トレンド項＋定数項	定数項	トレンド項＋定数項	定数項
CHN	-84.3038***	-84.2978***	-84.6502***	-84.6491***
ラグ	0	0	12	12
HKG	-87.3214***	-87.3178***	-87.3209***	-87.3264***
ラグ	0	0	7	8
SGP	-81.2877***	-81.2925***	-81.4352***	-81.4401***
ラグ	0	0	11	11
MYS	-36.2397***	-36.2376***	-81.8507***	-81.8538***
ラグ	5	5	9	9
THA	-57.2433***	-57.2428***	-82.9017***	-82.9080***
ラグ	1	1	21	21
IDN	-75.9324***	-75.9354***	-75.7651***	-75.7685***
ラグ	1	1	6	6

***は1%、**は5%、*は10%水準でそれぞれ単位根が存在するという帰無仮説が棄却されることを示す。ADF検定はSIC、PP検定はBartek.lett kerrnelによる。

表6　共和分検定：1992年1月1日～2021年3月31日

帰無仮説	対立仮説	トレース検定	5%境界値	最大固有値検定	5%境界値
r=0	r<=1	119.5	95.8	38.9	40.1
r<=1	r<=2	80.6	69.8	33.5	33.9
r<=2	r<=3	47.0	47.9	24.7	27.6
r<=3	r<=4	22.3	29.8	15.6	21.1
r<=4	r<=5	6.8	15.5	6.4	14.3
r<=5	r<=6	0.4	3.8	0.4	3.8

表7　共和分検定：1992年1月1日～2014年10月16日

帰無仮説	対立仮説	トレース検定	5%境界値	最大固有値検定	5%境界値
r=0	r<=1	121.8	95.8	50.4	40.1
r<=1	r<=2	71.4	69.8	31.3	33.9
r<=2	r<=3	40.2	47.9	21.5	27.6
r<=3	r<=4	18.7	29.8	13.5	21.1
r<=4	r<=5	5.1	15.5	5.1	14.3
r<=5	r<=6	0.0	3.8	0.0	3.8

表8　共和分検定：2014年10月17日～2022年3月31日

帰無仮説	対立仮説	トレース検定	5%境界値	最大固有値検定	5%境界値
r=0	r<=1	101.6	95.8	32.5	40.1
r<=1	r<=2	69.1	69.8	28.4	33.9
r<=2	r<=3	40.7	47.9	21.5	27.6
r<=3	r<=4	19.2	29.8	10.5	21.1
r<=4	r<=5	8.7	15.5	6.9	14.3
r<=5	r<=6	1.7	3.8	1.7	3.8

注：共和分検定：Johansen の尤度比検定. (likelihood ratio test)

