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NEXUS AMONG COMMODITY MARKETS AND STOCK MARKETS IN ASIAN COUNTRIES BEFORE & DURING COVID

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ABSTRACT

The purpose of this study is to examine the impact of the CM on the SM during & before COVID. Data for the APO region was used from 2017 to 2021. ADF's unit-roots test shows the stationarity of SRs. In both cases, all series are stationary & significant at 1%. Additionally, all regression models with predictor variables fit the data better than models without predictor variables, as shown by the F-test p-values below the significance level (5%). Since CMs performed better than SM during the COVID period, investors should invest in them rather than SM. Second, inflation can raise commodity prices, undermining the value of stocks & bonds. Even though commodities have performed well during high inflation, investors should be aware that they can be volatile. Furthermore, this study has implications for policymakers as well, since they can use the relationship between SRs & CMs to determine whether one market's price shock will affect others, & thus formulate regulatory policies accordingly.

Keywords: COVID, stock markets, commodity markets, uncertainty
JEL Codes: L10, D80

1. INTRODUCTION

Commodity PS & stock PS tend to move together in the past few years (Ildırar & Iscan, 2016). Nicolau, (2010) wrote that if interest rates rise, commodities will soar, & if interest rates fall, bonds & shares will decline, according to the theory that interest rates affect commodities & bonds. Chorafas (2005) also stated that inflation is a primary factor in the connection between commodities & derivatives. Rehman & Vo, (2021) believed that commodities are a popular investment option for new investors, as well as for professionals, regulators, & academics. According to the Domanski & Health (2007) study, there was an increase in commodity derivative contracts from 1998 to 2006, along with an increase in investors' presence. Sardana had been interested in commodities & the S&P 500 index correlation for some time. A correlation was shown for 13 commodities. Commodities & Islamic SMs are correlated based on an analysis (Tarek & Derbali, 2016), Correlations vary over time & are highly volatile (Khan & Masih, 2014) reached a similar conclusion, citing the financial crisis as a factor influencing this relationship in 2008. Murphy, (2015) compares stock & commodity Ps using the CR Bindex, which shows commodity Ps & the S&P 500 from 2006 to 2012. The two markets became increasingly interconnected after the financial crisis in 2008. The research Nirmala & Deepthy, (2018), in which the correlation between the commodity & equity markets demonstrated that they do not correlate over the long run. This study examined the correlation between SP & CP using the S&P500 P & the S&PGSCI P (Black et al., 2014; Sulehri & Ali, 2020; Audi et al., 2022). Their long-term relationship was cointegrated.

In many cases, the SMs & CMs are similar to volatility, which are caused by either very rare economic conditions or natural phenomena (Sharif et al., 2020; Abdullah et al., 2013; Ali, et al., 2021). It is unfortunate that a pandemic is such a natural phenomenon that causes absurd shocks to the financial & economic environment. A new type of pandemic, the Coronavirus, has begun spreading at the end of December 2020, which is a rare occurrence. COVID-19 was reported for the first time in China on 3 January 2020, & the World Health Organization (WHO) issued its global alert on 30 January 2020 (World Health Organization, 2020). As the deadly disease spread around the world, the WHO declared it a pandemic on 30 March 2020 (World Health Organization, 2020a). Initially, the WHO suggested

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social distancing & wearing a face mask as measures to curb the spread of COVID-19; later on, due to a sudden rise in the number of cases in India & around the world, most countries started enforcing complete lockdowns. The prolonged a result of the prolonged & stringent lockdown, both social & economic conditions of individuals as well as countries were adversely affected. Studies suggested that unexpected events like terrorist attacks & SARS pandemic have severe impacts on the economic & financial conditions of individuals (Nippani & Washer, 2004; Sulehri et al., 2022). Such events create a sense of fear & panic in the mind of individuals, apart from distorting the dem& for goods, money supply, & labor movements (Kollias et al., 2011). SMs in the US experienced a circuit breaker four times in ten days in March due to the drastic spread of Coronavirus. In addition to the US SM, Asian & European SMs also noticed a sudden plunge. Similarly, to the SM performance, commodity markets experienced abrupt movements in response to the COVID-19 outbreak. As a consequence of low dem& from the world market in April, the price of Ps of O recorded a negative value, & the price of G Ps also exhibited abrupt movements, from the lowest price in March to the highest price in May 2020 (Ahmed et al., 2021).

