Araştırma Makalesi / Research Article

TESAM Akademi Dergisi

Journal of TESAM Academy

ISSN 2148-2462 / E-ISSN 2458-9217

Covid-19's Fever on Financial Markets in China: The Interaction Between Foreign Exchange Market and the Stock Market

Çin Finansal Piyasalarında Covid-19 Ateşi: Döviz Piyasası ve Hisse Senedi Piyasası Arasındaki Etkileşim

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Cilt / Issue: 9(2), 683-701
Geliş Tarihi: 04 09. 2021
Kabul Tarihi: 10.03.2022

Atıf: Kahraman, S. ve Sarıyer, G. (2022). Covid-19's fever on financial markets in China: The interaction between foreign exchange market and the stock market. *Tesam Akademi Dergisi*, 9(2), 683-701. http://dx.doi.org/10.30626/tesamakademi.991071

Abstract

Although the effects of the COVID-19 pandemic on economies are different, financial markets have followed a similar path. Financial economy approaches reveal that the financial markets of the countries will be affected primarily as a result of an external shock. Accordingly, in an external effect, the stock markets of developing countries or the exchange rate market are affected in the first stage, and this effect spreads to the other market in the second stage. The study investigates the preliminary impact of the pandemic on the Chinese stock market and foreign exchange market covering data on COVID-19, relations between epidemic statistics (daily numbers of new cases and new deaths) by comparing the pre-pandemic and post-pandemic periods by performing Pearson correlation analysis. Moreover, box plots are comparatively presented to show the daily distributions of the SSEC index and CNY exchange rate. Because the determination of the first affected market will guide policymakers in terms of eliminating the high volatility and risk factor in the markets. The results show that there is a significant interaction between the two markets and that neither market behaves randomly. This link is very important for determining macroeconomic policies against a random walk. The main research question of the article is whether monetary policy interventions have a positive effect on increasing the efficiency of financial markets. The findings of the study indicate that even the stock prices follow random walk, due to the EMH the source of the price movement is seen informative. It can be said that the Chinese money market is now in an upward trend due to the relative decrease in uncertainty and pessimistic expectations in the following period.

Keywords: COVID-19, Foreign Exchange Market, Stock Market, Random Walk, Efficient Market Hypothesis (EMH).

Jel Codes: F31, E41, F61, F37.

Öz

COVID-19 pandemisinin ekonomiler üzerindeki etkileri farklı olsa da finansal piyasalar benzer bir yol izlemiştir. Finansal ekonomi yaklaşımları, eklenmeyen bir dış şok neticesinde ülkelerin öncelikle finans piyasalarının etkileneceğini ortaya koymaktadır. Bu doğrultuda, dışsal bir etkide ilk aşamada gelişmekte olan ülkelerin borsaları veya döviz kuru piyasası etkilenmekte ikinci aşamada ise bu etki diğer piyasaya sıçramaktadır. Çalışma, pandemi öncesi ve pandemi sonrası dönemleri karşılaştırarak, pandeminin Çin borsası ve döviz piyasası üzerindeki ön etkisini COVID-19 verileri ve ilgili istatistikler (günlük yeni vaka sayısı, yeni ölüm oranları), Pearson korelasyon testi uygulayarak araştırmaktadır. Ayrıca, SSEC index ve CNY döviz kurlarının günlük dağılımları karşılaştırmaları olarak box plotlar ile gösterilmiştir. Zira ilk etkilenen piyasanın belirlenmesi, piyasalardaki yüksek volatilitenin ve risk unsurunun giderilmesi anlamında politika yapıcılara yol gösterici olacaktır. Sonuçlar, iki piyasa arasında önemli bir etkileşim olduğunu ve her iki piyasanın da rastgele davranmadığını göstermektedir. Bu bağlantı, rastgele bir yürüyüşe (random walk) karşı makroekonomik politikaları belirlemek için oldukça önemlidir. Para politikası müdahalelerinin finansal piyasaların etkinliğini artırmada olumlu etkisinin olup olmadığı makalenin temel araştırma sorusudur. Araştırmaların bulgularına göre, her ne kadar hisse senedi fiyatları rastgele yürüyüşe göre hareket etse de, Etkin Piyasa Hipotezinin dayandığı gibi, bilgiye dayalı bir fiyat hareketi olduğu görülmektedir. İzleyen süreçte belirsizliğin nispeten azalması ve kötümser beklentiler nedeniyle Çin para piyasasının artık yükseliş eğiliminde olduğu söylenebilir.