Fig. 1 China impulse response function: 1992-01-01 to 2014-10-16

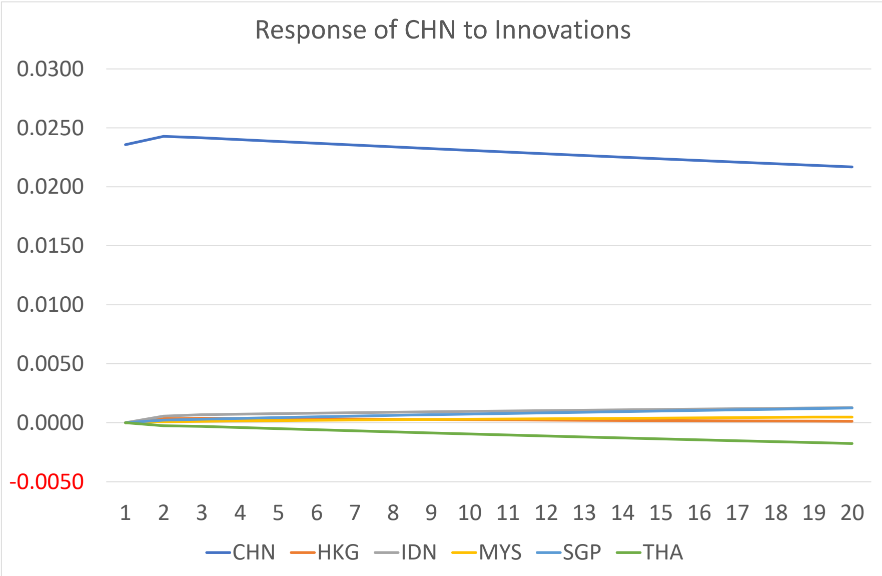


Fig. 2 China impulse response function: 2014-10-17-2021-3-31

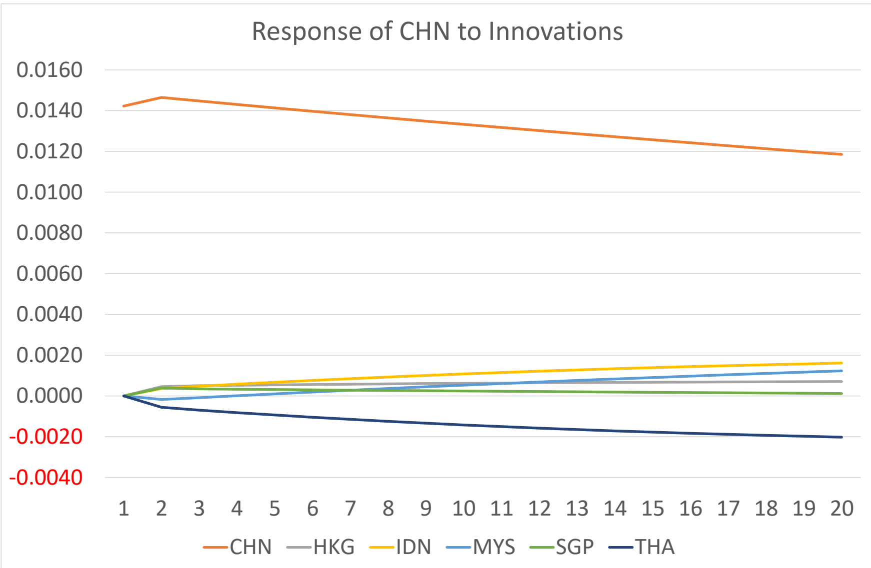