As global trade integration & the search for alternatives to market risks have increased over the past few decades, so has global asset markets' connectivity. Recently, CM & financial markets have had more causal relationships than at any time in history; there is an easy spillover between risks & opportunities. The vulnerability of the common financial markets (those that specialize in stocks) to unfavorable shocks, which may cause losses for investors & portfolio managers alike, has now led to commodities becoming a more significant part of investment portfolios throughout the world. According to Choi & Hammoudeh, (2010) study, investors in commodity assets can make optimal investment decisions if they track commodity P movements & stock P movements. Oil, G (gold), & other PMs (precious metal) were substituted for financial assets (stocks, currencies, foreign exchange, etc. since these are more suitable to serve as a hedge than financial assets (Jain & Biswal, 2016; Adekoya & Oliyide, 2021; Audi & Ali, 2017; Alim et al., 2022; Bibi & Ali, 2021).

Historically, the SM has shown some immunity to epidemic outbreaks because of its reaction to previous outbreaks (Kleintop, 2020). It is currently being debated whether the SM will remain immune to the current Coronavirus outbreak in light of this. A study on this issue has not been conducted, which is a concern. Since pandemics such as the Coronavirus can increase risk, experts predicted that they can negatively impact SMs (Gormsen & Koijen, 2020; Hafiz et al., 2020; Alim et al., 2021; Shahid & Ali, 2015; Alim et al., 2021). Pandemic can disrupt equity market trends, disrupt economic developments, & cause abrupt changes in sentiment (Wealth Advisor, 2020). Due to China's burgeoning economic strength & the fact that it has gained a major role in the global economy, it poses a greater threat to the SM than AIDS, which was eradicated in 2003. China used to be considered a sub-national nation 17 years ago. China is currently known for its highly demanded products, such as its significant consumption of oil & C (Alameer et al. 2019). In 2003, China contributed 4% to global GDP, but that has grown to 16% (Horowitz, 2020). An affecting North American pandemic C-19, should worry global economic giants.

As the 21st century progressed, a number of epidemics had an impact on stock performance. According to researchers, SM fluctuations are caused by investors' concerns & pessimism regarding future income as a result of epidemics causing significant economic losses to markets (Jiang et al., 2017; Ali & Audi, 2018; Liu et al., 2020). Stocks, however, responded differently to the C-19 pandemic in different sectors & industries. Schoenfeld (2020) discovered that the gas & petroleum, garment, automobile, transport, machinery, & hospitality industries were the worst affected by SMs because of C-19. A substantial number of depositor withdrawals over a short period of time & an increase in non-performing loans were the results of C-19, according to (Goodell 2020). Approximately one-third of the world's population was forced to experience some form of lockdown due to the C-19 pandemic (Hoof, 2020). The C-19 lockdown has been studied in several studies. Baig et al. (2020) found that the C-19 lockdown contributed to a decline in the stability & liquidity of the US SM. An analysis of 45 nations' SM indexes. International SM's performance was negatively impacted by the lockdown, according to the authors. The impact of the lockdown on each country, however, was not clarified by (Eleftheriou & Patsoulis 2020). Commodity Ps have experienced extreme volatility in recent years due to changing trends at the same time. According to macroeconomics, c Ps & their correlations should concern policymakers because they can feed inflationary pressures & volatility. Commodity & SMs are of interest to financial players since they form part of many investment portfolios (Dwyer, Gardner, & Williams, 2011; Silvennoinen& Thorp, 2013; Vivian & Wohar, 2012; Conover et al., 2010). It has also been demonstrated that traders who simultaneously track fluctuations in the SM & commodity market are capable of influencing the trend of other markets, as documented by Mensi, Hammoudeh& Yoon (2013); Creti, Joets& Mignon (2013); Choi &Hammoudeh, (2010). In the stock & CM, traders can make substitutions between commodities & stocks by comparing dynamic volatility.