Anahtar Kelimeler: COVID-19, Döviz Piyasası, Borsa, Rastgele Yürüyüş, Etkin Piyasa Hipotezi (EMH).

Jel Kodları: F31, E41, F61, F37.

Introduction

The novel coronavirus disease (COVID-19) pandemic has a crucial influence on global economies. Although studies on the impact of the pandemic on human health and improving the treatment process are prioritized, the effects that the countries will have on the economy are also significantly concerned. The second-generation crisis models developed by Obstfeld (1986, 1994) indicates that uncertainty and pessimist expectations of the economic decision-making units are the main problems in a weak macroeconomic condition. As the traditional sources of financial volatility and crisis, these problems may lead to an increase in speculative behaviours in financial markets.

After the financial liberalization, financial markets have become substantially more integrated which indicates that the contagion linkages across markets. In financial economics, third generation models of crises which can be dubbed as a contagion models try to identify that the which fundamentals lead the contagion. The contagion or spread effect of the change in the economy occurs in more than a single economy, driven by the pandemic has led to supply shock. The supply side of the economy was closed its doors or reduced its production or operations to protect itself. This may intensify the downward movements in the monetary economy as well as the real economy. As the spread of the disease and consumers stay at home, producers have faced falling aggregate demand levels which may lead to a decrease in the value of stocks. So that, investors expect that the disease may lead to decrease stock returns by dampening economic activity, capacity usage ratio, and production level, etc. Thus, investors have fled from emerging market assets to safe havens such as US Treasury bonds, etc.

The attention of international investors and portfolio managers was mainly focused on stock markets as a barometer of an economy. China Stock Exchange as the world's second-largest is known as one of the best performing stock markets among the emerging markets. This study contributes to the existing literature on the following aspects. First, to the best of our knowledge, this paper is a pioneer study on analysing the preliminary effects of the COVID-19 pandemic from economic aspects. Second, this paper extends previous works by providing random walk theory to explain the behaviour of the stock market and exchange market. In this study, we investigate the effects of the pandemic on the Shanghai Composite Index (SSEC) of China's Stock Market and foreign exchange rate (CNY) by comparing the pre-pandemic and post-pandemic

periods. We consider the random walk theory in finance to explain the behaviour of the financial market in China. Another aim of this paper is to explain the monetary policies to reduce financial volatility against the pandemic. The paper is organized as follows. The second section explains the theoretical approaches of the study while the third section provides empirical literature. In the following sections data, modelling, methodology, and empirical results are given. Finally, the last section provides a conclusion and discussion.

From Random Walks to Efficient Market Hypothesis (EMH)

Theoretical studies mainly consider the transmission mechanism in financial markets. The flow-oriented approach (Dornbusch, 1976 and Dornbusch and Fischer, 1980) and the portfolio-balance approach (Branson et al., 1977) posit theoretical linkage between stock exchange market and foreign exchange market. The first approach focuses on the current account or international trade balance and suggests that higher stock returns are correlated with currency depreciation. On the other hand, the second approach focuses on the portfolio diversification between foreign currency and domestic currency-denominated assets (Frankel, 1983).

