Assessing the Impact of covid-19 Shock on major Asian stock markets

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Abstract: This paper aims to evaluate the spillover effect of covid-19 shock on major global stock markets, including Shanghai, Hong Kong, Japan's Nikkei, Korea, and Nasdaq stock markets, using daily data of stock prices during covid-19 pandemic period. Our findings indicate , while shocks on some of these markets have long term impact but they are of short term effect on other markets in the group. Impulse response function analysis indicate, the pandemic shock on Japan and Shanghai stock markets caused persistent effects on Hong Kong stock market, but the shock on Nasdaq stock market caused transitory short-term effect on Hong Kong stock market. The pandemic shock on Hong Kong, Japan, and Nasdaq stock markets caused persistent impact on Korea stock market, but no persistent effects evidenced on Shanghai and Nasdaq stock markets from transmission of shocks on the other markets in the group.

Keywords: covid-19; impulse response effect; Asia; stock markets.

1- Introduction:

The fast expansion of the corona-virus Covid 19, around the globe, nearly 200,000 infections in about 120 countries by Februry 4, have spread fear around the globe and disrupted the world economic activities, including capital markets, the nerve of the world economy. Despite the start of the outbreak of the virus (Covid-19) was in December 2019, stock markets did not respond immediately as there was little information about the expected duration of the crisis and whether China would be able to contain it within a short period of time, and the risks entailing to the global economy due to the virus spread and becoming pandemic that endanger the global health situation. As a result of the great uncertainty that prevailed among investors in the third week of February, stock markets around the world incurred trillions of US dollars in losses in a single week (ending February) seen as the worst week for financial markets since the 2008 global financial crisis. On this week China's Shenzhen stocks incurred losses among major markets regionally as they closed sharply lower, followed by Nikkei 225, and then Hong Kong's Hang Seng. On the first week of March due to stimulus measures declared by central banks, some of these markets rebounded and gained earnings that erased the previous week's losses, but very soon again hit by another big losses. Central banks stabilization

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policies around the world took different directions in their attempt to avail the needed fiscal and monetary policy support. While the US Federal Reserve bank cut the interest rate to 1% . The European Central Bank, Bank of Japan and Bank of England announced readiness to respond to any negative impacts caused by the pandemic to safeguard financial stability of their markets. Chinese government approved 500 billion yuan ($71 billion) loans with low interest rates to small enterprises affected by the impact of the pandemic. However, all these moves by the central banks and governments to reassure investors around the world did little to calm fears, as financial markets resumed again their slide down after March second. To date, the virus outbreak is still expanding and causing global chaos that may disrupt economic activities in many countries around the world. Till now, no body knows how long will last the uncertainty hanging over the world economy. Unfortunately, the feared biggest problem ahead, is shrink of global economic growth. The OECD has already warned that continuation of the outbreak could cut global GDP growth to 1.5%, sending a number of major economies into recession.

The major problem facing the global economy as a result of the consequences of the epidemic is that it is difficult to envisage complete containment of the virus outbreak as almost after three months after the Chinese government announcement the globally adopted policy of social distancing without causing disproportionate economic and human costs. The production time for approved and effective Coronavirus vaccine is estimated to be around 18 months, which by then the global economy already plunged in deep recession. The International Monetary Fund disclosed that the pandemic was already driving the global economy into recession, urging countries to respond with “very massive” spending to avoid dipping into recession that may cause debt defaults of emerging markets. As a response to the IMF call, policy makers in major economies including Asia announced massive fiscal and monetary measures that aims to stimulate economies, but these measures characterized as short term measures that mitigates immediate damages to corporate funding to avoid looming credit crisis.

It is well known that transmission of exogenous shocks to the real economy is via capital markets . As stock markets fall and household wealth shrink, household savings increases and consumption fall, which lead into economic depression. This effect can be very strong in the economies where household highly exposed to equity assets. Covid-19

seems to be a potentially powerful direct hit on household confidence, as they become pessimistic about the longer term.

