Methodologies of Compiling Consumer Price Indices in Asian Countries

Makiko Ochiai: Price Analysis Section Staff
Daisuke Oda: Price Analysis Section Chief
Statistics Bureau of Japan

14th Ottawa Group Meeting
Tokyo May 21, 2015

<< Introduction >>

Many oil-poor countries depend on import oil to meet most of their energy needs in Asia[1]. Thus, there is some possibility that crude oil price affects inflation rates of these countries directly or indirectly.

The purpose of this paper is to display common characteristics of the national practices used in the CPIs across Pacific Asian countries and to examine movement of their CPIs throughout observing synchronicities between the CPIs and crude oil price.
In addition to that, regarding Singapore and Japan, contribution to the year-on-year % change of the CPIs are looked into to clear up what category pushed the CPIs up and pulled them down from 2011 to 2015.

With this analysis, Japan's CPI has ruled out the effects of consumer tax rate change in April 2014. In regards to this, the appendix explains the specific method.

I. Characteristics of Pacific Asian countries

Pacific Asian countries have a diversity of geography, climate and economy.

China is a continental country which has the largest population in the world and has the largest area in the Pacific Asian countries.

The population of Singapore is one-130000th of China but its GDP per capita is seven times larger than China. Concerning primary energy self-sufficiency, Singapore and Japan are extremely low. It is expected that movement of crude oil price has a dominant influence to their CPIs more directly than the other countries.

Table 1　Summary of Pacific Asian countries

	China	South Korea	Singapore	Vietnam	Philippines	Japan
Official	People's Republic of China	Republic of Korea	Republic of Singapore	Socialist Republic of Viet Nam	Republic of the Philippines	Nipponkoku (Nihonkoku)
Capital	Beijing	Seoul	Singapore	Ha Noi	Manila	Tokyo
Area (km^2) [1,2]	9,596,961	99,720	710	329,241	299,404	377, 962
Population (million) [1,2]	1,340 [2012]	49 [2012]	5 [2011]	89 [2011]	96 [2011]	127 [2013]
Currency	Renminbi	South Korean won	Singapore dollar	Dong	Peso	Yen
GDP (Total) (billion US$) [3]	10,380 [2014]	1,417 [2014]	308 [2014]	186 [2014]	285 [2014]	4,616 [2014]
GDP(PPP) (Per capita) (INT$)[3]	12,880 [2014]	35,277 [2014]	82,762 [2014]	5,635 [2014]	6,962 [2014]	37,390 [2014]
Self sufficiency (Primary energy) (%)[1,4]	91 [2010]	18	1 [2010]	111 [2010]	58 [2010]	4 [2010]
Self sufficiency (Oil) (%)[1,4]	47 [2010]	1 [2011]	0 [2010]	84 [2010]	7 [2010]	0 [2010]
A ratio of oil to primary energy (%)[1,4]	18 [2010]	37 [2011]	77 [2010]	31 [2010]	34 [2010]	41 [2010]

[ ] : year

II. Characteristics of the CPIs

1. Summary of CPIs of Pacific Asian countries

The following is a summary of CPIs of Pacific Asian countries.

Only China's formula is chain Laspeyres and the others are Laspeyres. Regarding the base year, China, South Korea and Japan's is 2010, Singapore's is 2014, Vietnam's is 2009 and Philippines' is 2006.

Table 2　Summary of CPIs of Pacific Asian countries

	China[5,11]	South Korea[6,11]	Singapore[7]	Vietnam[8]	Philippines[9,10]	Japan[11]
Formula	chained Laspeyres	Laspeyres	Laspeyres	Laspeyres	Laspeyres	Laspeyres
Base year	2010=100	2010=100	2014=100	2009=100	2006=100	2010=100
Weight	Urban and rural house-hold survey (2010), update every five years	Family Income and Expenditure Survey (2012), update every two or three years	Households Expenditure Survey (Oct. 2012 to Sep. 2013), update every five years	Vietnam Household Living Standard Survey (Jun. 2007 to May 2008), update every five years	Family Income and Expenditure Survey (2006)	Family Income and Expenditure Survey (2010), update every five years
Scope of the data	Nationwide households	One-person or more nationwide households, excluding farming and fishery households	Singapore Citizens or Permanent Residents	All consumers in Vietnam	Nationwide households	Nationwide, two-or-more-person households
Items	At least 600	481	(6,600)	256	271 to 693	588
Outlets	About 63,000	About 26,000	4,200	(254)		About 27,000
Frequency of collecting price	Twice a month, six times a month (e.g. Meat and fish), once a month (e.g. electricity)	Once a month, three times a month (e.g. livestock product)	Every week (e.g. Peri-shable food) , monthly, quarterly, half-yearly, as when the prices/rates change	Three times a month.	Twice a month, weekly (e.g. Food, Beverage, Tobacco in National Capital Region)	Once a month, three times a month (e.g. Fresh Foods)

China, South Korea, Vietnam December 2014, Singapore, the Philippines, Japan April 2015

'Items' of Singapore is unknown. That figure is the number of 'Brand and Variety'.

'Items' of the Philippines vary by province/city.

'Outlets' of Vietnam are markets, trading centers and retail outlets, etc.