Among other financial markets, the stock market is the first and highly affected component by economic and non-economic factors. In this paper, we assume that the spread effect transfers from the stock market to the foreign exchange market. So that, parallel to the above-mentioned theoretical framework on the linkage between two financial markets, we also consider the random walk theory to explain the behaviour of SSEC index value and the exchange rate (CNY). Policymakers would like to know the movement of stock markets as well as the foreign exchange market to determine the policy implications against random walk (Kiran and Rao, 2019).

The Efficient Market Hypothesis (EMH) first theorized by (Bachelier, 1900), states that the stock prices fully reflect all available information at any time. Therefore, stock prices are random and not influenced by past information. Hence, no investors can predict the price movements to earn excess profit inefficient market (Fama, 1965, 1970). This phenomenon is called the Random Walk Theory, named after the book "A Random Walk Down Wall Street" written by American economist Burton G. Malkiel (1973). This theory advocates a long-term "buy and hold" strategy. According to this strategy in practice, investors should diversify their portfolios to reduce the risk. The main criticism of the theory noted

that markets follow the same trend over time, in other words, it is possible to outperform the market without assuming additional risk. However, stock markets consist of a larger number of investors who have different investment behaviours to affect the market trend in the short run. The empirical studies support that the emerging market economies are more inefficient than the developed countries. Therefore, the appropriate macroeconomic policies may lead to a more efficient market (Karamchandani et al., 2014).

In financial economics, the EMH is linked with the random walk hypothesis to indicate the price movement which the change in price level randomly departures from the previous price level. The main idea behind the price movement is based on the flow of information (Malkiel, 2003). The known information is also included in the past movement of stock prices and its'returns wich do not follow random walks. The EMH also refers to informative efficiency, so that the information rapidly direct effect stock prices. However, stock price forecasting is very hard cause of today's stock price changes reflected by today's news, independent from the price of the day before which can be explained by the source of random walk (Gumus and Zeren, 2014).

Literature Review

Recent financial literature sparked a growing interest in the effect of non-economic variables on the interaction between two key actors of financial markets: the stock exchange market and the foreign exchange market. This issue has been examined by a large body of literature presents some examples of the causality and volatility between stock index exchange rates. Early empirical studies cover mostly the developed countries rather than emerging market economies. Gavin (1989) developed the model based on Tobin (1978) to evaluate the impact of monetary policy and fiscal policy on the stock market and exchange rate dynamics. The author states that even the stock market reduces the impact of monetary policy on the exchange market if there is a strong feedback relation between aggregate demand, the policies run in the opposite direction. Ayaji and Mougue (1996) perform an error correction model (ECM) to investigate the intertemporal relation between the stock market index and exchange rate for eight developed economies. The results indicate that a negative relationship between stock prices and the value of the domestic currency in the short run while a positive relationship is found in the long run. Another empirical study that focuses on these countries the UK and the USA is a study of Dimitrova (2005). The author applies

a multivariate short-run open economy model over the period between January 1990 and August 1994. The findings of this work suggest that a weak association and inverse relationship between the stock market and exchange rate exist. Ülkü and Demirci (2012) investigate the dynamic linkage between the stock market and foreign exchange market of eight European economies. They find that a strong correlation between the two markets is mainly driven by the depth level of the stock market and the dependence on foreign capital.

Moreover, after the 1997 Asian crisis economists focus on Asian countries rather than developed countries. Granger Huang and Yang (2000) is one such study to investigate the causal relationship between exchange rate and stock market for seven Asian economies from January 3, 1986, to June 16, 1998. The author's point of that causality runs from exchange rates to stock markets for Korea and found causality in an opposite way for the Philippines. The authors also show that there is a strong correlation between two market variables for the data of Hong Kong, Malaysia, Singapore, Thailand, and Taiwan while no interaction exists for Indonesia and Japan. In the Asian context, Ayaji, Mehdian, and Friedman (2008) explore the interaction between exchange rate and stock market for eight Asian emerging market economies by comparing advanced economies. The Granger causality test results indicate that causality runs from the money market to the stock market in Korea, and the reverse is found for Indonesia and the Philippines while no significant association exists between the variables for Malaysia, Singapore, Hong Kong, and Thailand. One another study Andreou et al. (2013) examines the linkage between the stock market and foreign exchange market in twelve emerging economies. The result of a vector autoregressive model with Generalized Autoregressive Conditional Heteroskedasticity (VAR-GARCH) in this study, indicates a significant bidirectional spillover effect between two markets. Additionally, an analysis of the interaction between stock exchange market and exchange rate market can be found in the works of Fama (1981), Solnik (1987), Nieh and Lee (2001), Staverek (2005), Li and Rose (2008), Inci and Lee (2014), and Naresh et al. (2018).