The initial purpose of this paper to estimate the impact of covid-19 pandemic breakout on major global stock markets, including Shanghai composite , Hong Kong's Hang Seng index, Nikkei 225 , Korean KOSPI, and Nasdaq stock market. The interactive association between these markets is important for investors as well as for policy-makers in these countries. Increasing departure of stock prices from their fundamental driver, that is the common economic bonds linking these markets, implies increasing risk for investors in these stocks. The results in this paper can help us understand how these markets can react to common shocks that hit the global economies, and also help to indicate diversion of these markets from joint long term trend or shared common cyclical path can make these markets fundamentally weak and speculatively strong. The results in this paper can help us comprehend the magnitude and scale of future pandemic crisis on major Asian capital markets.

2-Literature review

As to date, there is a few published studies available on the impact of the covid-19 pandemic on capital markets, but more recently some researchers investigated the impact of the pandemic on the U.S. economy. Study by Hai and Rayana (2021) indicate *evidence of herding behaviours in Asian and South East Asian stock markets during the pandemic. More stock market integration is evidenced during the onset of the pandemic, compared to the periods before and later in the pandemic.* Dingel and Neiman (2020) study the feasibility of working at home for all occupations, to find out that 34% of U.S. jobs, can be performed at home. On the other hand, Koren and Peto (2020) investigate reliance of U.S. business on human interaction, based on industry type and geographic location. Similarly, Leibovici et al.(2020) search the extent to which the pandemic shock can impact on contact-intensive industries and its spillover effects to the rest of the economy. Their findings indicate that 51% drop in the demand for goods and services from contact-intensive industries generates a 13% drop in the gross output of low-contact intensive industries and a 24% drop in gross domestic product. In a more comprehensive research project Jorda et al.(2020) investigate rates of return on assets using a large set of data on 15 major pandemics in the past century where more than 100,000 people died. Their findings indicate significant macroeconomic effects of the

pandemics spillover persist for a number of years, after the shock with real rates of return significantly declined. Ludvigson et al. (2020) employed VAR specification to estimate the cost of the covid-19 pandemic for the next few months, while Cochrane (2020) investigates if the recovery from the covid-19- shock will be U, V, or L shaped. Straub and Ulbricht (2013) and Van Nieuwerburgh (2006), show a negative non-pandemic short term shock to output raises uncertainty which in turn lower output level, and that in turn creates more uncertainty. Fajgelbaum et al.(2014) combine this mechanism with an irreversible investment cost, to show a long term impact of transitory shocks on output. Quing He et al.(2020) explore the direct effects and spill-overs of COVID-19 on major stock markets in Asia, Europe and USA. Their findings indicate COVID-19 has a negative but short- term impact on stock markets of affected countries, and its impact on stock markets has bidirectional spill-over effects between Asian countries and European and American countries. Their findings reveal an empirical evidence that COVID-19 has spill-over effects on stock markets of other countries.

The current paper, extend the existing literature on the spillover effect of covid-19 on cross-country stock markets to investigate persistence versus transitory impact of covid-19 shock on major Asian and USA stock markets.

3. Data and methodology:

To estimate the spillover effect of covid 19 pandemic shock on stock markets in China, Japan, USA, and Korea in this paper we employed the impulse response and variance decomposition effects, using daily closing stock prices from the five stock markets: Shanghai (SSE composite index), Hong Kong (Hang Seng Index), the Korean (KOSPI composite index), the Japanese NIKKEI 225, and NASDAQ composite indexe. The data cover the periods May-20-2019 to November-29-2019 (pre covid period) and December-2-2019 to May-18-2020 (covid period), including a sample of 120 observations for each sub-period[2].

[2] The data-source is Yahoo finance: Major World Indices - Yahoo Finance

Impulse response, together with variance decomposition evaluates the impact of shocks transmission across interdependent capital markets. To highlight briefly the impulse response function consider the following VAR process:

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_k y_{t-k} + u_t \qquad (1)$$

Where y_t is nx1 vector of variables, A_0 is an nx1 vector of intercept, $A_t\,(t = 1, \ldots k)$ are nxn matrices of coefficients, u_t is an n dimensional vector of white noise processes. For simplification purposes exogenous variables other than lagged y_t are omitted in the following specifications. VAR process of equation (1) above can be shown to have a moving average (MA) representation as follows:

$$y_t = C + u_t + \emptyset_1 u_{t-1} + \emptyset_2 u_{t-2} + \cdots \qquad (2)$$