2. Comparison between their baskets

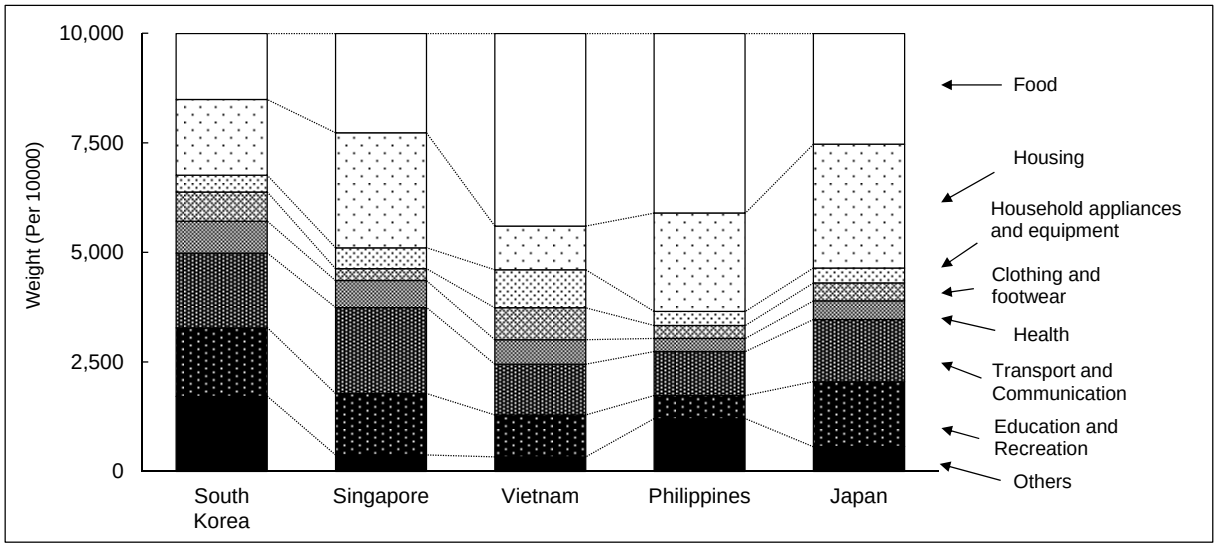
This chart is baskets of the CPIs. It is difficult to compare weights of categories which contain Oil-Related items. (i.e. 'Water, electricity, gas and other fuels', gas, kerosene and etc.; 'Transport', gasoline) Both Vietnam and the Philippines have relatively larger weight of 'Food' than the others. Therefore, it is expected that their CPIs don't synchronize with crude oil price clearly and the crude oil price impact on their CPI is weaker than the others because of the effect of Food price movement upon their CPIs.

Table 3　Baskets of CPIs of Pacific Asian countries

	South Korea[12]	Singapore[7]	Vietnam[8]	Philippines[10]	Japan[13]
All Items	10,000	10,000	10,000	10,000	10,000
Food	1,508	2,267	4,396	4,098	2,525
Housing	1,730	2,287	1,001	1,435	2,122
Water, electricity, gas and other fuels		338		812	704
Household appliances and equipment	382	475	865	322	345
Clothing and footwear	664	273	728	295	405
Health	729	615	561	299	428
Transport	1,114	1,579	887	781	1,030
Communication	591	385	273	226	391
Education	1,035	615	572	336	334
Recreation	530	788	383	193	1,145
Others	1,717	378	334	1,203	569

'Food' includes alcoholic beverages and tobacco.
'Others' of the Philippines includes restaurants.
'Others' of Korea includes 'Restaurants and hotels'.

Figure 1　Baskets of CPIs of Pacific Asian countries



'Housing' includes 'Water, electricity, gas and other fuels'.
'Others' of Korea includes 'Restaurants and hotels'.

III. Comparison between CPIs and crude oil price

1. CPI

This line graph is the year-on-year % change of the CPIs of Pacific Asian countries. It begins from 2011 because more than half of their base years are 2010.

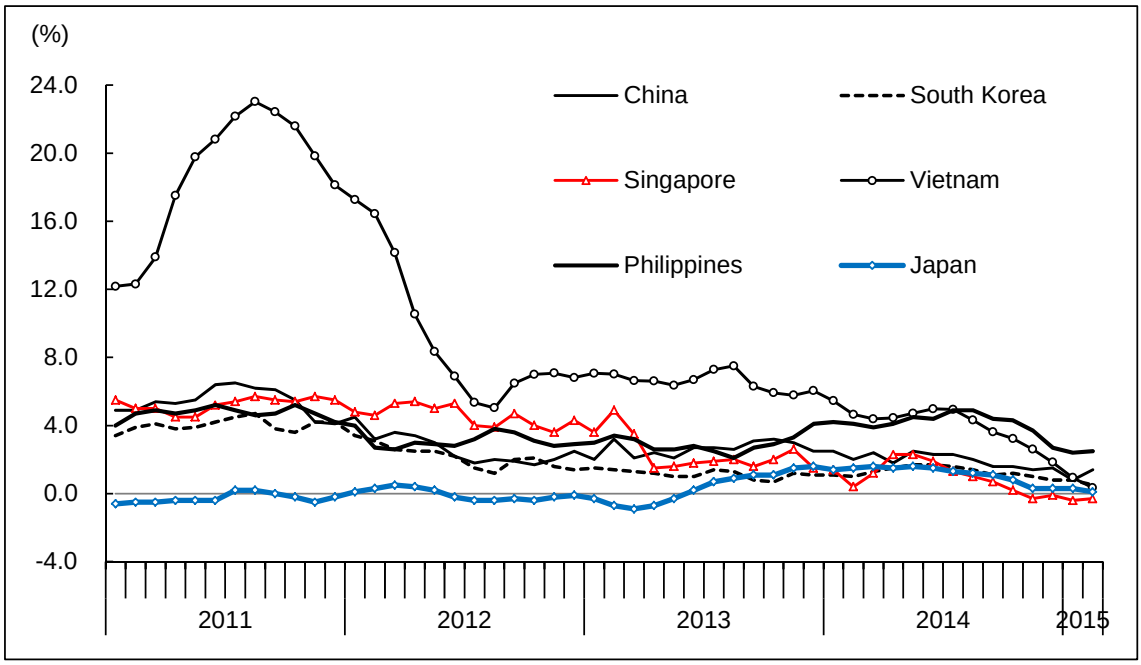
It seems clear that Vietnam suffered from inflation due to the weak dong from 2011 to mid 2012. It is said that the weak dong immediately made the gasoline price rise and it influenced prices of a lot of goods and services.