On the other hand, examining the test market efficiency has been a subject of research for quite a while. Although, there is no consensus regarding whether emerging economies or developed economies, most studies support that the financial market efficiency changes over time such as Brenner (1977), Malkiel (2003), Timmerman and Granger (2004), Lee et al. (2010), and Lee et al. (2014).

Empirical Study

Data

As well known, the money market is a rapidly influenced component of the economy. As the two main components of financial markets, the foreign exchange market and the stock market variables are examined in this study. The major stock market index namely the Shangai Composite Index – SSEC representing the stock market of China and the exchange rate of the Chinese yuan (CNY) in terms of the U.S. dollar are used. The data sources are the International Financial Statistics-IMF Data and CEIC. Data on COVID-19 statistics are obtained from situation reports documented by the World Health Organization (WHO, 2020). Daily statistics on new confirmed cases and new deaths are used.

The research includes five months of data from the beginning of November 2019 to the end of March 2020. This study period is divided into two in this research. The first period is labeled as "before" and covers the period of November 2019 to January 23, 2020. The critic day January 20, was the indicator of this selection. Thus, the "before" period is used to show the characteristics and relationships of the exchange rate and index value in China before and just the initial days of coronavirus' human-to-human transmission. Since the stock market is closed after January 23, until February 3, the second period, labeled as "after", covers the dates between February 3, to March 27 (to cover the whole week's data from Monday to Friday). Thus, the "after" period is used to identify how to index value, exchange rate, and the relation between them are affected by the coronavirus epidemic in China.

Research approach

SSEC index values and CNY exchange rates (%) are descriptively analyzed in "before" and "after" periods comparatively. The relation between the exchange rate and the index value is assessed by Pearson correlation analysis for both of the "before" and "after" periods to observe if the magnitude of the relationship is affected by the epidemic. For the second period, covering data on COVID-19, relations between epidemic statistics (daily numbers of new cases and new deaths), index value, and exchange rate are also investigated. Figural representations on daily values of the SSEC index and CNY exchange rate are comparatively shown for "before" and "after" periods. For investigating how daily distributions of index value and exchange rates are changed with the epidemic, box plots on these data are comparatively presented for "before" and "after"

periods for each weekday.

Empirical findings

Main descriptive statistics on index value and exchange rate are summarized for "before" and "after" periods comparatively in Table 1.

Table 1

Descriptive statistics on SSEC and CNY

Variable	Period	mean	std. dev.	min.	1st quartile	median	3rd quartile	max.	skew.	kurt.
Index Value	before	2980.4	76.6	2872.0	2909.7	2977.6	3054.3	3115.6	0.28	-1.34
	after	2895.4	112.2	2660.2	2784.8	2911.5	2990.5	3071.7	-0.39	-1.06
Exchange rate (%)	before	6.99	0.05	6.86	6.97	7.00	7.03	7.07	-1.08	0.22
	after	7.00	0.05	6.93	6.98	7.00	7.02	7.11	0.76	-0.06

