ISSN 2962-9179
e-ISSN: 2962-9179
UJoST
Universal Journal of Science and Technology

The Effects of the COVID-19 Pandemic on the Philippine Stock Exchange Index

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Abstract

This paper investigated the effects of the COVID-19 pandemic on the Philippine Stock Exchange Index from January 31, 2020 to January 31, 2022 using Robust Least Squares Regression and Augmented Dickey-Fuller (ADF). This study explored the correlation patterns between the increasing number of weekly COVID-19 infections to the Philippine Stock Exchange Index in order to determine the risk of extreme volatility in the Philippine Stock Exchange Index. Furthermore, this study examined the short and long-run effects of COVID-19 weekly infections prior to the fluctuations of the Philippine Stock Exchange Index. This article will significantly help investors understand and further analyze the effects of the pandemic on the volatility of the Philippine stock exchange index.

Keywords:
Coronavirus; COVID-19 Pandemic; Philippine Stock Exchange; Robust Least Square Regression; Augmented Dickey-Fuller

1. Introduction

The novel coronavirus or widely known as COVID-19 struck the Philippines on January 30, 2020, on which day the first case was reported. Domestic diseases are affected by the country's economic activity and value chains, lowering demand across the board. Uncertainty over the virus' spread and the degree of aggregate demand might harm the country's stock market

ISSN 2962-9179
UJoST
e-ISSN: 2962-9179
Universal Journal of Science and Technology

and increase its volatility. The increased uncertainty is being reflected in lower valuations and increased volatility in the financial markets affecting business investment, household consumption, and international trade (Boon et al., 2020; Wren-Lewis, 2020; Ramelli & Wagner, 2020).

This study examined the effects of the COVID-19 pandemic on the Philippine Stock Exchange. In addition, this study explored the relationship patterns between the increasing number of weekly COVID-19 infections to the Philippine Stock Exchange Index in order to determine the risk of extreme volatility in the Philippine Stock Exchange Index, subsequently, this study explored short and long-run effects of COVID-19 weekly infections prior to the fluctuations of the Philippine Stock Exchange Index.

This study chose this topic in view of the fact that the spread of the virus has brought uncertainties to the Philippine economy specifically in the PSEi. In line with this, this study discovered evidence to prove that weekly COVID-19 infections have effects on the dependent variable. Furthermore, this study wanted to know the short and long-run effects of rising COVID-19 infections as well as the relationship between the two variables using an econometric approach as it will establish patterns suggesting the association between the number of COVID-19 weekly infections, and the Philippine stock exchange index. This study discovered evidence of causation running from COVID-19 weekly infections to the Philippine Stock Exchange Index, and the study guided analysts and stockholders to change certain concepts to develop better outcomes that are worse than usual. Significantly, helped investors to understand and further analyze the effects of the pandemic on the volatility of the stock exchange index. The purpose of this study is to interpret the relationship patterns of an increasing number of weekly virus infections to the stock index which may greatly affect the investment of a lone stockholder.

There is very limited prior literature on how pandemics affect financial markets. This study, therefore, made an important contribution to this literature. Chen et al. (2009) and Loh (2006) found that the Severe Acute Respiratory Syndrome outbreak negatively affected sectors

ISSN 2962-9179
UJoST
e-ISSN: 2962-9179
Universal Journal of Science and Technology

like aviation, tourism, wholesale, and retail. About the COVID-19 outbreak, Zhang et al. (2020) showed that the pandemic has resulted in a significant increase in global financial market risks.

2. Literature Review

2.1. COVID-19 Impact on Stock Markets

Anh and Gan (2020) investigated the impact of the COVID-19 outbreak and subsequent lockdown on daily stock returns in Vietnam. According to the study, the daily increasing number of COVID-19 cases has a negative impact on stock returns in Vietnam. Rabhi (2020) investigated the emerging Asian stock market's vulnerability to pandemics. The results showed that the reported daily growth of Covid-19 confirmed cases along with the triggering fear event related to news about death, affected the Asian stock markets performance negatively. He et al. (2020) investigated the stock prices of industries that responded to the pandemic which had a negative impact on stock prices on the Shanghai Stock Exchange while having a positive impact on stock prices on the Shenzhen Stock Exchange. COVID-19 had a negative and serious impact on China's traditional industries, but it also created opportunities for the development of high-tech industries. The pandemic had a significant impact on the transportation, mining, electric, and heating industries, as well as the environment. Palma et al. (2020) investigated the effects of the COVID-19 pandemic on the daily prices of five IPO companies listed on the Philippine Stock Exchange, particularly with regard to how each company responded to the pandemic. The study's findings were that 4 out of 5 consumer and goods companies' stock values are negatively impacted by COVID-19 cases, fatalities, and recoveries. Topcu and Gulal (2020) revealed that the outbreak's negative impact on emerging stock markets has waned and begun to taper off by mid-April. When the countries are grouped by region, Asian emerging markets are found to be the most affected, whereas the influence in Europe is little. This study found a negative and statistically significant impact of the coronavirus on emerging stock markets until April 10, with a relatively higher magnitude during March. However, when they extended the period to April 17, the impact turned out to be insignificant, which is the case for the full sample as well. Zehri (2021) showed that indirect spillovers on the Chinese stock market are heavier than direct

ISSN 2962-9179
e-ISSN: 2962-9179
UJoST
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spillovers, and impacts deluge only via Hong Kong. The study contrasted spillover features of the US COVID-19 shock and the 2015 Chinese crisis. Furthermore, the results showed a large spillover effect from the US to East Asian stock markets. Compared to the tranquil period, these spillovers become stronger in COVID-19. Kumarapperuma et al. (2021) examined the impact of COVID-19 on the stock market of 15 Asian countries representing developed, emerging, and frontier markets. In the South Asian Journal of Business Insights 38, the study specifically examined the effect of COVID-19 on certain markets' stock returns while examining the correlation between confirmed COVID-19 cases and stock returns. The event studied empirical findings showed that anomalous returns following the event day were negative, and it is clear that the COVID-19 outbreak significantly impacted the stock returns of a few Asian stock exchanges. Yousaf et al. (2021) studied how gold performed in thirteen Asian stock markets (China, Japan, India, Indonesia, Hong Kong, Pakistan, Taiwan, South Korea, Singapore, Philippines, Thailand, Vietnam, and Malaysia) during the incredibly turbulent COVID-19 sub-period as a safe haven, hedge, and/or diversifier. The findings on strong/weak safe-haven assets revealed that gold secures investors and portfolio managers from losses during the COVID-19 outbreak in a few of the Asian stock markets. During the COVID-19 sub-period, most Asian stock markets' hedging efficacy is higher.