Where $C = E(y_t) = (I - A_1 - \cdots - A_k)^{-1} A_0$ and $\emptyset_t$ can be computed from A_t recursively $\emptyset_t = A_1 \emptyset_{t-1} + A_2 \emptyset_{t-2} + \cdots A_k \emptyset_{t-k}$, t=1,2,….and $\emptyset_0 = I$ and

$\emptyset_t = 0 \quad for\ t < 0.$

The moving average coefficients in equation (2), examine the interdependence between variables, or the impulse response function of the ith variable to a shock t periods. For instance, the ijth element of $\emptyset_k$ is the impulse response of the ith variable to a shock t periods ago in the jth variable, given that the effect is isolated from the influence of other shocks in the system. So important issue related to impulse response function is isolation of the effect of a shock on specific variable from the influence of all other shocks, which is obtained thorough orthogonalisation, which is a transformation of the residuals with zero diagonal elements in the covariance matrix (for more details on this issue see Peijie 2009).

4- Empirical Analysis:

Descriptive summary statistics in table (1) show the behavior of daily stock returns, calculated as the closing price differences, for the five stock markets before the pandemic shock during the period from May-20-2019 to November-29-2019, and during the pandemic period from December-2-2019 to May-18-2020. The mean return statistics reflect the impact of covid-19 pandemic on stock markets, by comparing before and after the shock. It is indicating that the three markets that incurred losses (negative returns) during the pandemic are Hong Kong (-17.13), Japan (-25.80), and Korea (-0.92) stock markets, whereas Shanghai and Nasdaq stock markets show a positive mean returns of (0.189) and (5.14) respectively. The paired t-test results show that there is no significant

difference between the mean returns of the five markets before and after the pandemic. Volatility measures of standard deviation indicate during the pandemic period volatility of all five markets decreased substantially compared to volatility before the pandemic. The variance ratio test indicate volatility of stock returns in the five markets differ significantly during the pandemic shock as compared to volatility before the pandemic period. Skewness statistics reveal that all five markets, except Japan stock market, were trending towards losses during the pandemic period. The range statistic indicate among the five markets the least volatile during the pandemic period was Shanghai stock market, and the markets with highest variation of stock returns are Hong Kong, Japan, and Korea stock markets. The range statistic also indicate the pandemic shock generated higher variability of stock returns, compared to the pre-shock period, as the range statistics are substantially higher for all five markets in the period after the shock. Shanghai stocks return variability jumped from (150) to (320) points at the post- crisis period, and for the Hong Kong market the variability was much higher, as it jumped from (1762) to (2203) points, and for Japan, from (907) to (2582) which is the highest range in all five markets. In general, these results indicate evidence of significant shock effect pertaining to covid-19 on these stock markets. Important question we need to investigate in the following is degree of persistence of the shock effect.

Table (1): Descriptive statistic of daily price change

	Shanghai	Hong Kong	Japan	Korea	Nasdaq
Mean (1) Mean (2) T test (paired) p-value	0.189 -0.10 -0.06 (0.94)	-17.13 -6.52 0.25 (0.80)	-25.80 20.05 1.14 (0.25)	-0.92 0.01 0.24 (0.80)	5.14 6.02 0.04 (0.96)
Std.dev (1) Std.dev (2) p-value (3)	3.55 2.14 (0.000)*	36.81 25.03 (0.000)*	35.27 15.6 (0.000)*	3.45 1.50 (0.000)*	20.47 7.08 (0.000)*
Skewness (1) Skewness (2)	-2.04 -0.07	-0.44 0.14	0.25 -0.16	-0.17 -0.55	-0.77 -0.80
Min (1) Min (2)	-229.92 -77.69	-108.94 -767.26	-1128.58 -453.83	-133.56 -51.15	-970.29 -278.03
Max (1) Max (2)	90.6 69.3	1095.9 995.38	1454.3 454.05	127.51 39.72	673.08 176
Range (1) Range (2)	320 147	2203 1762	2582 907	260 90	1643 472

(1) =During the pandemic crisis period; (2) = Before pandemic crisis period.
(3)=H0:variance ratio=1, *significant at 1% significance level.
Source: Stock prices data collected from Major World Indices - Yahoo Finance.