Singapore sharply dropped in early 2013.

Japan seems to suffer from deflation until the middle of 2013.

After mid 2014, all countries' CPIs were on the decrease. Singapore even marked under zero percent in some months.

Figure 2　Year-on-year % change of the CPIs of Pacific Asian countries

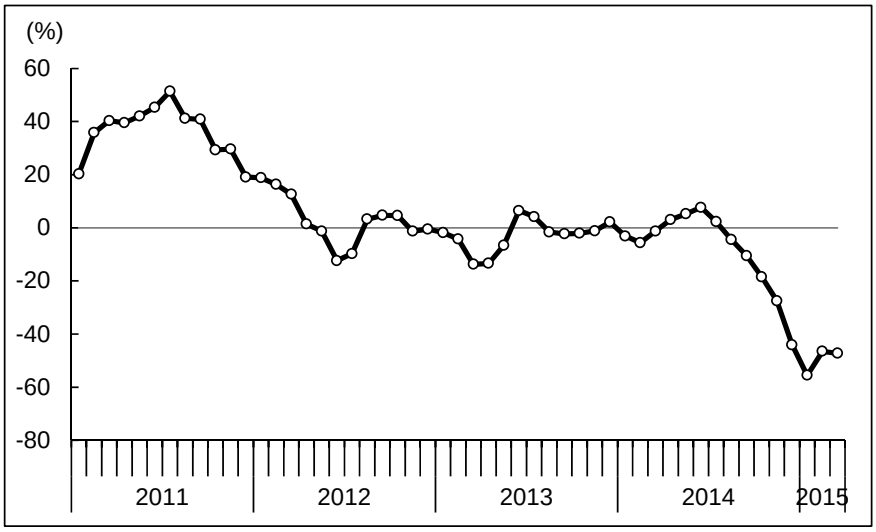


The CPI of Japan is excluding the effects of consumer tax rate change in April 2014, as well as the following.

2. Crude oil price

This shows the year-on-year % change of crude oil price which is US dollar per barrel in Dubai[14]. The price stabilized from 2012 to mid 2014 but dramatically turned into a decreasing phase after that. Now, it is still around -50%.

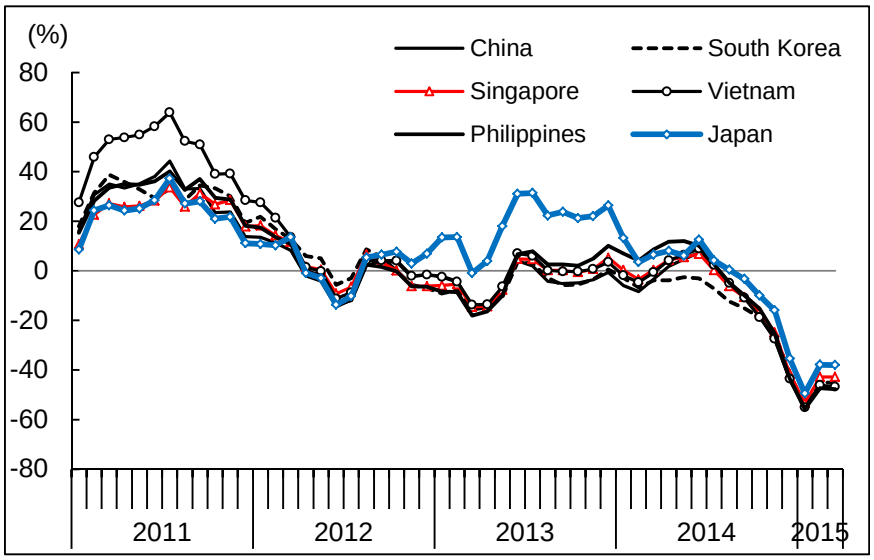
Figure 3　Year-on-year % change of crude oil price in Dubai: US dollar per barrel[14]



Next is a line graph of the movement translated into each country's currency from US dollar to consider something by movement of each exchange rate. In 2011, Vietnam rose to a higher level than the others due to the weak dong. From mid 2012 to 2013, Japan also went up due to weak yen.

Furthermore, all nations have been declining similarly since mid 2014, which seems like the movement of their CPIs. It appears that crude oil price is the cause of the CPIs dropping from the middle of 2014.

Figure 4 Year-on-year % change of crude oil price translated into each country's currency[14, 15]



3. Comparison between the CPIs and crude oil price

In order to observe synchronization between the CPIs and crude oil price, the following analysis shows correlation coefficient of them by each time lag from zero to twelve months. In general, there is a strong relation in short lag. It clearly indicates that the movement of crude oil price is a cause of the movement of the CPIs.

Specifically, the Philippines is the strongest at one month. China, South Korea and Vietnam are the strongest at two months. Moreover, they become steadily weaker over time.