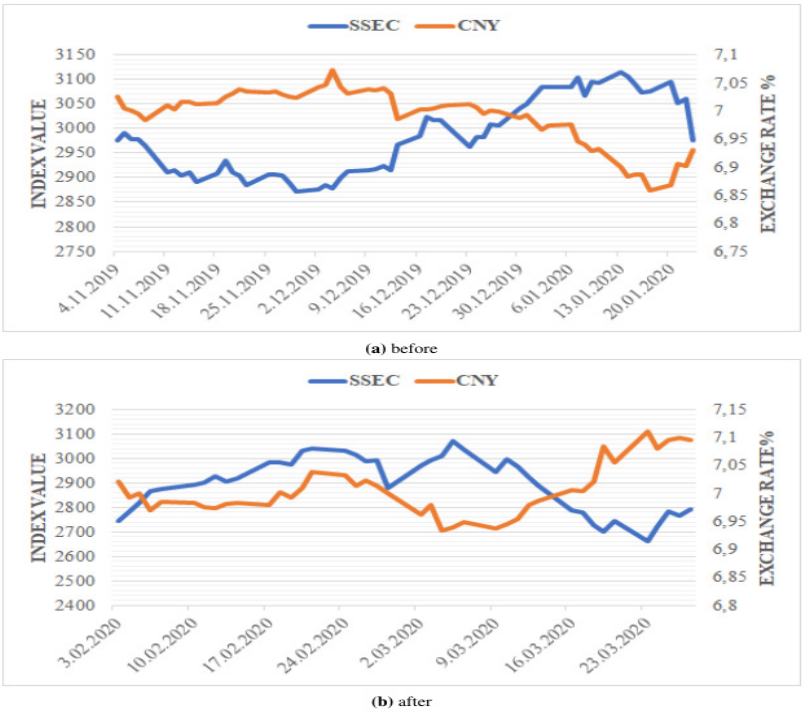
Source: IMF and CEIC

According to the presented statistics in Table 1, it is mainly observed that while index values are sharply decreased in the "after" period, the volatility in index values is increased. Besides, while index values are right-skewed in the "before" period, skewness shifts to left in the "after" period showing that distribution on index values is also affected by the coronavirus epidemic. While some amount of increase is observed in exchange rates, the volatility is not seemed to be significantly affected by the epidemic. On the other hand, the distribution of exchange rate is observed to be changed; while exchange rate distribution is left-skewed in the "before" period, it seems to have a right-skewed distribution in the "after" period.

Figure 1 shows daily index values and exchange rates in "before" and "after" periods respectively.