Fig. 3 Hong Kong impulse response function: 1992-01-01 to 2014-10-16

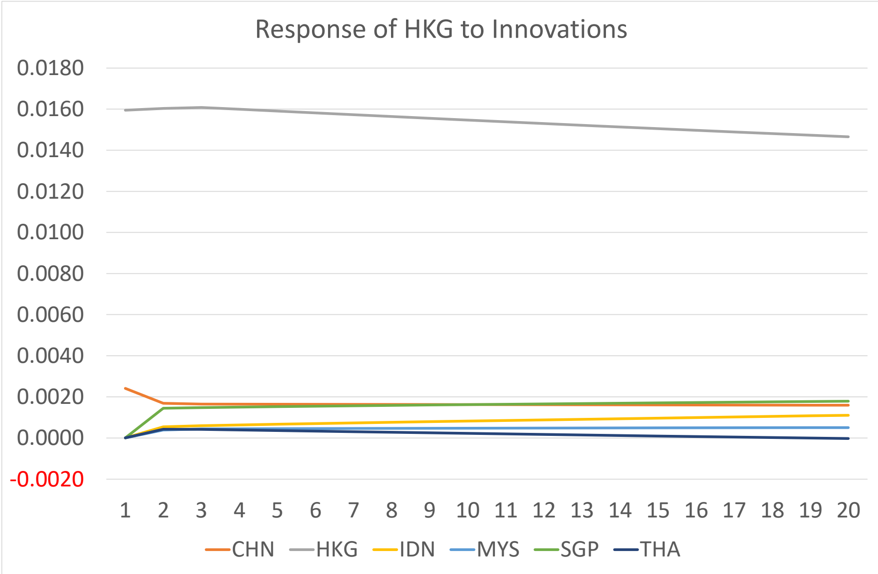


FIG. 4 Hong Kong impulse response function: 2014-10-17-2021-3-31

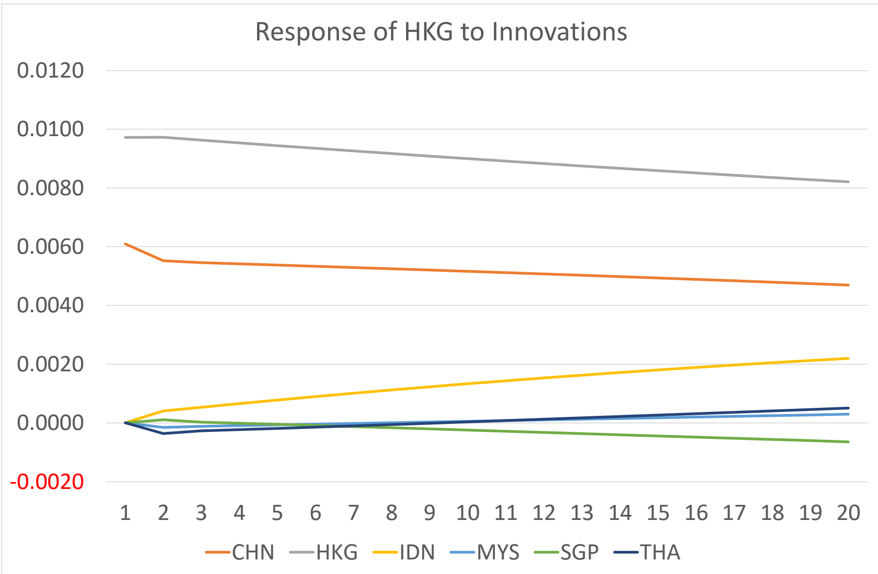