A glance at the financial market revealed that the coronavirus has resulted in a volatile economy. This event had a significant impact on both the world and Indonesian economies, particularly the stock market. This is due to the fact that investor behavior varies as a result of the information they get. Stock market returns are influenced by important occurrences (Al-Awadhi et al., 2020). Zhang et al. (2020) aimed to portray the general patterns of country-specific risks and systemic risks in the global financial institutions. The present results show that global financial market risks have increased substantially in response to the pandemic. Individual stock market reactions are linked to the severity of the outbreak in each country. The great uncertainty of the pandemic and its associated economic losses had caused markets to become highly volatile and unpredictable. Uddin et al. (2021) investigated how this pandemic affected stock market volatility and if economic strength, as determined by a number of specific country-level economic features and factors such as economic resilience, the intensity of capitalism, level

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UJoST
e-ISSN: 2962-9179
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of corporate governance, financial development, monetary policy rate and quality of health system, can potentially mitigate the possible detrimental effect of the global pandemic on stock market volatility. The findings have confirmed the effect of fear arising from the severity of a global pandemic on global stock markets. Diaz et al. (2022) looked at how news about reproductive numbers influences volatility in stock markets around the world and discovered that when the reproductive number is more than one, which suggests the disease's spread should accelerate, it has a positive and significant impact on volatility. The results showed that volatility is more (less) sensitive to reproductive numbers when the pandemic is in a high-contagion (low-contagion) state. Ibrahim et al. (2020) investigated the correlation between COVID-19, governmental responses, and stock market volatility for 11 developed and developing economies in the Asia-Pacific region. Most countries in this study perceived government intervention measures positively, reducing market volatility. Extreme and stringent government measures, on the other hand, may be counterproductive and increase market volatility.

COVID-19 embodied the fear of the unknown and is the father of all fears that have engulfed global financial and economic institutions. This study argued further that it is anxiety that drives not only governments but even businesses to act. By the time governments have reacted and, as a result, companies have reacted without much choice, individuals have no space to react; they become "reaction takers." The theories of investor underreaction and overreaction, therefore, guided our interpretation of the behavior of stock prices. (Daniel, Hirshleifer, and Subrahmanyam 1998; Hong and Stein 1999; Hong, Torous, and Valkanov 2007). Liu et al. (2020) discussed the result of their study that the stock markets in major afflicted countries and localities declined sharply after the viral outbreak. In comparison to other countries, Asian countries had greater negative anomalous returns. Further panel fixed effect regressions back up the negative influence of COVID-19 confirmed cases on stock indices aberrant returns via an effective channel that combines investors' pessimism about future returns and fears of uncertainty. Market psychology is the dominant emotion of financial market buyers and sellers at any given time. Greed, fear, expectations, and circumstances all contribute to market psychology. The tendency of these states of mind to cause periodic "risk-on" and "risk-off" cycles in financial markets, or boom and bust cycles, is well documented (Samsul, 2006).

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External events can have an impact. on the economy, and affect investor sentiment (Liu et al., 2020; Khanthavit, 2020). Altig et al. (2020) examined several measures of economic uncertainty before and during the COVID-19 pandemic and showed that the pandemic and its economic fallout lack close historic parallels in at least two respects: First, the suddenness and enormity of the massive job losses and, second, the severity of the economic contraction relative to the size of the mortality shock. The unprecedented scale and nature of the COVID-19 crisis helped explain why it has generated such an extraordinary surge in economic uncertainty. Wren-Lewis (2020) claimed that the COVID-19 pandemic would significantly impact countries' GDP due to reductions in production and consumer demand. Additionally, if banks were unable to supply the financial demands of businesses owing to declining demand, stock markets all over the world would crash. Khan et al. (2020) examined the impact of the COVID-19 pandemic on the stock markets of 16 nations and discovered that the rate of weekly new COVID-19 cases negatively predicts stock market returns. The study found that investors in these countries did not react to COVID-19 media reports during the early stages of the pandemic. However, once human-to-human transmission was established in both short- and long-event intervals, stock market indices reacted negatively to the news. Khanthavit (2020) indicated that the COVID-19 pandemic had caused tremendous economic damage to all countries throughout the world. This paper investigated if and how damages are reflected in stock price changes. The study discovered strong unfavorable market reactions to the sickness based on event study assessments of global and national stock returns. More crucially, it demonstrates that the emotions were triggered by extensive media coverage of the sickness, rather than by changing events or situations. The results were significant negative Abnormal Returns (ARs), and Average Abnormal Returns (AARs) for the various COVID-19 events, and their extensive media coverage led the study to conclude that the world and national stock markets reacted negatively to COVID-19. Adnan (2022) examined the effects of local COVID-19 detection announcements on major Asian capital markets. The study revealed that the epidemic had changed investors' emotions, causing them to become anxious and panicky about their investments. The epidemic has caused market uncertainty, which has weakened investor confidence and led to varying degrees of market volatility, depending on the severity of the pandemic in the area.

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e-ISSN: 2962-9179
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Chaudhary et al. (2020) revealed that during the COVID period, all market indices had daily negative mean returns (January 2020 to June 2020). Though all market indices with altered strengths have recovered in the second quarter of the COVID period, volatility remains higher than in typical periods, reflecting a bearish trend in the market. He et al. (2020) analyzed that COVID-19 had a negative but short-term influence on the stock markets of the eight impacted countries, according to data from the domestic chronology and the timeline of the selected countries. COVID-19's impact on stock markets has bidirectional spillover effects between Asian, European, and American countries. Furthermore, there is no evidence that COVID-19 has a detrimental influence on the major stock indices in these nations when compared to the S&P 1200 Global Index, except for China in the short event window of the domestic timeline. Yousef (2020) examined the impact of the novel coronavirus on the standard deviations of the returns for the key G7 (world's 7 advanced economies) indices of the study. The group also looked at how the daily number of new cases and the daily growth rate of new instances affect the standard deviations of these index results. The regression analysis revealed that COVID-19 has a considerable positive impact on the standard deviations of index returns. Furthermore, both the daily number of new cases and the growth rate in daily new cases have a considerable favorable impact in this regard. Yilmazkuday (2020) examined the impact of coronavirus disease 2019 (COVID-19) cases in the United States based on the S&P 500 Index data from December 31, 2019 to May 1, 2020. The findings showed that a one percent increase in the total number of daily COVID-19 incidents in the U.S. causes a cumulative decline in the S&P 500 Index of about 0.01 percent after a day and about 0.03 percent after a month. A historical breakdown of the S&P 500 Index revealed that the majority of the negative impact of COVID-19 cases in the United States on the S&P 500 Index occurred in March 2020. Alam et al. (2020) investigated the impact of COVID-19 on the stock market of India from February 24 to April 17, 2020. The results revealed that the market responded favorably throughout the lockout period, as evidenced by significantly positive Average Abnormal Returns (AAR). Investors responded favorably since they expected the lockdown; but, prior to the lockdown, investors panicked and had negative AAR.