Results of covid-19 shock persistence included in tables (2)-(6) reveal while the shock on some of these markets display short term effect, but on other markets have persistent longer period impact. As indicated in table (2), during covid 19 pandemic period, Hong Kong stock market price behavior influenced by lagged own price changes, as well as shocks originated from Japan and Shanghai stock markets that caused significant persistent impact. However, the influence of covid-19 shock on Nasdaq stock market had short-term impact on Hong Kong stock market behavior. Tables (3 and 4) reveal that shocks originated from Hong Kong, Japan, and Nasdaq stock markets have significant persistent impact on Korea stock market, but for Japan stock market, shocks that originate from lagged own price effect and those originated from Nasdaq have significant persistent impact, but those originated from Hong Kong, Korea, and Shanghai stock markets have short term impact. However, spillover effect of covid-19 shock on Korea and Shanghai have adverse impact on Japan stock market. As for Shanghai and Nasdaq stock markets, lagged own price change display persistent impact on their future stock price behavior, while shocks in Nasdaq stock market have short-term impact on Shanghai stock market. However, transmission effect of shocks at Hong Kong and Korea stock markets have short term adverse impact on Nasdaq stock market. Figures (1 to 8) included in the appendix of the paper also support the above mentioned findings.

Table (2): Hong Kong stock market (HIS)

Stock return	Shocks	Coef.	std Err.	p-valu
Hong Kong	Hong Kong			
	L1.	0.49*	0.16	0.002
	L2.	0.31	0.17	0.075
	Korea			
	L1.	0.16	1.80	0.928
	L2.	-1.87	1.83	0.307
	Japan			
	L1.	0.37*	0.12	0.003
	L2.	-0.10	0.12	0.418
	Shanghai			
	L1.	-2.03	1.11	0.068
	L2.	2.67**	1.09	0.015
	Nasdaq			
	L1.	0.48**	0.21	0.022
	L2.	-0.41**	0.20	0.045
	_cons	171.43	1325.73	0.897

*significant at 1% significance level.**significant at 5% sig.level.

Source: Stock prices data collected from Major World Indices - Yahoo Finance.

Table (3): Korea stock market (KOSPI)

Stock return	Shocks	Coef.	std Err.	p-valu
Korea	Hong Kong			
	L1.	-0.03	0.02	0.065
	L2.	0.03	0.02	0.123
	Korea			
	L1.	0.68*	0.17	0.000
	L2.	-0.07	0.17	0.674
	Japan			
	L1.	0.03**	0.01	0.018
	L2.	0.00	0.01	0.914
	Shanghai			
	L1.	0.01	0.11	0.905
	L2.	0.01	0.10	0.903
	Nasdaq			
	L1.	0.07*	0.02	0.001
	L2.	-0.04	0.02	0.052
	_cons	-47.96	126.47	0.705

*significant at 1% significance level.**significant at 5% sig.level.

Source: Stock prices data collected from Major World Indices - Yahoo Finance.

Table (4): Japan stock market (Nikki 225)

Stock return	Shocks	Coef.	std Err.	p-valu
Japan	Hong Kong			
	L1.	0.06	0.18	0.725
	L2.	0.38**	0.19	0.042
	Korea			
	L1.	-1.13	1.94	0.561
	L2.	-4.21**	1.99	0.034
	Japan			
	L1.	0.88*	0.13	0.000
	L2.	-0.02	0.13	0.901
	Shanghai			
	L1.	-2.33*	1.20	0.053
	L2.	0.83	1.18	0.483
	Nasdaq			
	L1.	0.71*	0.23	0.002
	L2.	0.13	0.22	0.547
	_cons	-752.16	1435.56	0.6

*significant at 1% significance level.**significant at 5% sig level.

Source: Stock prices data collected from Major World Indices - Yahoo Finance.

Table (5): Shanghai stock market

Stock return	Shocks	Coef.	std Err.	p-valu
Shanghai	Hong Kong			
	L1.	0.00	0.02	0.994
	L2.	0.03	0.02	0.116
	Korea			
	L1.	-0.30	0.19	0.12
	L2.	-0.11	0.20	0.585
	Japan			
	L1.	0.01	0.01	0.366
	L2.	-0.02	0.01	0.232
	Shanghai			
	L1.	0.83*	0.12	0.000
	L2.	-0.01	0.12	0.933
	Nasdaq			
	L1.	0.05**	0.02	0.042
	L2.	0.02	0.02	0.294
	_cons	76.42	141.03	0.588

*significant at 1% significance level.**significant at 5% sig level.