FIG. 5 Singapore impulse response function: 1992-01-01 to 2014-10-16

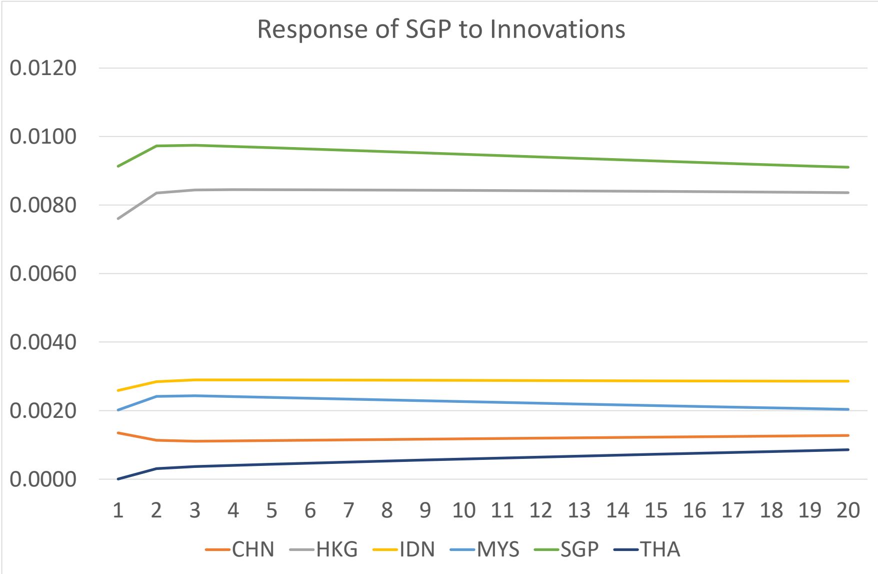


FIG. 6 Singapore impulse response function: 2014-10-17-2021-3-31

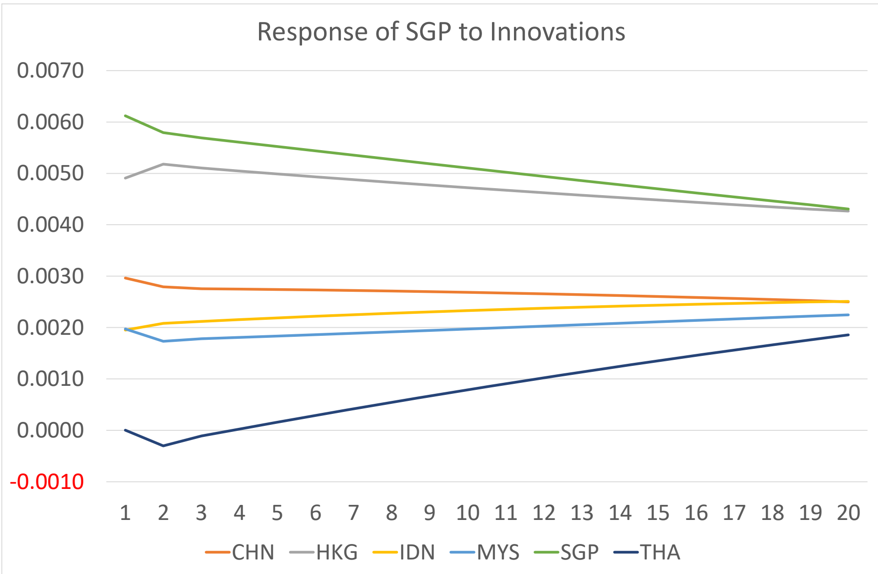