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e-ISSN: 2962-9179
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AlAli (2020) examined the effect of the WHO announcement declaring COVID-19 as a global pandemic on stock market returns of the largest five Asian stock markets. Results showed a negative effect of the WHO announcement on market abnormal returns and there was a statistically significant difference between market returns before and after the announcement. Baek and Lee (2021) investigated how much daily COVID-19 news as measured by the daily death rate and the COVID-19 recovery rate in the United States contributes to daily stock market volatility in the United States. The US stock market return volatility is found to be dependent on both its previous shocks and prior COVID-19 shocks. The group also showed that the volatility spillover effect between the US stock market and the COVID-19 news exists. More particularly, they discovered that the volatility of the COVID-19 mortality rate (i.e., bad news) has a significant and beneficial impact on stock market volatility, while the volatility of the COVID-19 recovery rate has a negative impact. Gormsen and Koijen (2020) showed that news regarding fiscal stimulus raises the stock market and long-term growth, but has little effect on increasing expectations for short-term growth. Baker et al. (2020) analyzed that no past infectious disease outbreak caused daily stock market fluctuations that even remotely resemble the past month's response to COVID-19 developments. Sutrisno et al. (2021) examined the impact of COVID-19 on six stock market indexes of countries listed on ASEAN Exchanges and three stock market indexes of countries listed on ASEAN Exchanges which have sectoral indices of consumer products and property. The study found that all the variables tested had a highly significant degenerating long-term relationship due to the impact of the COVID-19 pandemic. There was an ARCH or GARCH effect in all stock market indexes in ASEAN Exchanges affected by the COVID-19 pandemic, and there was a relationship between the COVID-19 pandemic event and the return on the country's stock market index and which for the consumer products and property sector in the ASEAN Exchanges with heterogeneity.

Ozili and Arun (2020) found that while the level of economic activity was unaffected by the rising number of verified coronavirus infections, it was positively impacted by transportation restrictions and increased fiscal policy investment. Verma and Gustafsson (2020) emphasized the importance of an urgent policy response from the government to face the change caused by the global pandemic. The authors pointed out the necessity of proactive and forward-looking

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e-ISSN: 2962-9179
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business strategies and economic policies. The findings of the study will help governments and policymakers to investigate various country-level factors that may be of use to cope with the situation. Doidge et al. (2007) mentioned that country-level factors are more important than firm-level factors in ensuring discipline in the economy. Therefore, faced with economic turmoil due to the global pandemic, governments and policymakers can emphasize the adoption and implementation of the right economic policies by using a set of economic factors that they have shown to be effective. Alzyadat and Asfoura (2021) examined the impact of the COVID-19 pandemic on the Saudi Arabia stock market and concluded that the stock market in KSA responded negatively and strongly during the early periods of the COVID-19 pandemic, then the response began to decline. The stock markets are responding quickly to the COVID-19 pandemic, but this response varies over time according to the stage of the pandemic. However, the Saudi government's response time and size of the stimulus package have played an important role in alleviating the impacts of the COVID-19 pandemic on the stock market. La and Miranti (2021) investigated the impact of various government interventions on the spread of COVID-19 as well as stock markets in South-East and East Asia. According to the study, stricter actions including gathering bans, postponed public events, and mask regulations drastically lessened the pandemic's severity in the area.

Cua (2021) investigated the impact of COVID-19 pandemic on the stock markets of China, the United States, and the Philippines. The study concluded that pandemics, such as COVID-19, have a devastating impact on economics around the world, with markets experiencing a sharp decrease during the pandemic's outbreak. Ibrahim et al. (2020) investigated the effects of the COVID-19 crisis on public health and the associated government measures on the volatility of the respective domestic equity markets. This study analyzed the effects of these events on domestic equity markets as the national health crisis emerged in alongside with some major international events, such as the Market Crash 2020 caused by the oil disagreement and the pandemic declaration. The paper extends to the evidence that the public health issue and government policies have a major impact on market volatility in our sample countries. International events, on the other hand, did not touch all countries. As a result, misinterpreting the effects of the national health crisis over financial contagion or spillover arguments may

ISSN 2962-9179
e-ISSN: 2962-9179
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Universal Journal of Science and Technology

mislead asset allocation strategies used by traders. Most countries in this analysis perceived government intervention measures favorably, reducing market volatility. Extreme and stringent government efforts, on the other hand, may be unproductive and increase market instability.

3. Research Method

3.1. Augmented Dickey-Fuller (ADF)

The majority of economic time series data had unit roots, indicating that their means and variances are not time-invariant. If this is the case, a univariate series is said to be non-stationary and cannot be used in regression with other non-stationary univariate series due to the risk of biased and misleading results. The only exception to this rule is when the unit-roots of all variables' time series data are identical.

The Augmented Dickey-Fuller (ADF) test is the most commonly used unit root test. The ADF test (Dickey and Fuller, 1979, 1981) is used to determine the order of integration of our series, allowing us to infer the number of unit roots contained in each variable (Coughlan, 2014). The following is the basic equation for testing the stationarity of a time series:

$$\Delta x = \alpha_o + \alpha_1 t + \beta x_{t-i} + \Sigma\varphi\Delta x_{t-i} + \varepsilon_t$$

Where the first difference of the series, Δxt, is regressed against the lagged values of its original level series, time, and itself. The series is said to be stationary if the estimated value is less than the MacKinnon critical values. It is otherwise non-stationary and therefore has a unit root. The augmented portion of the test is designed to correct for any serial correlation in the variable.

3.2. Robust Least Square Regression

The model for estimation takes into account the functional form that follows:

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e-ISSN: 2962-9179
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PSEI = f (COVID)

Where PSEI is the Philippine Stock Exchange weekly adjusted closing index. The variable has been logarithmically transformed for the convenience of parameter estimation: LOG(PSEI). Weekly data from January 31, 2020 to January 31, 2022 were obtained online from the websites of the World Health Organization (WHO) and The Wall Street Journal. Before estimating the robust least squares regression, correlation analysis must be used to establish the relationship between the variables. The degree of association between the number of COVID-19 weekly infections and the Philippine stock market index is analyzed using the coefficient of correlation. The independent variable will be the COVID-19 Pandemic (Number of Weekly Infections of the Virus). Meanwhile, the dependent variable will be the Philippine Stock Exchange Index.