Source: Stock prices data collected from Major World Indices - Yahoo Finance.

Table (6): Nasdaq stock market

Stock return	Shocks	Coef.	std Err.	p-valu
Nasdaq	Hong Kong			
	L1.	-0.21**	0.10	0.031
	L2.	0.17	0.10	0.094
	Korea			
	L1.	2.13**	1.06	0.045
	L2.	-2.15**	1.09	0.048
	Japan			
	L1.	0.09	0.07	0.226
	L2.	-0.02	0.07	0.735
	Shanghai			
	L1.	-0.50	0.66	0.449
	L2.	-0.06	0.65	0.929
	Nasdaq			
	L1.	0.49*	0.12	0.000
	L2.	0.44*	0.12	0.000
	_cons	1817.56**	785.29	0.021

*significant at 1% significance level.**significant at 5% sig level.

Source: Stock prices data collected from Major World Indices - Yahoo Finance.

5- Concluding remarks:

This paper investigates the transmission effect of covid-19 pandemic on stock markets behavior in major Asian stock markets, including Shanghai, Hong Kong (SEHK), Japan's Nikkei 225, Korea Stock price index (KOSPI) , and Nasdaq stock market, using impulse response effect to assess persistence of the spillover effect of covid-19 shock on those markets. Results of shock persistence reveal while shocks on some of these markets have significant impact on some markets but they are of short term effect, while on other markets display persistent effect for longer period of time. The difference in covid 19 pandemic transmission effects on stock markets behavior from one country to another could be due to difference in governments interventions scales including *border closures, stay-at-home orders, and gathering restrictions and travelling bans.*

Our finding in the paper indicate that Covid-19 has bidirectional effect among the Asian stock markets under investigation. Hong Kong stock market influenced by shocks originated from lagged own effect, as well as those originated from Japan and Shanghai stock markets which show significant persistent impact due to covid- 19 shock impact, but shocks that originated from Nasdaq stock market have short-term impact. Shocks originated from Hong Kong, Japan, and Nasdaq stock markets have significant persistent impact on Korea stock market, but for Japan stock market, shocks that originate from own lagged effect and those originated from Nasdaq have significant persistent impact, but those originated from Hong Kong, Korea, and Shanghai stock markets have short term impact. However, shocks from Korea and Shanghai have adverse impact on Japan stock market, that is a negative shock have a positive impact on stock returns. Shanghai stock market influenced only by own lagged effect, but shocks in Nasdaq stock market have short-term impact. As for Nasdaq stock market, significant and persistent shocks due to lagged own market effect, but transmission of shocks originated at Hong Kong and Korea stock markets have short term impact on Nasdaq stock market.

These results are consistent with the findings of Hai and Rayana (2021) that indicated *evidence of herding behaviours in Asian and South East Asian stock markets during the pandemic era. The difference in response of these stock markets to each others behavior during the pandemic period, can be attributed to the different policies adopted by each government to curb the spread of the pandemic. However, the same study also indicate evidence of integration of these markets during the onset of the pandemic, compared to the periods before and later in the pandemic, implying stronger and faster transmission of shocks among these markets during the first wave of the disease spread.*