On the other hand, Singapore and Japan, which were expected to be influenced easily by crude oil price because of their low primary energy self-sufficiency, are unexpected results. Singapore is the strongest at eleven months. Japan's figures indicate that there is no correlation between the CPI and crude oil price.

Table 4 Correlation coefficient between CPIs of Pacific Asian countries and crude oil price[14, 15]

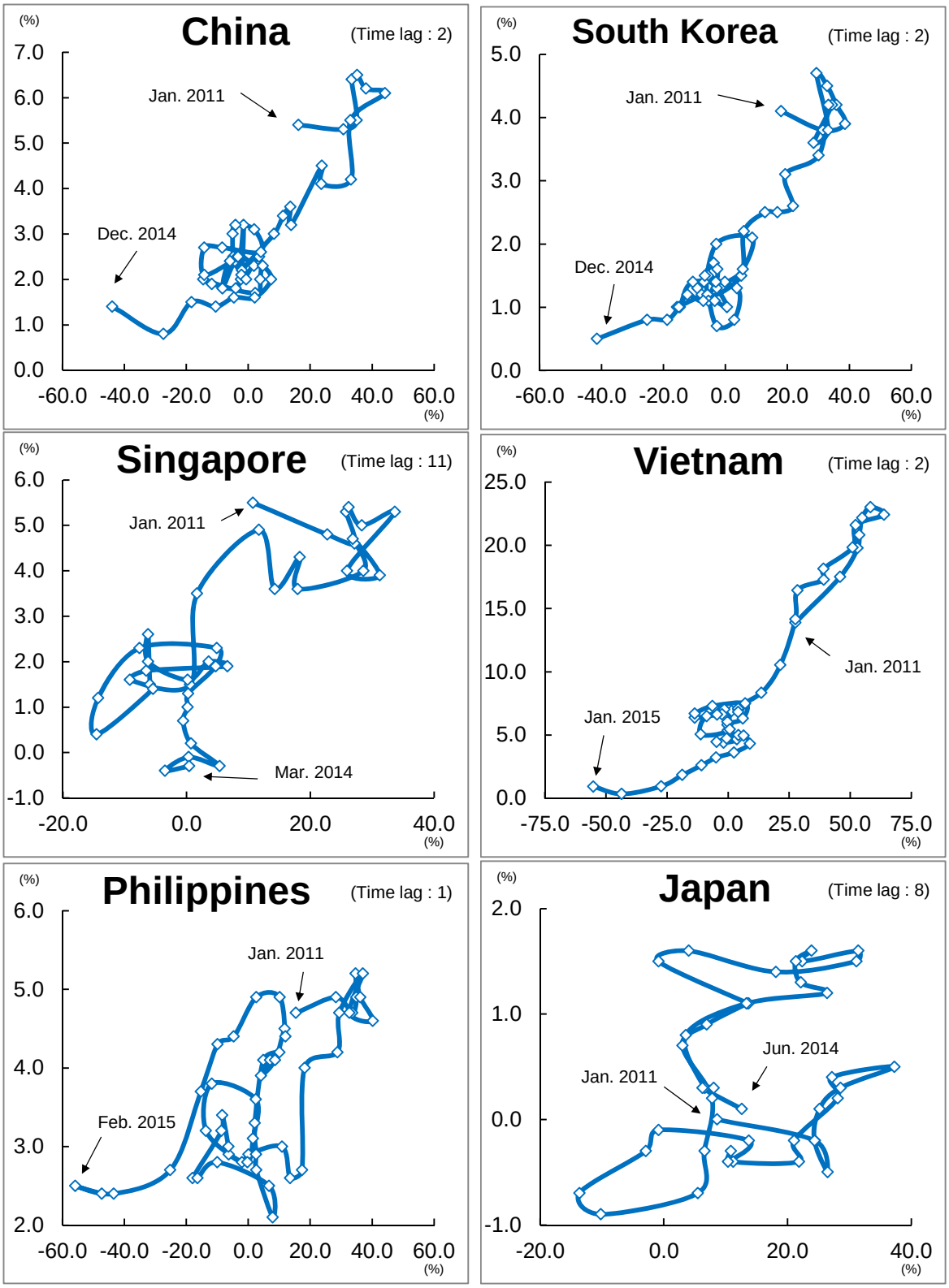
Time lag	China	South Korea	Singapore	Vietnam	Philippines	Japan
0	0.873	0.869	0.737	0.895	0.663	-0.006
1	0.876	0.900	0.747	0.936	0.672	0.080
2	0.880	0.917	0.729	0.956	0.664	0.149
3	0.859	0.913	0.724	0.941	0.653	0.203
4	0.806	0.900	0.740	0.905	0.615	0.250
5	0.712	0.881	0.726	0.859	0.533	0.303
6	0.645	0.837	0.697	0.807	0.418	0.324
7	0.555	0.804	0.657	0.749	0.253	0.321
8	0.494	0.796	0.649	0.697	0.081	0.325
9	0.477	0.758	0.726	0.651	-0.035	0.318
10	0.446	0.705	0.769	0.613	-0.116	0.252
11	0.385	0.681	0.792	0.572	-0.196	0.089
12	0.259	0.655	0.774	0.515	-0.268	-0.097

Crude oil price: per barrel, translated into each country's currency
Time lag: month(s) of lag behind movement of crude oil price

To make this more visible, the following shows scatter plots between crude oil price and the CPI put of the time lag. China, South Korea and Vietnam prove that crude oil price had a strong plus relation with the CPIs put of time lag of one or two months.