Fig. 7 Malaysian impulse response function: 1992-01-01 to 2014-10-16

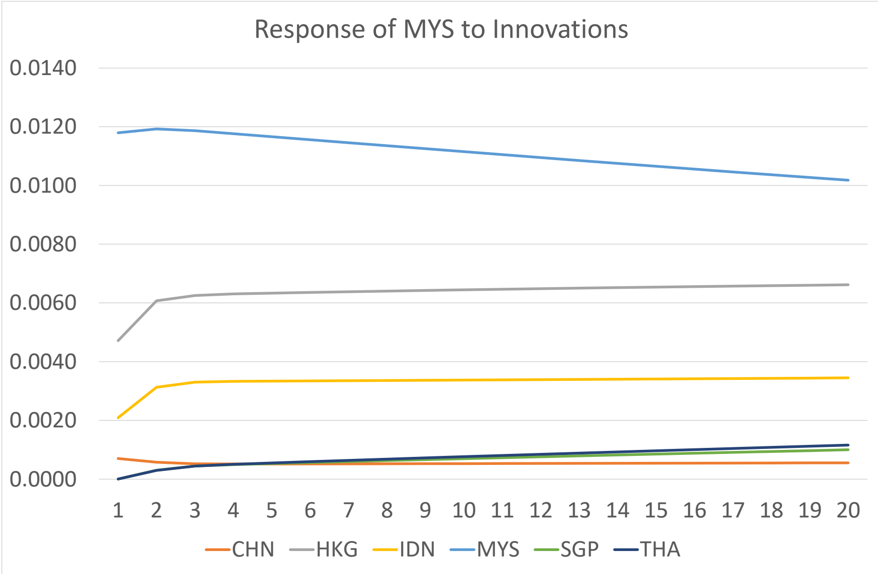
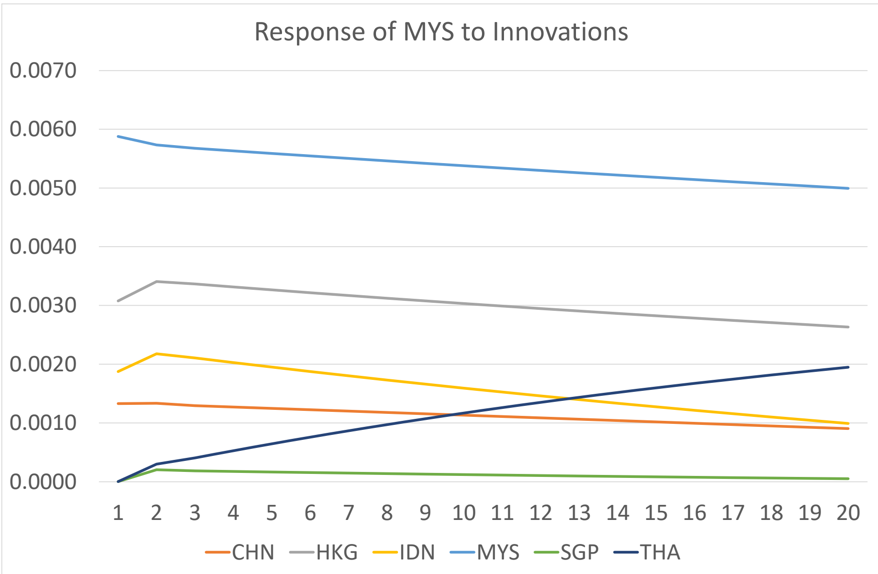
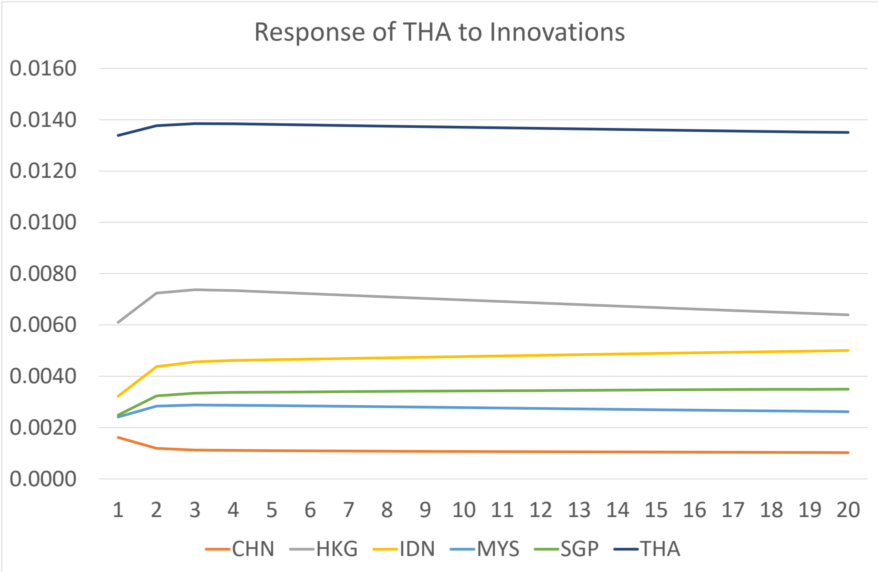