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Appendix

Fig (1): Hong Kong and Japan

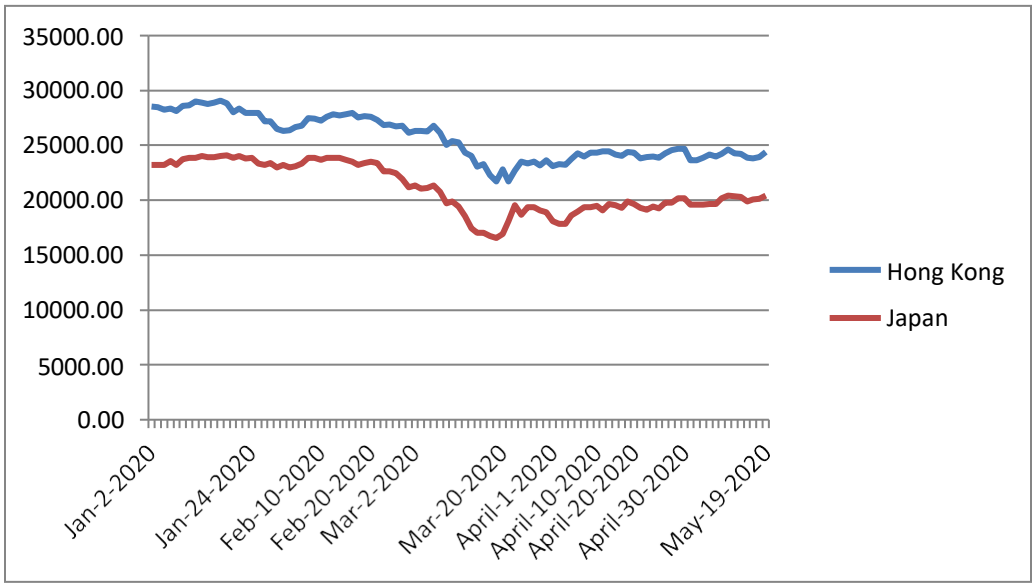

Fig (2): Hong Kong and Nasdaq

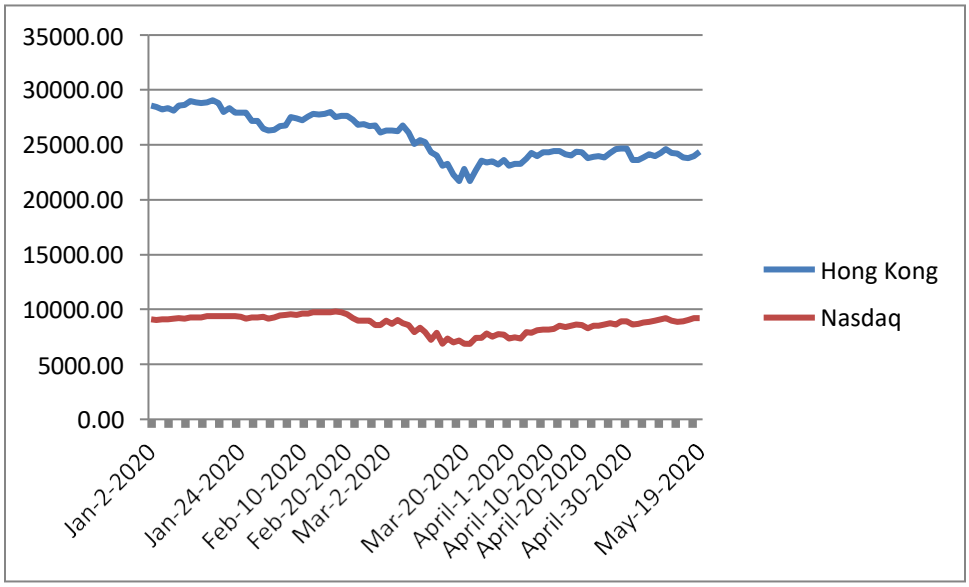