The relationship of the variables should first be established using correlation analysis before estimating the robust least squares regression. That is, the degree of the link between the number of COVID-19 weekly infections and the index of the Philippine stock market was tested using the coefficient of correlation. The method of robust least squares regression is designed to be robust, or less sensitive, to outliers. This study applied the method of MM-estimation (Yohai, 1987) to address outliers in both the dependent (LOG(PSEI)) and the independent variables (LOG(COVID)). Therefore, the regression models of interest are:

$$\square\square\square\square\square\square\square_{\square} = \square_0 + \square_1\square\square\square\square\square\square\square\square_{\square} + \square_{\square}$$

4. Results and Discussion

4.1. Historical Trends of Variables

Figure 2 Weekly Covid-19 Cases (January 31, 2020- Jan 31, 2022)

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e-ISSN: 2962-9179
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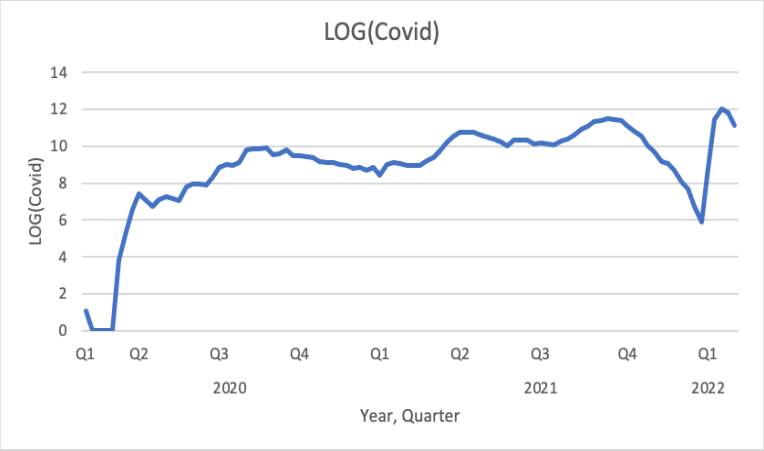

Figure 2 shows the weekly number of COVID cases per quarter from 2020 to 2022. The effect of the WHO announcement declaring COVID-19 as a global pandemic on the stock market showed a negative effect of the WHO announcement on market abnormal returns and there was a statistically significant difference between market returns before and after the announcement (AlAli, 2020). In the first quarter of 2020 it was announced by the World Health Organization that there are a few covid-19 cases. Starting the second quarter of 2020, we can see a significant increase of covid-19 cases (LOG(Covid) until the third quarter of 2021. Meanwhile, at the start of the fourth quarter of year 2021 we can see a significant decrease of covid-19 cases. On the contrary, after easing the lockdown in the Philippines it significantly increased going to the first quarter of 2022.

Figure 3 Weekly Financial Sector Adjusted Close (January 31, 2020- Jan 31, 2022)

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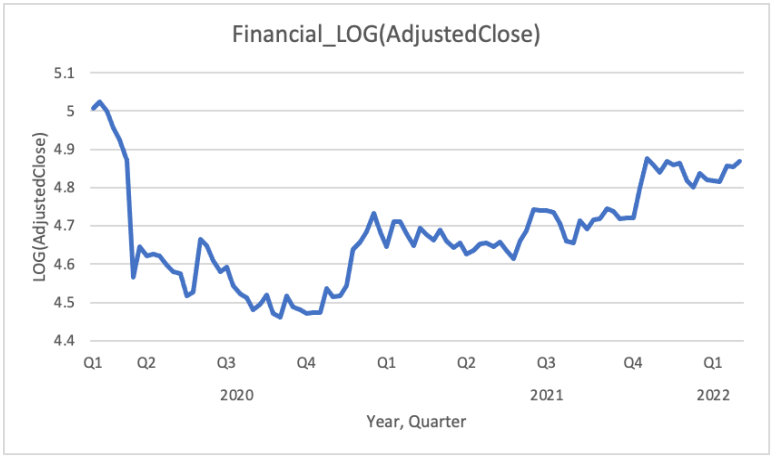

Figure 3 shows the movement of stocks present in the PSE involving financial industries. It shows that in the first quarter of 2020 the adjusted close of stocks was at its highest since the amount of COVID cases was still few. As time passes and the cases rise, we can see a very significant drop from the first quarter to second quarter until the fourth quarter of 2020. From then on, the movement of the financial sector has been slowly recovering and the trend of its sector is gradually increasing starting the fourth quarter of 2020 until the first quarter of 2022.

Figure 4 Weekly Industrial Sector Adjusted Close (January 31, 2020- Jan 31, 2022)

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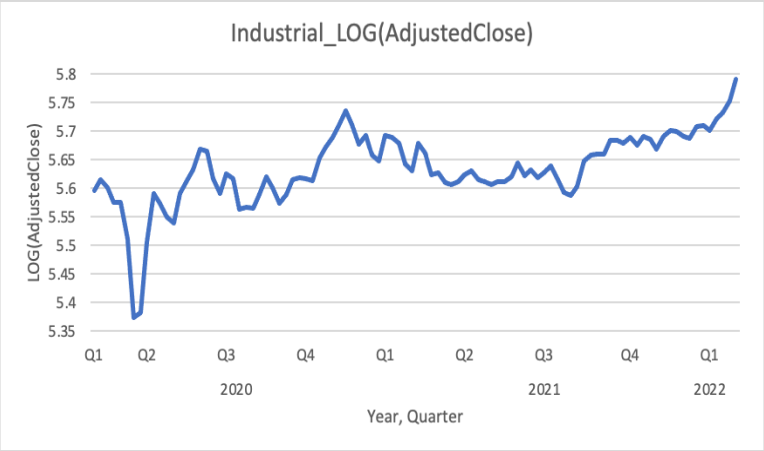

Figure 4 shows the movement of stocks present in the PSE involving industrial companies. We can see that in the first quarter of 2020 it was in mid-level then it dropped by a big amount as it reached quarter 2 since that is when the cases began to rise even to a point higher than the first quarter of 2020. The stocks then quickly rose after the second quarter of 2020 and maintained a slightly continuous trend upwards until the start of 2022.

Figure 5 Weekly Holding Firm Sector Adjusted Close (January 31, 2020- Jan 31, 2022)

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Figure 5 shows the movement of stocks present in the PSE involving the holding firm sector. We can see that in the start of 2020 it was in a higher level compared to a big drop when it reached quarter 2 since that is when the cases began to rise even to a point higher than the first quarter of 2020. The stocks then gradually rose after the second quarter of 2020 since the holding firm sector was not affected negatively by the COVID-19.

Figure 6 Weekly Property Sector Adjusted Close (January 31, 2020- Jan 31, 2022)

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Figure 6 shows the movement of stocks present in the PSE of companies involved in properties. At the start of the first quarter of 2020, it can be seen that the stock was at its highest point then dropped by a significant amount during the rise of COVID cases which is in quarter 2. From then on, the stocks moved erratically but made a rise again at the end of 2020.

Figure 7 Weekly Service Sector Adjusted Close (January 31, 2020- Jan 31, 2022)

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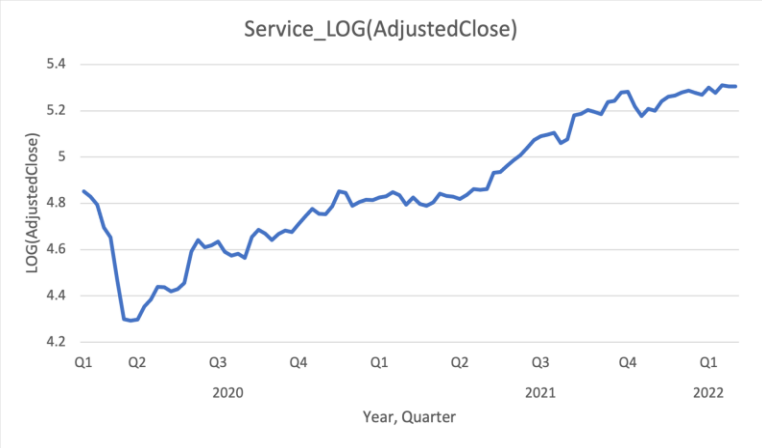

Figure 7 shows the movement of stocks present in the PSE of companies involved in services. In the start of 2020, the stocks were in mid-level but significantly dropped in quarter two due to COVID cases. As time passed, the stocks began to rise again. It can be seen that the stocks rose continuously up until the last quarter of 2021 and the start of 2022.