On the other hand, Singapore and Japan seem to have a weaker relation than those countries.

Figure 5　Scatter plots between the year-on-year % change of crude oil price and the CPI put of the time lag[14, 15]



Horizontal axis: year-on-year % change to crude oil price of each country's currency

Vertical axis: year-on-year % change to the CPI

IV. Cause of movement of the CPI

This chapter focuses on Singapore and Japan to make out why their indices didn't synchronize with crude oil price.

1. Energy-Related items

This chart shows weights of energy related items. Both countries' weights of them are not smaller than Vietnam, which showed the strongest coefficient correlation of all nations. Moreover, Japan's total weights account for 773 per ten thousand in the CPI-All items. Concerning 'Gas, manufactured and piped' and 'Liquefied propane', Japan is five times larger than Singapore.

Table 5　Items of 'Energy' and these weights[13]

	Singapore		Japan		Vietnam	
	Weight	Frequency of collecting price	Weight	Frequency of collecting price	Weight	Frequency of collecting price
Energy	499	-	773	-	410	-
Electricity	215	each quarter	317	once a month	246	once a month
Gas, manufactured and piped	18	each quarter	96	once a month	155	Collecting price is calculated by time average price.
Liquefied propane	16	once a month	81	once a month		
Kerosene	-	-	50	once a month		
Gasoline	250	once a month	229	once a month	9	

Even though Japan's CPI was ruled out as the effect of the consumer tax rate revision in April 2014, deviations stand out from 2014 in Japan. But, as a rule, this graph shows that movements of 'Energy' and crude oil price were relatively similar. It seems that the CPIs moved behind crude oil price.

Figure 6　Year-on-year % change 'Energy' and crude oil price translated into each country's currency

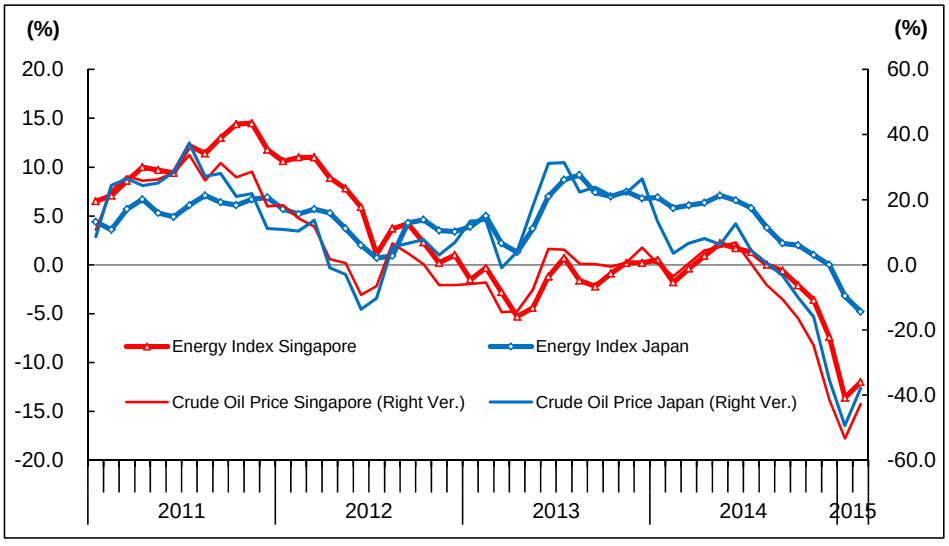
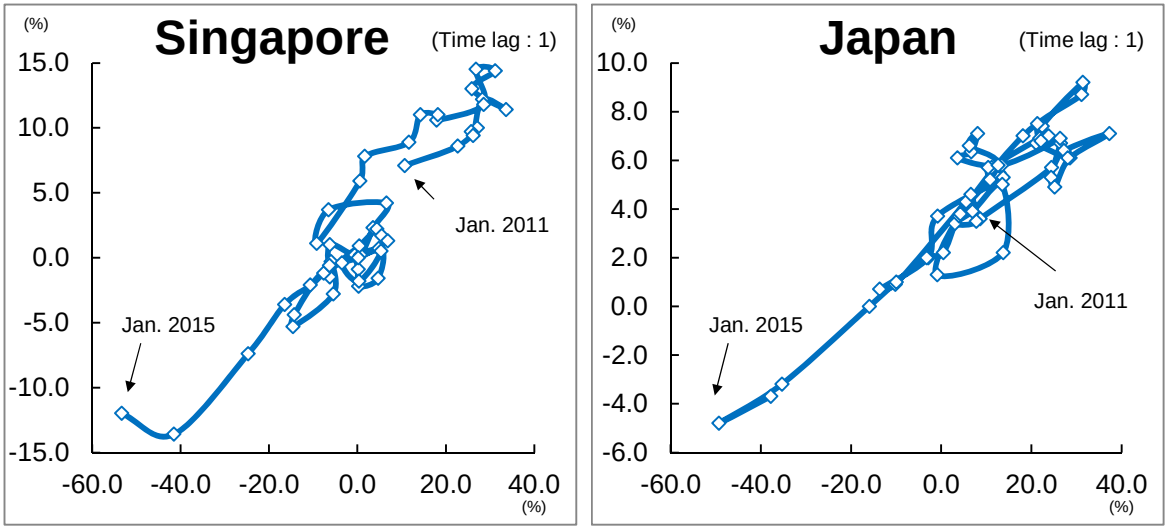


Table 6 and Figure 7 indicate 'Energy' and crude oil price had the strongest relation in one month lag, which means that crude oil price affected inflation rates of energy related items in both countries. Scatter plots clearly display a strong plus relative between them.