Figure 1

Daily values of SSEC and CNY



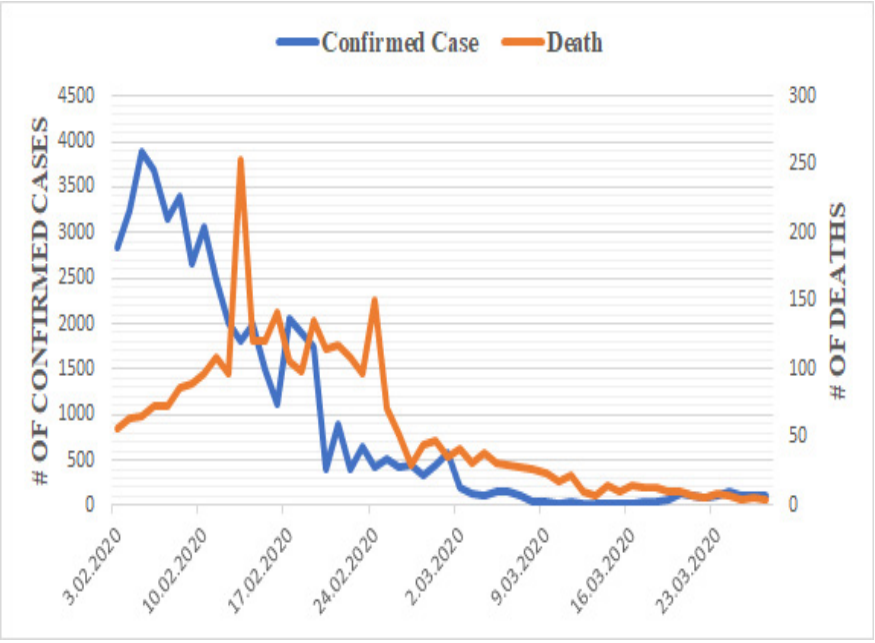
Source: IMF and CEIC

Figure 1 shows that index value and exchange rate changes inversely in general for both of the "before" and "after" periods. Please note that the first few days of human-to-human transmission of coronavirus, namely January 20 to 23, are evaluated in the "before" period and this effect is seen in Figure 1a, where index values begin to decrease and exchange rates begin to increase in these last days of this period. An increase in the value of the stock index has a negative short-run impact on the value of the domestic currency (CNY), likely due to pessimist expectations. This view of the exchange rate movement posits that the money demand is driven. Figure 1b, representing the "after" period, decrease in index values are generally observed in comparison with the "before" period. In addition, the difference between the two lines is seemed to sharpen in the "after" period. As can be seen in the above-mentioned figure, domestic currency appreciation harms the stock index movement.

The coronavirus was first detected in the city of Wuhan, China on December 31, 2019. Later then on January 20, China's National Health Commission confirmed human-to-human transmission of the coronavirus. On March 11, the World Health Organization (WHO) characterized COVID-19 as a pandemic published the first report on the issue. According to the WHO by 26 March 2020, COVID-19 had led to more than 81,394 confirmed infections and 3,295 deaths in China (WHO, 2020). The considered documented statistics on coronavirus are also represented in Figure 2. Thus, the results of Figure 1b, representing index values and exchange rates in the "after" period" should be interpreted collectively with epidemic statistics.

Figure 2

Daily numbers of new cases and deaths (February 3 - March 27)



Source: WHO

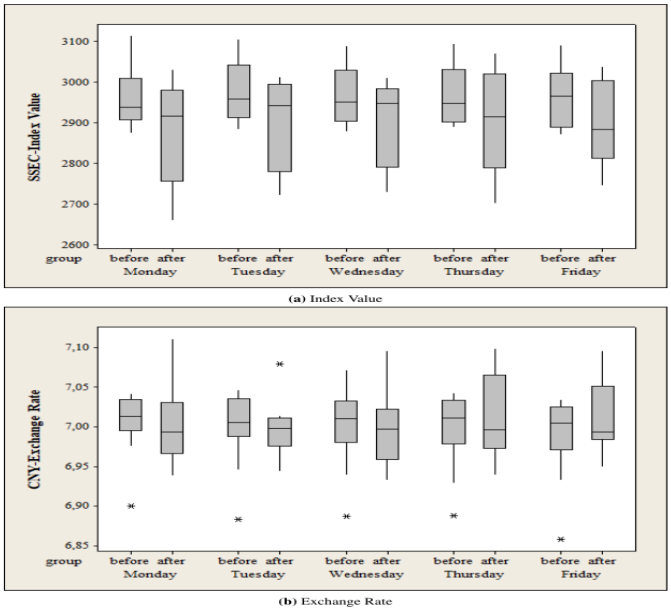
According to Figure 2, it is observed that daily statistics on cases and deaths are higher in the first days of February, several new cases make a peak on the 5th of February, and several deaths make a peak on the 13th of February. Since the last days of February 2020, the death rates began to decline in parallel to confirmed cases. These statics then starts to

decrease. In the first days of March, numbers on new cases are counted in decimals or just in one hundred. Similarly, starting from half of March, several deaths are counted in units of one-tenth. The decreases and stabilization on COVID-19 statistics reflect financial data, where index values started to increase and exchange rates started to decrease in the last days of March. Thus, a contagion of the COVID-19 pandemic behaves differently than a contagion of financial distress.

Figure 3 represents the distribution of index values and exchange rates for each day of the week in "before" and "after" periods comparatively. The figure also explains how investors responded to the pandemic during the weekdays.