Figure 8 Weekly Mining & Oil Sector Adjusted Close (January 31, 2020- Jan 31, 2022)

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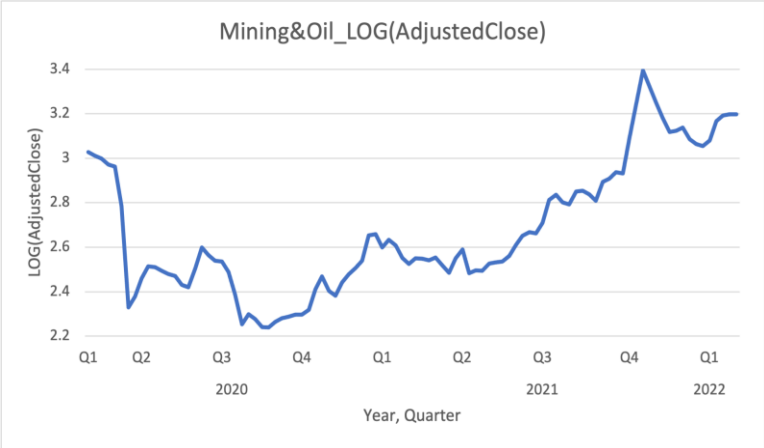

Figure 8 shows the movement of stocks present in the PSE of companies involved in mining and oil. As expected, the stocks of the companies dropped at the beginning of the spread of COVID-19 cases. As time passed, the stocks began to move erratically but are maintained at a low level compared to the normal. The stocks began to rise again by quarter 3 of 2021 until the end of quarter 4 of 2022.

4.2. Augmented Dickey-Fuller Test (ADF)

Table 3: ADF Unit Test Results

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Augmented Dickey-Fuller test for l_Financial_AdjustedClose testing down from 11 lags, criterion AIC sample size 97 unit-root null hypothesis: a = 1 with constant and trend including 0 lags of (1-L)l_Financial_AdjustedClose model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e estimated value of (a - 1): -0.130308 test statistic: tau_ct(1) = -3.55511 asymptotic p-value 0.03376 1st-order autocorrelation coeff. for e: -0.075	Augmented Dickey-Fuller test for l_Industrial_AdjustedClose testing down from 11 lags, criterion AIC sample size 92 unit-root null hypothesis: a = 1 with constant and trend including 5 lags of (1-L)l_Industrial_AdjustedClose model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e estimated value of (a - 1): -0.194109 test statistic: tau_ct(1) = -2.72162 asymptotic p-value 0.2276 1st-order autocorrelation coeff. for e: -0.154 lagged differences: F(5, 84) = 7.697 [0.0000]	Augmented Dickey-Fuller test for l_HoldingFirm_AdjustedClose testing down from 11 lags, criterion AIC sample size 94 unit-root null hypothesis: a = 1 with constant and trend including 3 lags of (1-L) l_HoldingFirm_AdjustedClose model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e estimated value of (a - 1): -0.195211 test statistic: tau_ct(1) = -3.11665 asymptotic p-value 0.1023 1st-order autocorrelation coeff. for e: 0.002 lagged differences: F(3, 88) = 1.673 [0.1787]
Augmented Dickey-Fuller test for l_Property_AdjustedClose testing down from 11 lags, criterion AIC sample size 94 unit-root null hypothesis: a = 1 with constant and trend including 3 lags of (1-L)l_Property_AdjustedClose model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e estimated value of (a - 1): -0.205144 test statistic: tau_ct(1) = -4.04253 asymptotic p-value 0.007568 1st-order autocorrelation coeff. for e: 0.003 lagged differences: F(3, 88) = 4.683 [0.0044]	Augmented Dickey-Fuller test for l_Service_AdjustedClose testing down from 11 lags, criterion AIC sample size 87 unit-root null hypothesis: a = 1 with constant and trend including 10 lags of (1-L)l_Service_AdjustedClose model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e estimated value of (a - 1): -0.167793 test statistic: tau_ct(1) = -2.09924 asymptotic p-value 0.5457 1st-order autocorrelation coeff. for e: -0.016 lagged differences: F(10, 74) = 1.953 [0.0511]	Augmented Dickey-Fuller test for l_Mining&Oil_AdjustedClose testing down from 11 lags, criterion AIC sample size 95 unit-root null hypothesis: a = 1 with constant and trend including 2 lags of (1-L)l_Mining&Oil_AdjustedClose model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e estimated value of (a - 1): -0.114183 test statistic: tau_ct(1) = -3.51191 asymptotic p-value 0.03805 1st-order autocorrelation coeff. for e: -0.019 lagged differences: F(2, 90) = 6.857 [0.0017]

The Augmented Dickey-Fuller (ADF) test is the most commonly used unit root test. The ADF test (Dickey and Fuller, 1979, 1981) is used to determine the order of integration of our series, allowing us to infer the number of unit roots contained in each variable (Coughlan, 2014). In Table 3: ADF Unit Test Results, the asymptotic p-value obtained from the Financial, Property, and Mining & Oil sectors are 0.034, 0.008, & 0.038, respectively. Therefore, these sectors obtained less than 5% significance level, which means that we reject the null hypothesis . On the other hand, Industrial, Holding Firm, and Service sectors obtained 0.228, 0.102, & 0.546, respectively. Therefore, these sectors obtained more than 5% significance level, which means that we fail to reject the null hypothesis.

