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Risk Analysis of World Major Stock Indexes under COVID-19

Maitsetseg Davaasuren
Master's Student, Da-Yeh University, Dacun Township, Changhua County, Taiwan

Abstract: Covid-19 has had an outstanding impact on world stock market volatility. This paper studied how stock index volatility changed during Covid-19. For the purpose of comparison, S&P 500, NASDAQ, DAX, CAC40, Hang Seng and KOSPI data collected from January 2020 to December 2020 from Yahoo finance. Results show that Covid-19 more affected on NASDAQ and S&P 500, however all six indexes were in drastic shock in the beginning of the year. Thus, HANSENG and DAX stabilized from May, KOSPI progressively recovered from September, yet CAC40 in a high fluctuation at the end of the year.

I. INTRODUCTION

The Covid-19 pandemic has brought unpredictable uncertainty as the second wave started, and negative sentiments contributed to an increase in market illiquidity and volatility resulting in the collapse of market stability (Baig, Butt, Haroon, & Rizvi, 2020; Chen, Liu, & Zhao, 2020). Because of the pandemic uncertainty, it becomes difficult to foresee the market prices. Especially, how stock markets around the world reacts to the Covid-19 and it's strong negative returns (Awadhi et al. 2020; Ashraf 2020b; Baker et al. 2020; Ramelli and Wagner 2020; Zhang et al. 2020). For instance, Alfaro et al. (2020) and Ashraf (2020b) found that stock market returns declined in response to local Covid-19 outbreaks for the US and other countries. Zhang et al. (2020) report that European stock markets remain connected during the pandemic and the US stock market failed to take the leading role before and during the outbreak, and industries more exposed to virus transition have experienced deeper stock market crashes (Alfaroet al., 2020). Although a few studies have compared the financial impacts of Covid-19 on different stock markets by applying diverse statistical techniques, no broad study has addressed the impacts on stock market indexes.

The objective of this paper is to analyze market risks of world major stock indexes during the Covid-19 pandemic as attempts to investigate the volatility of S&P 500, NASDAQ, DAX, CAC40, Hang Seng and KOSPI. For the purpose of comparison, the data collected from January 2020 to December 2020 from Yahoo finance.

II. METHOD

Considering the Covid-19 pandemic, this paper chose American (S&P 500, NASDAQ), European (DAX, CAC40), and Asian (Hang Seng, KOSPI) stock indexes for the purpose of outlining the impacts on the global stock market. For instance, DAX and CAC40 represents France and German stock markets, Hang Seng and KOSPI are selected on behalf of Hong Kong and Korean stock markets respectively. These indexes demonstrate the countries that have been impacted by the pandemic. IBM SPSS used to investigate the market volatility to analyze the stock market volatility during the Covid-19. The Markov Switching (MS) regime AR model (Mina Glambosky, 2020) used to determine structural changes in stock volatility. Calculate daily volatility of S&P 500, NASDAQ, DAX, CAC40, Hang Seng and KOSPI. The formula is as follows:

$$Volatility = (TP - MP)/(2 \times (TP + MP)), \quad (1)$$

where TP is the daily highest trading price and MP is the daily lowest trading price. Thus, time series of volatility for six stock indexes are generated.

III. EMPIRICAL RESULTS

This paper utilizes unit root test to detect whether stock index volatility time series are stationary or not. Time series data of S&P 500, NASDAQ, DAX, CAC40, Hang Seng and KOSPI are shown in Figure 1. The horizontal axis represents weekly dates and the vertical axis represents weekly volatility.

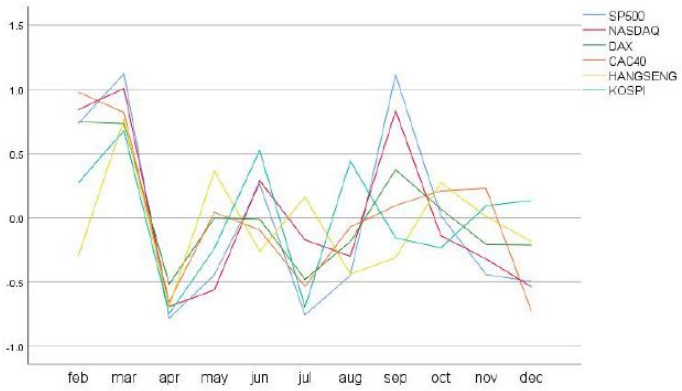

Figure 1. Monthly volatility line chart of all indexes

It is obvious that all six indexes had drastic fluctuation in the beginning of the year however HANGSENG, DAX are stabilized from the second term. Furthermore, S&P 500 and NASDAQ were in high volatility whereas CAC40 got high fluctuation at year end and KOSPI stabilized from September.

Table 1. Summary of descriptive statistics of stock index volatility

Stock index	Mean	Std. Deviation	Skewness	Kurtosis	Critical Value			p-value
					99%	95%	90%	
S&P500	814.999	582.707	2.249	6.263	1337.436	1185.233	1117.090	0.001
NASDAQ	2817.336	1565.445	1.872	4.608	4220.865	3811.972	3628.905	0.000
DAX	3491.243	1482.493	1.486	3.219	4820.400	4433.174	4259.808	0.000
CAC40	1406.973	735.821	1.693	4.059	2066.688	1874.492	1788.443	0.000
HANG SENG	5676.636	2063.742	1.287	1.914	7526.923	6987.875	6746.536	0.000
KOSPI	517.375	203.588	2.288	5.955	699.906	646.729	622.921	0.000

The p-values of S&P 500 is 0.001, NASDAQ, DAX, CAC40, Hang Seng and KOSPI are all zero, suggesting that stock index volatility is stationary. As stated by the summary of descriptive statistics, stock index volatility of S&P 500, NASDAQ, DAX, CAC40, HANGSENG and KOSPI are right-skewed fat-tail distribution, hence there is no normal distribution.

CONCLUSION

The outbreak of the Covid-19 pandemic has brought great uncertainty on global stock markets and to a major increase in volatility. For the purpose of finding out the impact of Covid-19 on Global stock market indexes, this study chose S&P 500, NASDAQ, DAX, CAC40, Hang Seng and KOSPI. According to unit root test all six indexes faced high volatility in the beginning of the year but HANGSENG and DAX stabilized until the end of the term. On the other hand, S&P 500 and NASDAQ had high volatility during the year where the fluctuation of CAC40 increased and KOSPI volatility stabilized at the end of the year.

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