Figure 3

Index value and exchange rate distribution for days of the week



Source: IMF and CEIC

Based on the box plots shown in Figure 3 following results are obtained. Firstly, distributions of index values are highly affected by the epidemic for each day of the week. For Monday through Thursday while the index value has right-skewed distributions in the "before" period, it is observed to have left-skewed (Monday through Wednesday) or symmetric

(only for Thursday) distributions in "after" periods. However, just the opposite result is seen on Friday, while the index value has a left-skewed distribution in the "before" period, the distribution shifts to the right in the "after" period. So that the SSEC index value was closed sharply higher on Wednesday, and following positive returns was seen from the financial shares. After the pandemic, since a strong recovery from Friday's massive panic sell-offs on Monday, the SSEC index is currently in an upward trend.

For exchange rates, such a comparison does not hold for each weekday. Specifically, for Thursday and Friday, significant changes are observed in distributions of exchange rates, namely while distributions are left-skewed for these days in the "before" period, they are highly shifted to the right in the "after" period. It is also seen that the effects of outliers are almost eliminated in the "after" period compared to the "before" period, which shows that exchange rate values are stabilized after the epidemic. Because of the high-risk level of money markets, investors respond to any change very rapidly by trading or managing their portfolios.

Tables 2 and 3 show the results of correlation analyzes between the considered variables.

Table 2

Correlation between index value and exchange rates

period	correlation coefficient (r)	significance (p-value)
before	-0.839	0.000
after	-0.649	0.000

Source: IMF and CEIC

Table 3

Correlation between COVID-19 and financial data (daily)

Pairwise data		Correlation results	
COVID-19	Financial	coefficient	p-value
# of new cases	index value	-0.056	0.734
	exchange rate	-0.215	0.183
# of deaths	index value	0.396	0.011
	exchange rate	-0.240	0.136

Source: IMF and CEIC

Table 2 shows that CNY-exchange rates and SSEC-index values are significantly and negatively correlated in both of the "before" and "after" periods. However, a decrease is observed in the magnitude of the correlation in the "after" period, showing that epidemic effects on behaviors of financial indexes. No significant association is observed between COVID-19 statistics and the CNY-exchange rate. According to the random walk hypothesis, the findings indicate that there is a random walk in financial markets. However, due to the idea of EMH which the movement of stock price is based on the flow of information. This result is in line with our previous findings, showing that although the epidemic causes some changes in exchange rates, these changes are not so significant, meaning that exchange rates are more robust to this epidemic. However, the index value cannot be able to robust with the epidemic. Significant changes are observed in index values in reaction to several deaths, where such a significant change is not observed on index values in reaction to several new cases. This result should be interpreted as an increase in the number of deaths creates a higher panic in economic decision-making units and investors in comparison with the number of new cases, because these players are aware that recovery rates for new cases are high and this should decrease their concerns.

2020 China Stock Market Crash

The Covid-19 pandemic began in China bringing financial distress as it rapidly spread to the financial markets. The pandemic resulted in speculation, pessimist expectations, and uncertainty which led to increasing the volatility spill overs.

As the second-largest stock market in the world, China's stock market investors are dominated by retail that's relatively wealthy investors. China shares have faced the biggest sharp fall in the last four years. Since the pandemic began, capital outflows are as large as the financial crisis such as the 1997 Asian crisis (Lanau and Fortun, 2020). Due to the pandemic, a negative speculative bubble is seen in the stock market when investors expect that the stock prices will fall on subsequent days. International investors appear to have begun pricing behaviour in the last week of December. Later then on the China Stock Exchange was closed on 23 January by four trading days and reopened on 3 February. The reopening sent a relatively positive signal to the financial markets. As new information arrives, the WHO March 11 announcement on COVID-19 as a pandemic, the stock market entered a bear market. After that, the stock market equilibrium shifts to another decline phase by falling about