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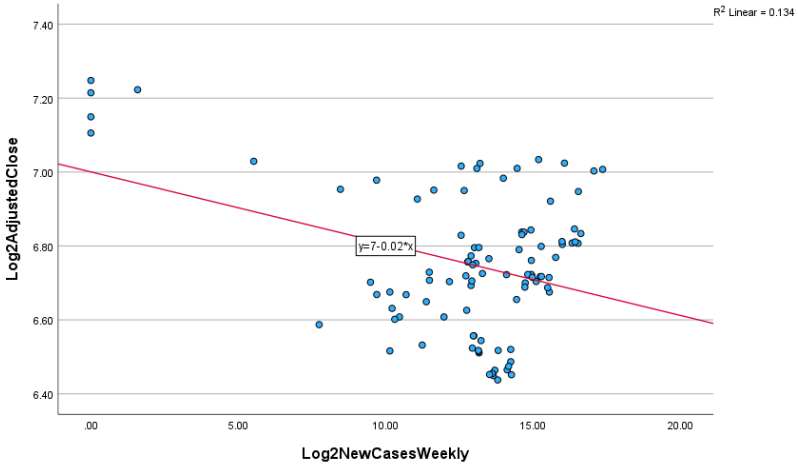
4.3. Robust Least Squares Regression

Figure 9: Scatter Diagram Log(Covid) Against Log(Financial_AdjustedClose)



The method of robust least squares regression is designed to be robust, or less sensitive, to outliers (Yohai, 1987). Initially, it is determined whether the variables show any degree of correlation. The scatter plots in Figure 9 further verify the calculated paired correlations (r). The shown correlation patterns established a negative linear correlation between the Philippine stock exchange index - Financial sector (Log(Financial_AdjustedClose)) and the number of COVID-19 weekly infections (COVID). The correlation coefficient of 0.134 indicates that PSEI and COVID have a strong negative association. Financial market revealed that the coronavirus has resulted in a volatile economy. This event had a significant impact on both the world and Indonesian economies, particularly the stock market. This is due to the fact that investor behavior varies as a result of the information they get. Stock market returns are influenced by important occurrences (Al-Awadhi et al., 2020). It is projected that rising COVID-19 infection rates will cause the Philippine Stock Exchange - Financial sector to decline.

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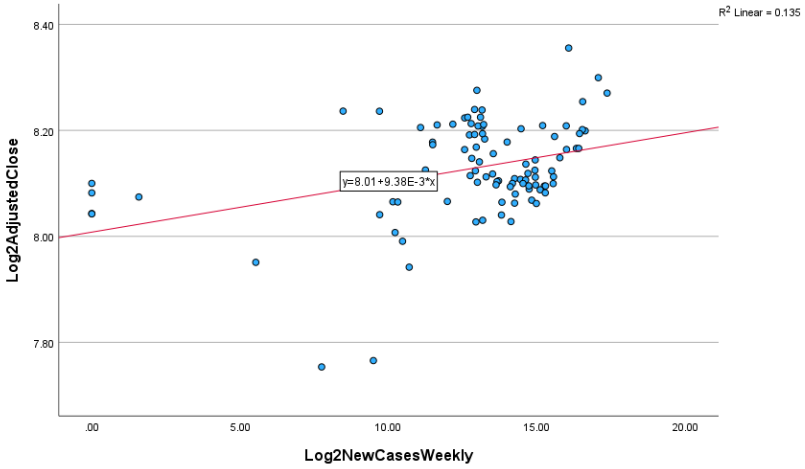
Figure 10: Scatter Diagram Log(Covid) Against Log(Industrial_AdjustedClose)



The shown correlation patterns in Figure 10 established a positive linear association of the Industrial Sector (l_Industrial_AdjustedClose) with respect to the number of COVID-19 weekly infections (COVID). The correlation coefficient of 0.135 indicates that PSEI and COVID have a strong positive association. It is projected that rising COVID-19 infection rates will not cause the Philippine Stock Exchange - Industrial sector to decline. The unprecedented impact gradually stabilized and recovered to some extent, but not before markets have performed badly and generated negative returns (Singh et al., 2020).

Figure 11: Scatter Diagram Log(Covid) Against Log(HoldingFirm_AdjustedClose)

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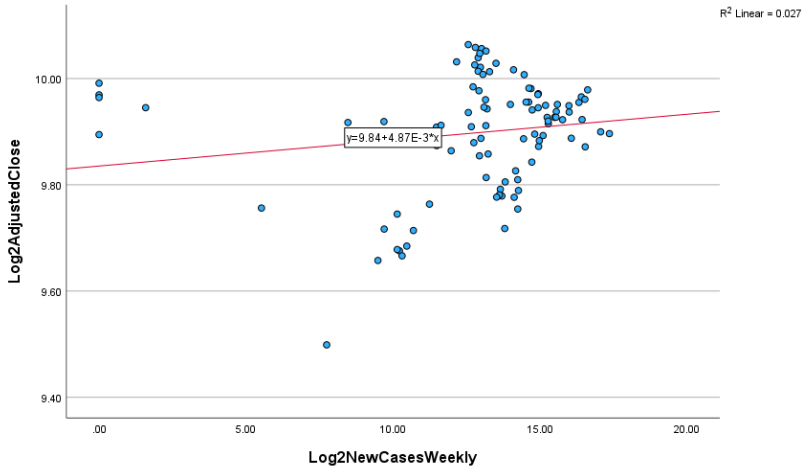

The shown correlation patterns in Figure 11 established a positive linear association of the Holding Firm Sector (l_HoldingFirm_AdjustedClose) with respect to the number of COVID-19 weekly infections (COVID). The correlation coefficient of 0.027 indicates that PSEI and COVID have a positive association. It is projected that rising COVID-19 infection rates will not cause the Philippine Stock Exchange - Holding Firm sector to decline.

Figure 12: Scatter Diagram Log(Covid) Against Log(Property_AdjustedClose)

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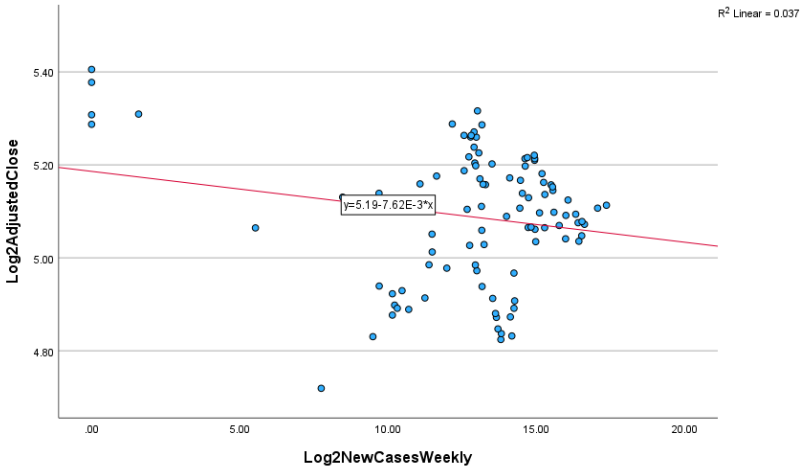

The shown correlation patterns in Figure 12 established a negative linear association of the Property Sector (l_Property_AdjustedClose) with respect to the number of COVID-19 weekly infections (COVID). The correlation coefficient of 0.037 suggests strong negative association of the Property sector with COVID, respectively. It is projected that rising COVID-19 infection rates will cause the Philippine Stock Exchange - Property sector to decline.