Table 6　Correlation coefficient between year-on-year % change of 'Energy' and crude oil price[14, 15]

Time lag	Singapore	Japan
0	0.899	0.839
1	0.928	0.907
2	0.914	0.796
3	0.895	0.620
4	0.882	0.557
5	0.846	0.512
6	0.777	0.451
7	0.704	0.308
8	0.638	0.196
9	0.638	0.174
10	0.635	0.082
11	0.619	-0.064
12	0.507	-0.287

Figure 7　Scatter plots between the year-on-year % change of crude oil price and 'Energy' put of the time lag[14, 15]



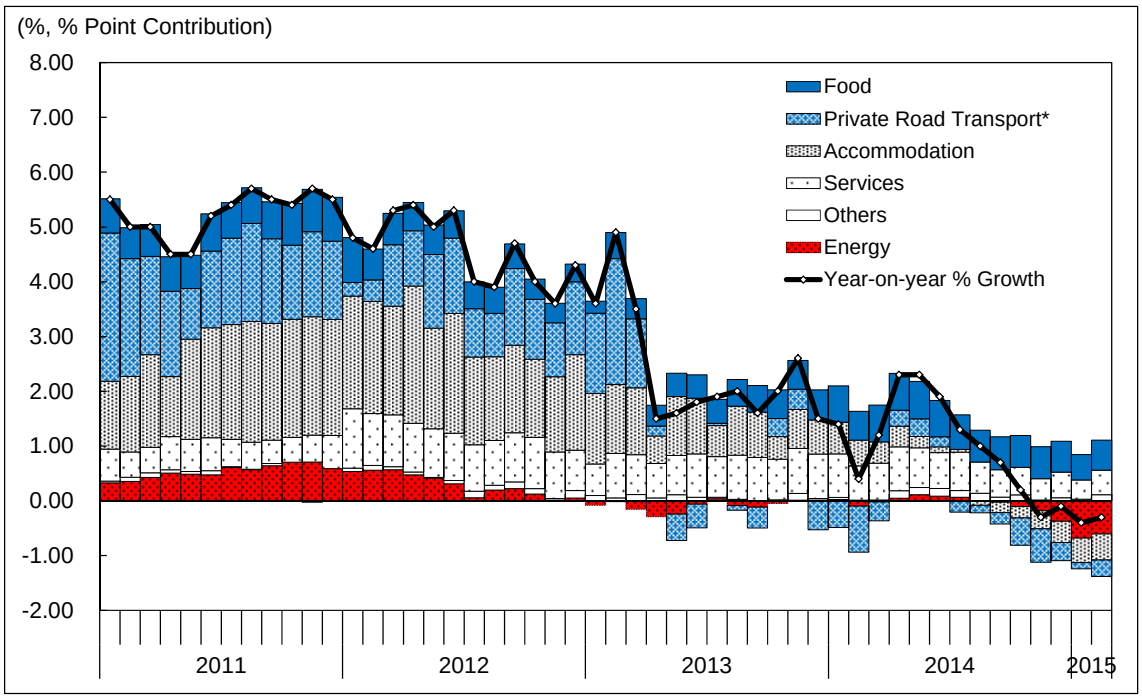
The horizontal axis: year-on-year % change to crude oil price of each country's currency
The vertical axis: year-on-year % change to the CPI

2. Contribution to the year-on-year % change of the CPI-All Items

The following displays contribution to make out how 'Energy' and the others contributed to the year-on-year % change of the CPI-All Items.

As for Singapore, 'Energy' pushed the CPI up from 2011 to 2012 and pulled it down from the middle of 2014 but it seems much smaller than the others which are 'Accommodation' and 'Private Road Transport (exclude Petrol)'. They covered for 'Energy' from 2011 to early 2014[17]. Above all, 'Private Road Transport (exclude Petrol)' moved volatility. Its impact on the CPI was larger than 'Energy' throughout the period.

Figure 8　% Point Contribution to Year-on-year % change of the CPI-All Items of Singapore[16]