20 percent of its peak value relative to the previous month. The average on March 18, the SSEC index value dropped by less than 1 percent. On March, 19, the SSEC index reached above 2,780 points (SSEC, 2020). The SSEC index closed about an 8 percent daily drop. Since 6 March 2020, due to the pessimist expectations of the stock market investors, a sharp decline occurs. In more detail, stock prices of mainly service industries and manufacturing industries have experienced a sharp decline while stocks of healthcare producers have gone up by 10 percent. This level of stock market volatility is not seen since the 2011 Eurozone Sovereign Debt Crisis. The dept of the pandemic and the weakening of domestic currency has increased risk aversion. The forecast of the investment companies on China's Stock Exchange is now more optimistic. This might reflect relatively strong macroeconomic fundamentals.

Conclusion and Policy Implications

Stock Markets are the most volatile financial markets and the stock is known as the riskiest investment instrument. As the novel coronavirus spread all over the world, the virus represents the source of systemic risk by financial markets. The forecast of the economic impact of COVID-2019 is hard because of the rapid spread and uncertainty of the disease. In this case, the stock market movements provide valuable information to observe the behaviour of the aggregate economy. Since the first case was reported, stock market investors worried about the liquidity level and corporate debt even most companies are well-capitalized in China. Other major determinants, which affect the investors' behaviour are that the zero interest rate announcements of FED on government bonds, exchange rates, and other monetary and commodity prices such as oil and gold.

Defining the relationship between the stock exchange market and the exchange rate market is important for a few reasons. First, the way of relationship directly affects the policy implications and the decisions of macroeconomic policies on both monetary and fiscal. Second, the interaction between these markets may help for forecasting mainly the value of domestic currency which may lead to reducing the volatility in exchange rates. This will benefit multinational corporations and international trade companies that are dominated in the Chinese economy. Third, currency and stock are the key investment instruments. If the path of the stock index and the exchange rate is known, this may reduce the risk probability for international portfolio investors and investment companies (Ayaji and Mougoue, 1996). Most importantly, establishing the interaction between the stock exchange market and

foreign exchange market may reduce uncertainty and volatility as the main source of financial distress.

China's monetary and fiscal authorities implemented several economic policies to encourage the market efficiency. Even the China Stock Exchange has faced a sharp decline, and it is not clear how long the recovery period might last, many investors remain optimistic. The People's Bank of China (PBOC) conducted to open market operation tool. The Central Bank of the Republic of China (CBC) intervenes in the exchange rate by changing the repo rate to support the money supply (Reuters, 2020). The increase in money supply causes domestic currency (CNY) to depreciate. According to the monetary transmission mechanism, an increase in money supply led to a decrease in interest rate then led to an increase in investment level, and finally which in turn aggregate demand. This expansionary monetary policy accelerates economic activity with the support of the stock market that has a positive impact on aggregate demand while excess money supply may cause inflation. This process provides an overview of the theory of capital market inflation. A large proportion of fund inflow is taken out by government securities and corporate securities. In this process, the price level rise in the market has caused to accelerate the demand of financial investors. Thus, the impact of such changes, the cut the interest rate causes an increase in expenditure in an economy (Toporowski, 1999).

Overall, our study briefly explains the reaction of the SSEC Index value and the CNY exchange rates to the COVID-19 pandemic. The results suggest that the China SSEC-Shanghai Composite Stock Market rapidly responds to the coronavirus of the economic consequence. The regulatory authorities are still monitoring the impact of a pandemic on global economies to stabilize the financial markets. Now, the unknown answer is how long and how deep that pandemic distress is on the global economy. In the upcoming period, financial and macroeconomic instability could continue to grow as a result of the recession.

Declaration

In all processes of the article, TESAM's research and publication ethics principles were followed.

There is no potential conflict of interest in this study.

The authors declared that this study has received no financial support.

The authors contributed equally to the study.

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