Fig. 8 Malaysian impulse response function: 2014-10-17-2021-3-31



Impulse response function of the Thai in Fig. 9: 1992-01-01 to 2014-10-16



Impulse Response Function of Thailand, Figure 10: 2014-10-17-2021-3-31

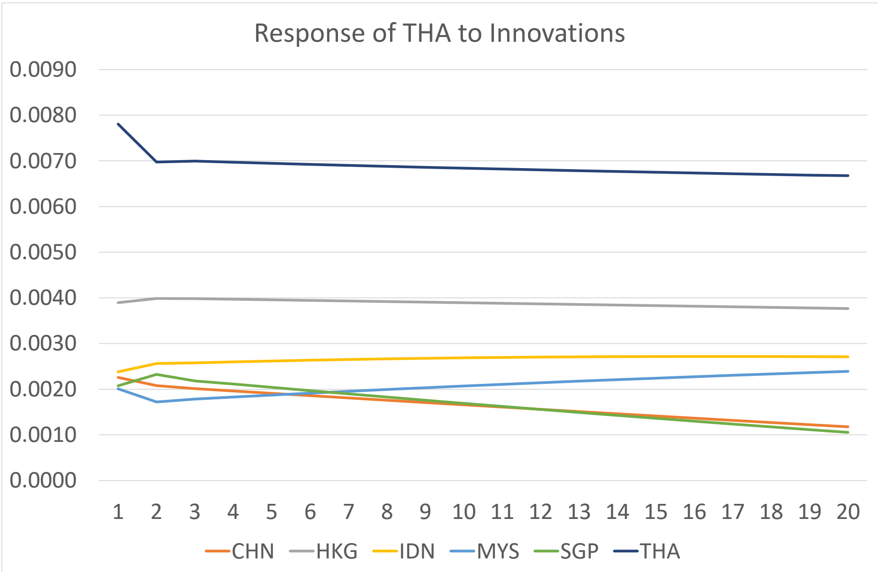


Figure 11: Impulse Response Function of Indonesia: 1992-01-01 to 2014-10-16

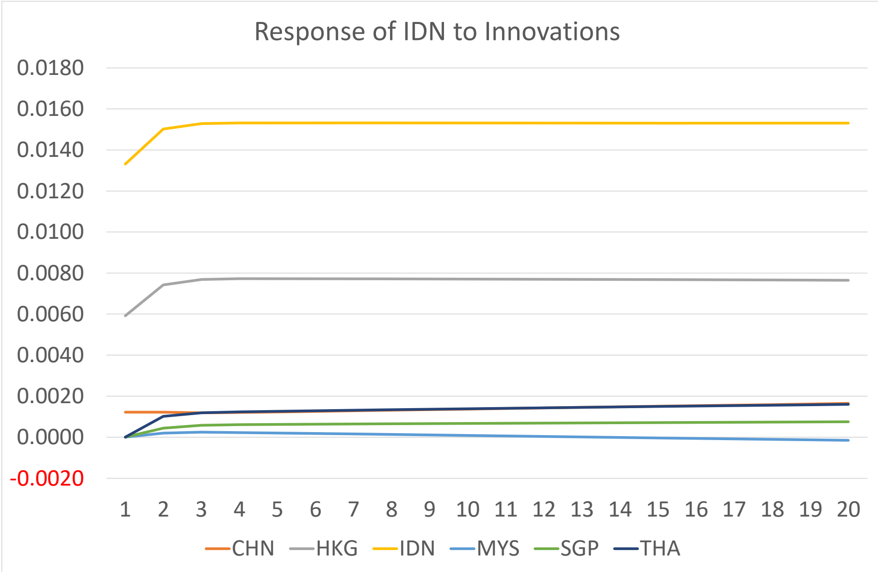