Figure 13: Scatter Diagram Log(Covid) Against Log(Service_AdjustedClose)

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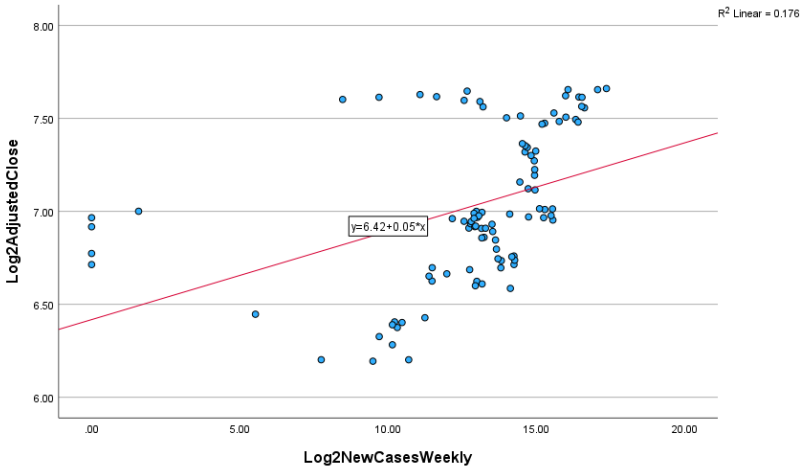

The shown correlation patterns in Figure 13 established a positive linear association of the Service Sector (l_Service_AdjustedClose) with respect to the number of COVID-19 weekly infections (COVID). The correlation coefficient of 0.176 indicates that PSEI and COVID have a strong positive association. It is projected that rising COVID-19 infection rates will not cause the Philippine Stock Exchange - Service sector to decline.

Figure 14: Scatter Diagram Log(Covid) Against Log(Mining&Oil_AdjustedClose)

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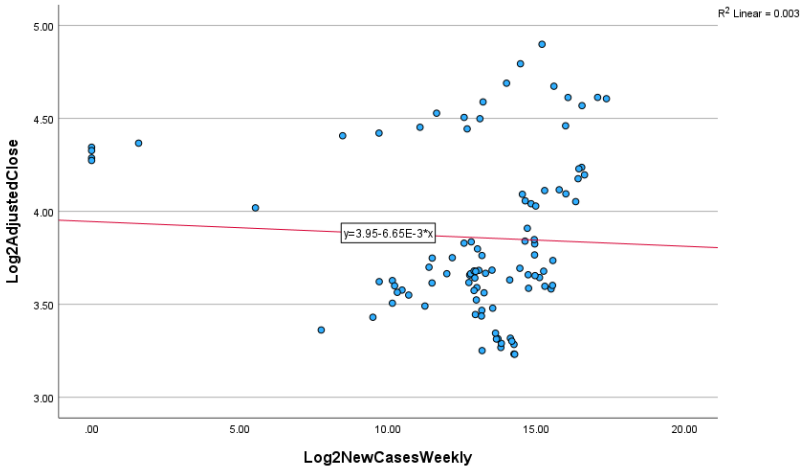

The shown correlation patterns in Figure 14 established a negative linear association of the Mining & Oil Sector (l_Mining&Oil_AdjustedClose) with respect to the number of COVID-19 weekly infections (COVID). The correlation coefficient of 0.003 suggests a negative association of PSEI with COVID, respectively. It is projected that rising COVID-19 infection rates will cause the Philippine Stock Exchange - Mining & Oil sector to decline.

4.3.1 MM-estimation

Table 4: Financial

Coefficients

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	Value	Std. Error	t value
(Intercept)	7.012	0.078	90.014
Log2NewCasesWeekly	-0.020	0.006	-3.468
rlm(formula = Log2AdjustedClose ~ Log2NewCasesWeekly, data = dta, na.action = na.exclude, method = "MM", model = FALSE) Residual standard error: 0.15189 Degrees of freedom: 96			

In Table 4, The Log2NewCasesWeekly values -0.020 with a corresponding t-value of -3.468 indicate a strong negative correlation between the two variables. This implies that the transformed logarithmic models are not significant. Accordingly, the number of COVID-19 weekly infections had no significant effect on the Philippine Stock Exchange Financial Sector for January 31, 2020, to January 31, 2022.

Table 5: Industrial

Coefficients			
	Value	Std. Error	t value
(Intercept)	8.052	.028	283.212
Log2NewCasesWeekly	.006	.002	3.000
rlm(formula = Log2AdjustedClose ~ Log2NewCasesWeekly, data = dta, na.action = na.exclude, method = "MM", model = FALSE) Residual standard error: 0.07688 Degrees of freedom: 96			

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In Table 5, The Log2NewCasesWeekly values 0.006 with a corresponding t-value of 3.000 indicate a strong positive correlation between the two variables. This implies that the transformed logarithmic models are significant. Accordingly, the number of COVID-19 weekly infections had a significant effect on the Philippine Stock Exchange Industrial Sector for January 31, 2020 to January 31, 2022.

Table 6: Holding Firm

Coefficients			
	Value	Std. Error	t value
(Intercept)	9.890	.039	254.749
Log2NewCasesWeekly	.002	.003	.558
rlm(formula = Log2AdjustedClose ~ Log2NewCasesWeekly, data = dta, na.action = na.exclude, method = "MM", model = FALSE) Residual standard error: 0.08618 Degrees of freedom: 96			

In Table 6, The Log2NewCasesWeekly values 0.002 with a corresponding t-value of 0.0558 indicate a positive correlation between the two variables. This implies that the transformed logarithmic models are significant. Accordingly, the number of COVID-19 weekly infections had a significant effect on the Philippine Stock Exchange Holding Firm Sector for January 31, 2020 to January 31, 2022.

Table 7: Property

Coefficients			
	Value	Std. Error	t value
(Intercept)	5.219	.057	90.936

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Log2NewCasesWeekly	-.009	.004	-2.140
rlm(formula = Log2AdjustedClose ~ Log2NewCasesWeekly, data = dta, na.action = na.exclude, method = "MM", model = FALSE) Residual standard error: 0.12159 Degrees of freedom: 96			

In Table 7, The Log2NewCasesWeekly values -0.009 with a corresponding t-value of -2.140 indicate a strong negative correlation between the two variables. This implies that the transformed logarithmic models are not significant. Accordingly, the number of COVID-19 weekly infections had no significant effect on the Philippine Stock Exchange Property Sector for January 31, 2020 to January 31, 2022.

Table 8: Service

Coefficients			
	Value	Std. Error	t value
(Intercept)	4.606	.089	51.634
Log2NewCasesWeekly	.174	.007	25.969
rlm(formula = Log2AdjustedClose ~ Log2NewCasesWeekly, data = dta, na.action = na.exclude, method = "MM", model = FALSE) Residual standard error: 0.21945 Degrees of freedom: 96			

In Table 8, The Log2NewCasesWeekly values 0.174 with a corresponding t-value of 25.969 indicate a strong positive correlation between the two variables. This implies that the transformed logarithmic models are significant. Accordingly, the number of COVID-19 weekly infections had a significant effect on the Philippine Stock Exchange Service Sector for January 31, 2020 to January 31, 2022.