Fig (3):Hong Kong and Shanghai

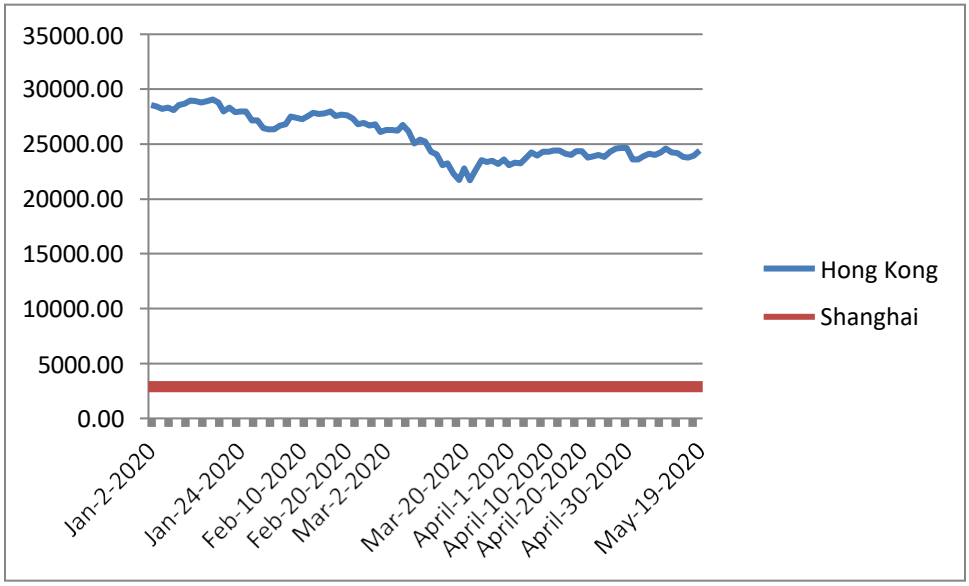

Fig (4):Japan and Shanghai

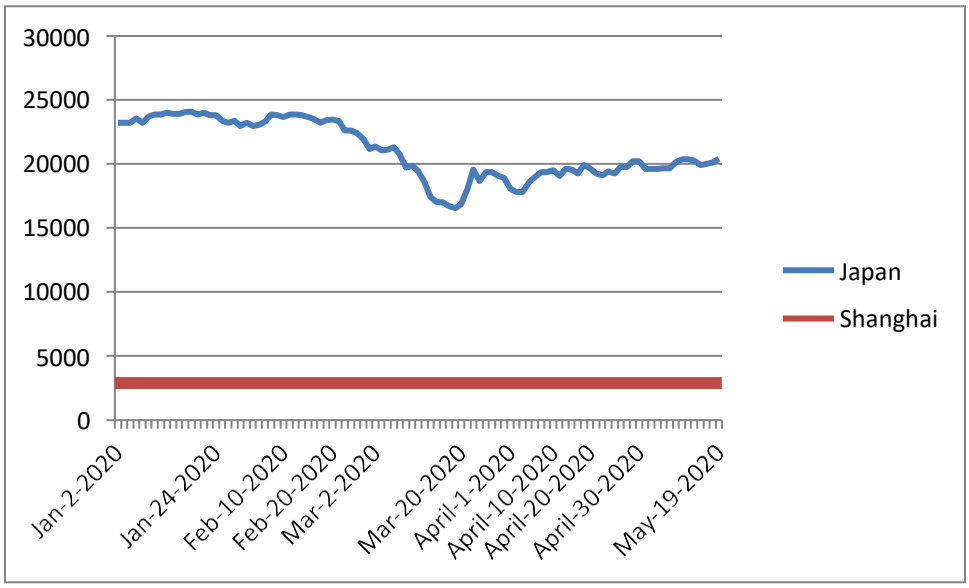

Fig (5) Shanghai and Nasdaq