Figure 12: Impulse Response Function of Indonesia: 2014-10-17-2021-3-31

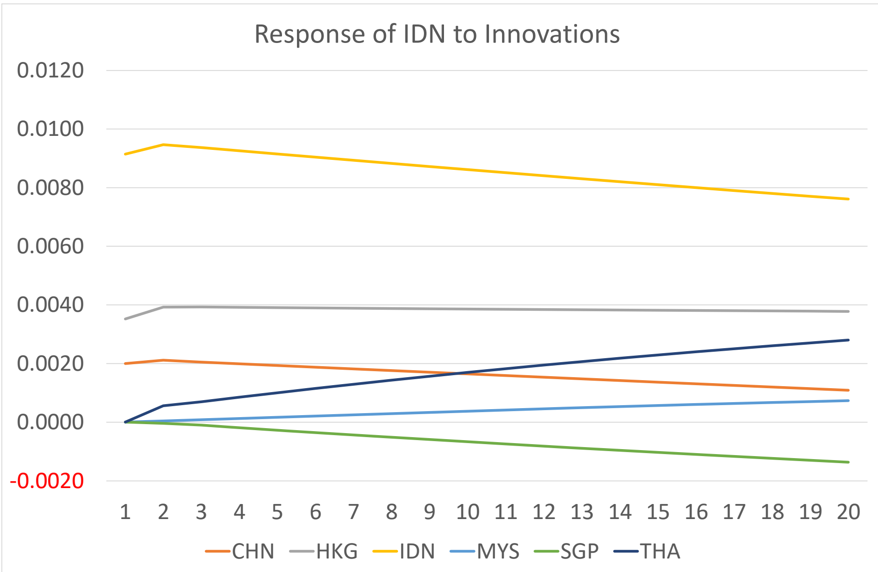


Figure 13 Detached Dispersions: 1992-01-01-2014-10-16

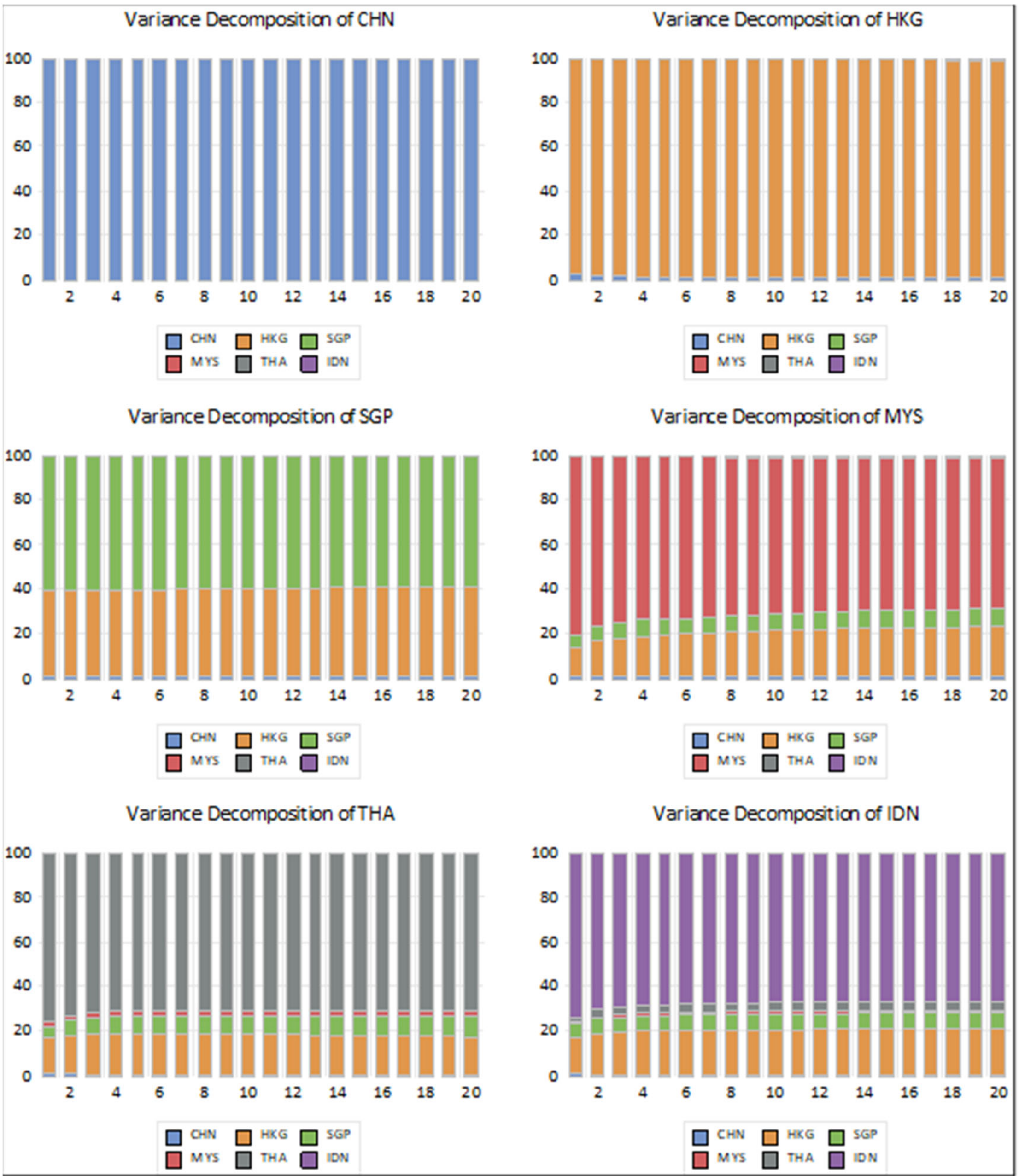
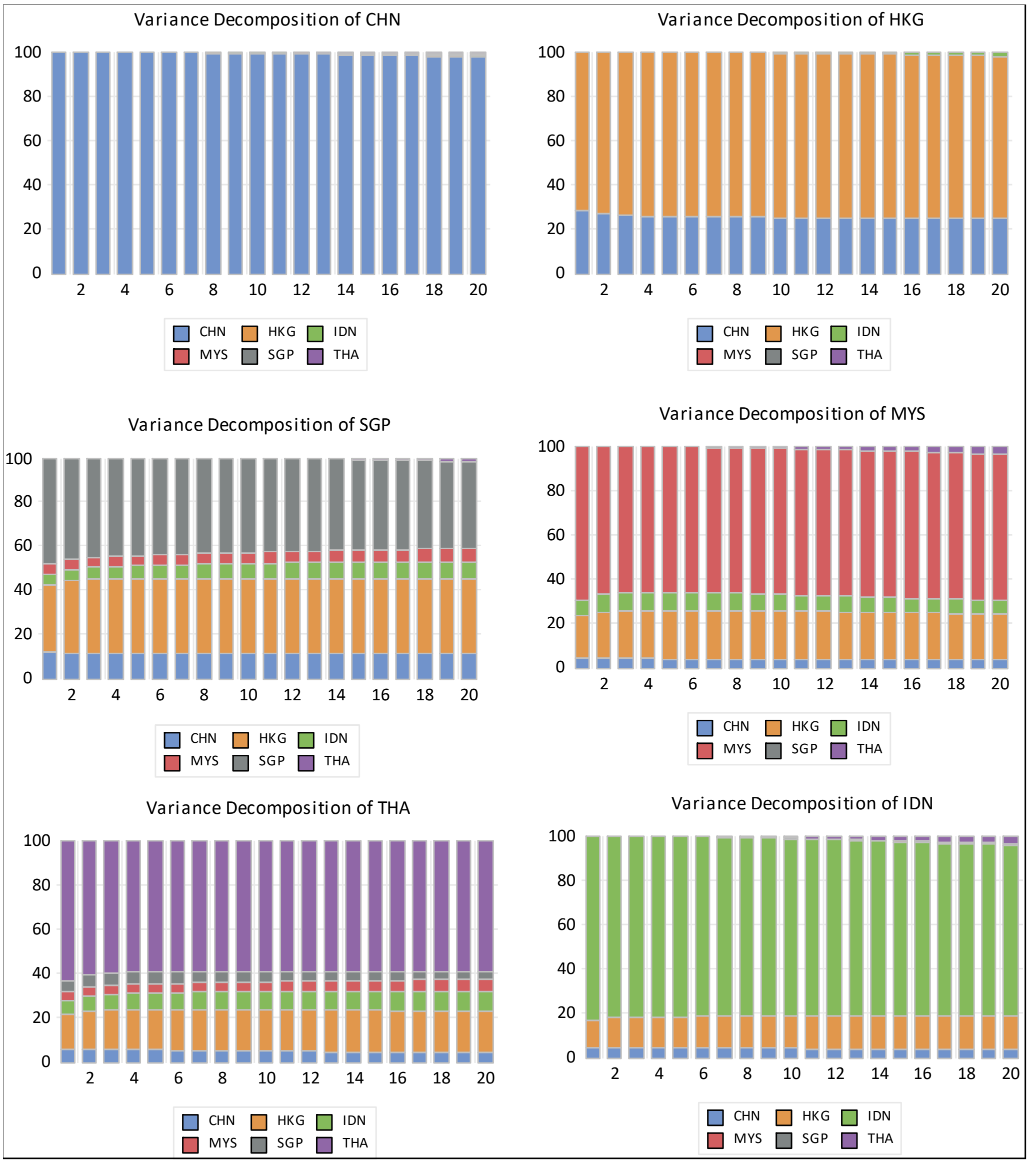


Figure 14 Detached Dispersions: 2014-10-17-2021-3-31



[1] Naito (2010) page 7.

[2] The nonstationary process, in which the first-order difference is steady, is I(1) (the first-order sum process), and the linear combination of the variables I(1) is the steady-state process (i.e., I(0)) and is defined as the relationship of the sum. The relationship between the variables is that they converge to a constant relationship over the long term without large deviations (see Box 2010, page 152).

[3] MSCI。