Table 9: Mining & Oil

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Coefficients			
	Value	Std. Error	t value
(Intercept)	4.000	.177	22.581
Log2NewCasesWeekly	-.015	.013	-1.103
rlm(formula = Log2AdjustedClose ~ Log2NewCasesWeekly, data = dta, na.action = na.exclude, method = "MM", model = FALSE) Residual standard error: 0.34887 Degrees of freedom: 96			

In Table 9, The Log2NewCasesWeekly values -0.15 with a corresponding t-value of -1.103 indicate a negative correlation between the two variables. This implies that the transformed logarithmic models are not significant. Accordingly, the number of COVID-19 weekly infections had no significant effect on the Philippine Stock Exchange Mining & Oil Sector for January 31, 2020 to January 31, 2022.

5. Conclusion

Robust Least Squares regression and the Augmented Dickey-Fuller test were used in this study to investigate the impact of the COVID-19 pandemic on the Philippine Stock Exchange index. For the Financial Sector (i_Financial_AdjustedClose), the paper established the correlation patterns suggesting a negative association, therefore, an increase in the number of COVID-19 weekly infections will lead to a decrease in the Philippine Stock Exchange for the Financial sector. The results of the study showed that global financial market risks have increased substantially in response to the pandemic. The great uncertainty of the pandemic and its associated economic losses had caused markets to become highly volatile and unpredictable (Zhang et al., 2020). The robust least square regression indicates that the number of COVID-19 weekly infections has a significant but minimal effect on the Philippine stock exchange for the financial sector. A positive shock to COVID-19 weekly infections has affected the Philippine

stock exchange index - Financial sector in the short term, but the effects become negligible in the long term. The Augmented Dickey Fuller test obtained less than 5% significance level. Therefore, the COVID-19 pandemic does affect the Philippine stock exchange - Financial sector.

For the Property Sector (i_Property_AdjustedClose), the paper established the correlation patterns suggesting a negative association, increasing the number of COVID-19 weekly infections will lead to a decrease in the Philippine Stock Exchange for the Property sector. The robust least square regression indicates that the number of COVID-19 weekly infections has a significant but minimal effect on the Philippine stock exchange for the property sector. A Positive shock to COVID-19 daily infections has affected the Philippine stock exchange index - Property sector in the short term, but the effects becomes negligible in the long term.The Augmented Dickey Fuller test obtained less than 5% significance level. The daily increasing number of COVID-19 cases has a negative impact on stock returns in Vietnam (Rabhi, 2020). Therefore, the COVID-19 pandemic does affect the Philippine stock exchange - Property sector.

For the Mining & Oil Sector (i_Mining&Oil_AdjustedClose), the paper established the correlation patterns suggesting a negative association, increasing the number of COVID-19 weekly infections will lead to a decrease in the Philippine Stock Exchange for the Mining & Oil sector. The COVID-19 pandemic would significantly impact countries' GDP due to reductions in production and consumer demand (Wren-Lewis, 2020). The robust least square regression indicates that the number of COVID-19 weekly infections has a significant but minimal effect on the Philippine stock exchange for the Mining & Oil sector. A positive shock to COVID-19 weekly infections has affected the Philippine stock exchange index - Mining & Oil sector in the short term, but the effects becomes negligible in the long term.The Augmented Dickey Fuller test obtained less than 5% significance level. Therefore, the COVID-19 pandemic does affect the Philippine stock exchange - Mining & Oil sector.

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For the Industrial Sector (i_Industrial_AdjustedClose), the paper established the correlation patterns suggesting no significant effect in the long run. The robust least square regression indicates that the number of COVID-19 weekly infections has minimal effect on the Philippine stock exchange for the Industrial sector. A positive shock to COVID-19 daily infections has affected the Philippine stock exchange index - Industrial sector in the short term, but the effects become negligible in the long term. The Augmented Dickey Fuller test obtained greater than 5% significance level. Therefore, the COVID-19 pandemic does not affect the Philippine stock exchange - Industrial sector. The unprecedented impact gradually stabilized and recovered to some extent, but not before markets have performed badly and generated negative returns (Singh et al., 2020).

For the Holding Firm Sector (i_HoldingFirm_AdjustedClose), the paper established the correlation patterns suggesting no significant effect in the long run. The robust least square regression indicates that the number of COVID-19 weekly infections has minimal effect on the Philippine stock exchange for the Holding Firm sector. A positive shock to COVID-19 daily infections has affected the Philippine stock exchange index - Holding Firm sector in the short term, but the effects become negligible in the long term. The Augmented Dickey Fuller test obtained greater than 5% significance level. Therefore, the COVID-19 pandemic does not affect the Philippine stock exchange - Holding Firm sector. Country-level factors are more important than firm-level factors in ensuring discipline in the economy. Therefore, faced with economic turmoil due to the global pandemic, governments and policymakers can emphasize the adoption and implementation of the right economic policies by using a set of economic factors that they have shown to be effective. (Doidge et al. 2007)

For the Service Sector (i_Service_AdjustedClose), the paper established the correlation patterns suggesting no significant effect in the long run. The robust least square regression indicates that the number of COVID-19 weekly infections has minimal effect on the Philippine stock exchange for the Service sector. A positive shock to COVID-19 daily infections has affected the Philippine stock exchange index - Service sector in the short term, but the effects become negligible in the long term. The Augmented Dickey Fuller test obtained greater than 5%

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significance level. Therefore, the COVID-19 pandemic does not affect the Philippine stock exchange - Service sector. The level of economic activity was unaffected by the rising number of verified coronavirus infections, it was positively impacted by transportation restrictions and increased fiscal policy investment (Ozili and Arun 2020).

To further conclude, The COVID-19 pandemic has negatively affected all of the Philippine Stock Exchange sectors in the short run. The shocks of the number of COVID-19 weekly infections differ in the short and long run. News regarding fiscal stimulus raises the stock market and long-term growth, but has little effect on increasing expectations for short-term growth (Gormsen and Koijen 2020). The ADF test results concluded that the COVID-19 pandemic does affect the Financial, Property, and Mining & Oil sectors in the long run. On the other hand, the COVID-19 pandemic does not affect the Industrial, Holding Firm, and Service sectors in the long run. Furthermore, the robust least square regression results showed that the COVID-19 pandemic harmed Financial, Property, and Mining & Oil. Meanwhile, the COVID-19 pandemic had no significant effect on Industrial, Holding Firms, & Services.

Moreover, we identified strong evidence of a link between COVID-19 weekly infections and the Philippine stock exchange index, rather than the other. This paper has discussed the correlation between the COVID-19 pandemic and The Philippine Stock Exchange. Also, it showed the two-year trend of each sector in The Philippine Stock Exchange. This gives the investors the bigger picture of the trend of each sector in the Philippine Stock Exchange. Therefore, it is recommended that investors should invest in sectors with no significant effect on COVID-19 infections in the long run. Also, investments should be held for longer periods since it tends to exhibit lower volatility than those held for shorter periods. The government should emphasize the importance of an urgent policy response to face the change caused by the global pandemic. It is necessary to have proactive and forward-looking business strategies and economic policies. The findings of the study will help governments and policymakers to investigate various country-level factors that may be of use to cope with the situation (Verma and Gustafsson 2020).

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