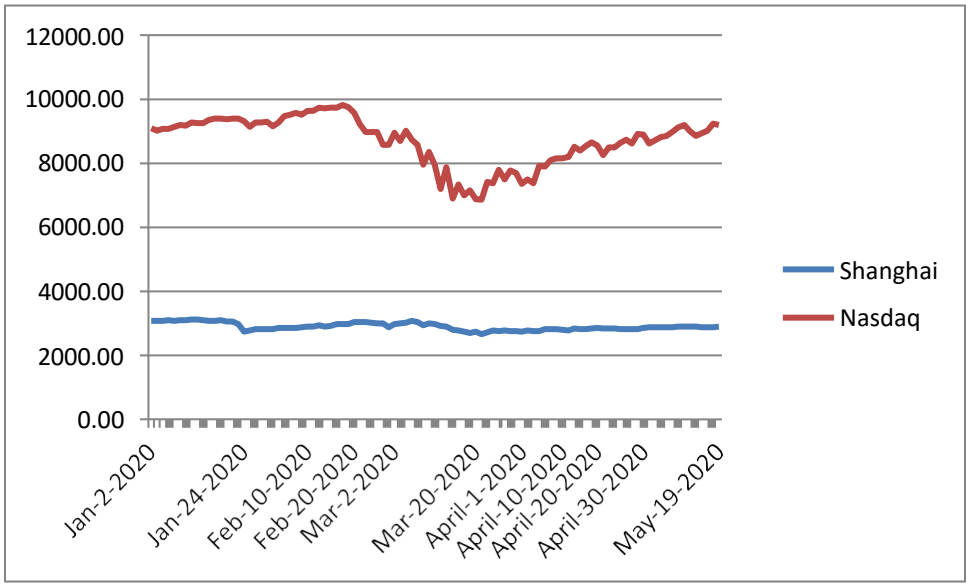

Fig (6) Korea and Shanghai

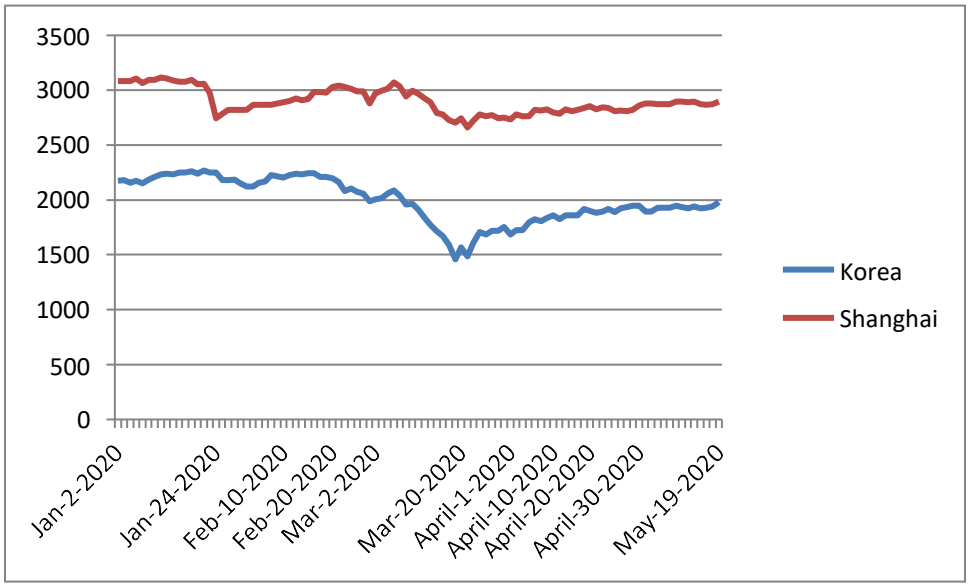

Fig (7): Nasdaq and Korea

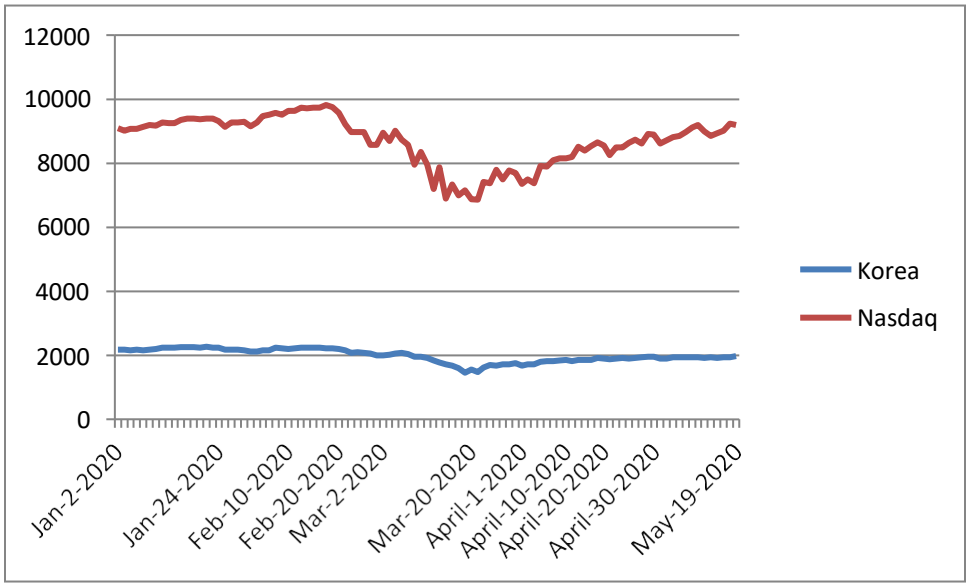

Fig (8): Korea and Japan