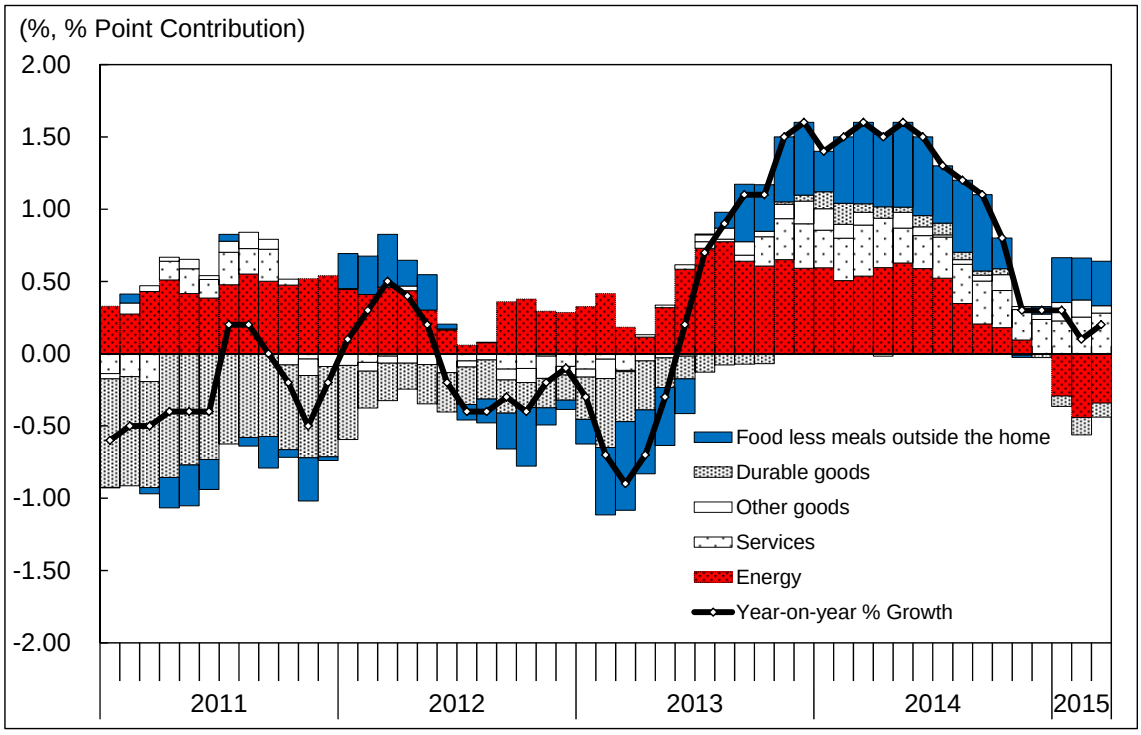


* 'Private Road Transport' excludes 'Petrol'

As for the % point contribution, estimates between 2011 and 2013 are computed based on the old weighting pattern under the 2009-base year.

On the other hand, in Japan, 'Energy' was not smaller than the others. It pushed the CPI up from 2011 to 2014 and pulled it down afterwards, but before the middle of 2013, the year-on-year % change of the CPI marked under zero percent in three terms. 'Food less meals outside the home' and 'Durable goods' were the causes of it. They neutralized the impact of 'Energy' so that the CPI-All Items didn't synchronize with crude oil price in the period.

Figure 9　% Point Contribution to Year-on-year % Change of the CPI-All Items of Japan



V. Conclusion

This paper explained methodologies of Consumer Price Indices in Pacific Asian countries and compared the movement of the CPIs with the movement of crude oil price from 2011 to 2015. It proved that the movement of crude oil price synchronized with the CPIs' movement put of time lag of one or two months in most Pacific Asian countries, except Singapore and Japan. Regarding Singapore and Japan, this paper observed contribution to the year-on-year % change of their CPIs. It found out that 'Energy' synchronized with crude oil price in both countries but 'Private Road Transport (exclude Petrol)' affected Singapore's CPI more particularly than 'Energy' throughout the period. On the other hand, 'Food less meals outside the home' and 'Durable goods' neutralized the impact of 'Energy' upon Japan's CPI.

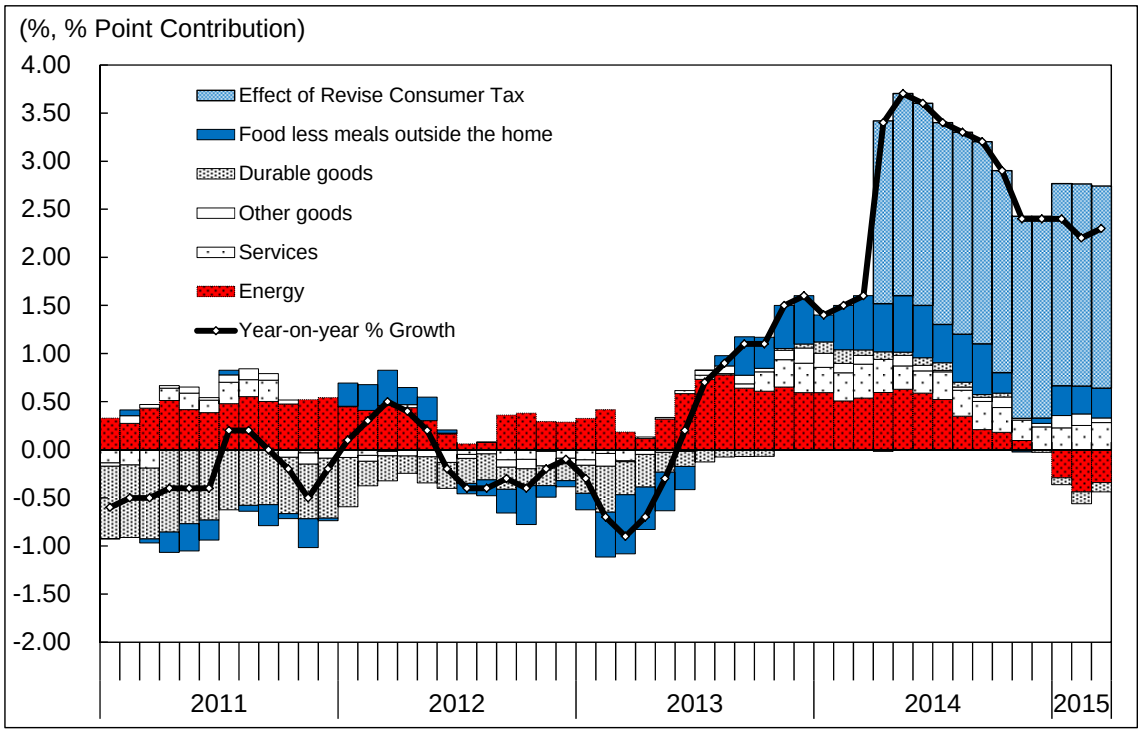
<< Thanks >>
Without the solid support of the following people, this paper would not have been possible.
I would like to express my gratitude to Lai Pek Yee, Department of Statistics Singapore; Xiu Si, Monetary Authority of Singapore; Do Thi Ngoc, General Statistics Office of Vietnam and Rosario Lodovice, Philippine Statistics Authority.
Furthermore, on behalf of our staff, I would like to thank the National Bureau of Statistics of the People's Republic of China and Statistics Korea for their persistent help with our annual reports.

<< Appendix >>

For analysis synchronous between the CPI and crude oil price, this paper excludes the effects of the consumer tax rate revised in April 2014 from Japan's CPI. The figure of the effects followed the Bank of Japan's report[17]: April 2014, 1.9% point; after then, 2.1% point. The BOJ announced inflation target means that the CPI excluded these figures.

This chart shows how each category contributed to the year-on-year % change of the CPI-All Items.

Figure % Point Contribution to Year-on-year % change of the CPI-All Items of Japan (before excluding the effects of consumer tax rate revised in April 2014)



<< References >>

[1] The Institute of Energy Economics, Japan, February 2013,「平成24年度国際石油需給体制等調査報告書(諸外国のエネルギー政策動向等に関する調査)－経済産業省資源エネルギー庁委託調査－」, <http://www.meti.go.jp/meti_lib/report/2013fy/E003341.pdf> (April 10, 2015)

[2] Statistics Bureau of Japan, *Japan Statistical Yearbook 2015,* <http://www.stat.go.jp/english/data/nenkan/index.htm> (April 28, 2015)

[3] International Monetary Fund, 2015, World Economic Outlook Database April 2015 Edition, <http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx> (April 28, 2015)

[4] Agency for Natural Resources and Energy, June 2013,「エネルギー需給の概要」,『平成 24 年度エネルギーに関する年次報告(エネルギー白書 2013)』第 2 部第 1 章第 1 節, <http://www.enecho.meti.go.jp/about/whitepaper/2013html/2-1-1.html> (April 28, 2015)

[5] Organisation for Economic Co-operation and Development, Main Economic Indicators, <http://stats.oecd.org/mei/default.asp?lang=e&subject=8> (April 28, 2015)

[6] International Monetary Fund, Special Data Dissemination Standard (Korea, Price index: Consumer prices), Dissemination Standards Bulletin Board, <http://dsbb.imf.org/Pages/SDDS/DQAFBase.aspx?ctycode=KOR&catcode=CPI00> (April 28, 2015)

[7] Singapore Department of Statistics, February 2015, Rebasing of the Consumer Price Index (Base Year 2014=100), <http://www.singstat.gov.sg/docs/default-source/default-document-library/publications/publications_and_papers/prices/ip-e44.pdf> (April 10, 2015)

[8] General Statistics Office of Vietnam, December 28, 2009, PRESS RELEASE ON UPDATING CPI CALCULATION METHOD IN THE PERIOD 2009-2014, General Statistics Office Of Vietnam, <http://www.gso.gov.vn/Modules/Doc_Download.aspx?DocID=10860> (April 10, 2015)

[9] Philippine Statistics Authority, 2011, METHODOLOGY IN REBASING THE CONSUMER PRICE INDEX TO 2006, <http://www.nscb.gov.ph/resolutions/2011/NSCBReso7Annex.pdf>, (April 10, 2015)

[10] Philippine Statistics Authority, October 2011, THE 2006-BASED CONSUMER PRICE INDEX, <http://web0.psa.gov.ph/old/data/sectordata/cpi2006basetx.html>, (April 28, 2015)

[11] Statistics Bureau of Japan, March 2015,「主要国の消費者物価指数の概要」, *Annual Report on the Consumer Price Index, Japan 2014*,
<http://www.stat.go.jp/data/cpi/report/2014np/pdf/shugai.pdf>, (April 28, 2015)

[12] Statistics Korea, April 2015, Consumer Price Index in March 2015,
<http://kostat.go.kr/portal/english/news/1/1/index.board?bmode=download&bSeq=&aSeq=334794&ord=1>, (April 15, 2015)

[13] Statistics Bureau of Japan, March 2015, Appendix 1 List of CPI Items, *Annual Report on the Consumer Price Index, Japan 2014*,
<http://www.stat.go.jp/english/data/cpi/report/2014np/pdf/fu1.pdf>, (May 15, 2015)

[14] International Monetary Fund, IMF Primary Commodity Prices (Crude Oil (petroleum), West Texas Intermediate 40 API, Midland Texas, US$ per barrel),
<http://www.imf.org/external/np/res/commod/index.aspx>, (April 17, 2015)

[15] OANDA Corporation, Historical Exchange Rates,
<http://www.oanda.com/currency/historical-rates/>, (April 17, 2015)

[16] Monetary Authority of Singapore, March 2015, Consumer Price Developments in February 2015,
<http://www.mas.gov.sg/~/media/MAS/Monetary%20Policy%20and%20Economics/The%20Singapore%20Economy/Inflation%20Monthly/2015/InflationFeb15.pdf>, (April 17, 2015)

[17] Bank of Japan, March 2014, BOX Chart Effects of the Consumption Tax Hike (5%→8%) on Consumer Price Index, Monthly Report of Recent Economic and Financial Developments March 2014, <http://www.boj.or.jp/en/mopo/gp_2014/gp1403b.pdf>, (May 15, 2015)