Considering the decline in CM affected businesses & society at large, the study needs to examine the relationship between equity & CM before & after the COVID period. Before & after COVID, str& of literature is available on SM. Multiple studies have shown that COVID affects CM (Baker et al., 2020; He et al., 2020; & Takyi & Bentum, 2021). There have been numerous studies on the effects of COVID on agriculture (Wang et al., 2020, Siche, 2020, Salisu et al., 2020). As suggested the result of the information about the interaction between two markets, this study can be of interest to investors & portfolio managers. As part of their research into this topic, investors need to know about related commodities that impact stock Ps. Commodities & SM investments should also be included in portfolios to reduce risk. Investing & portfolio managers can benefit from the study's comprehensive coverage of the interaction between SMs & commodities markets. As an investor, you can study how dynamic systems react to changes in the external environment to gain a deeper understanding of the links between markets. In developing investment strategies & diversifying their portfolios, portfolio managers & investors may find this study useful.

Finally, the study examines how stock performance & sustainability have been impacted by different stages of the crisis in selected countries. As a result of its information about the interaction between two markets, this study can be of interest to investors & portfolio managers. As part of their research into this topic, investors need to know about related commodities that impact stock Ps. Commodities & SM investments should also be included in portfolios to reduce risk. Investing in commodities will be a concern for fund managers & investors. This means that volatile commodity Ps will negatively affect investor returns. Investing in the SM can be affected by investors' investment power. Therefore, correlations between representative market indices as well as the various methods that have been employed to study them have been examined in this thesis. Besides that, there will be clear instructions for investors interested in investing in a certain market, as well as answers to any questions they may have about the commodities. To date, this is the only study examining the effects of the commodities index on the APO member, including Fiji, Hong Kong, Indonesia, Islamic Republic of Iran, Japan, Republic of Korea, Lao PDR, Bangladesh, Cambodia, Malaysia, Mongolia, Nepal, Pakistan, India, Philippines, Singapore, Sri Lanka, Thail &, Turkey, & Vietnam.

In the next section, a literature review is presented as the second part of the study. The third section refers to the theoretical model & forth part includes the research design, proceeding to analysis & discussion of the results. Lastly, the fourth section describes the conclusion.

2. LITERATURE REVIEW

The purpose of this section is to provide a brief overview of the foundational concepts of this empirical study. This article elaborates on the constructs & proposes a hypothetical relationship between the variables. Yan et al. (2020) examined the possibility of investing in the SM with C-19. Researchers at the University of California, Berkeley examined the potential effects of the Coronavirus on SM. In addition to Cathay Pacific, Eastern Airlines, & China Airlines, researchers also used C-19 as an independent variable. It is believed that two periods of SARS were responsible for the outbreak. The pre-event period runs from 1 December 2002 to 11 March 2002, & the sub-period is different for each country. It might be profitable to short travel stocks, entertainment stocks, & certain technology stocks during the ST panic selloff caused by the outbreak. Furthermore, we recommend purchasing a G ETF to take advantage of the increased market volatility. On May 1st, the VIX index measured 31.19, which indicated the market is quite volatile. The returns would have been pretty significant if researchers had shorted the market between February 21 & May 1st.

Ahmad, (2021) examined the macroeconomic impact of C-19 on Bangladesh. To stabilize the macroeconomic & financial environment, monetary, fiscal, & financial policies pose significant challenges. The growth & prosperity of the economy can only be achieved by the synthesis of government institutions & the foresight of policymakers. Despite the current economic shock of C-19, global uncertainty can still cause long-term disruptions. Combined macroeconomic framework architecture is necessary to under st & the shocks in the informal sector. Politicians should pay attention to the situation & make calculated decisions.

Al-Awadhi et al. (2020) examined deaths & contagious infectious diseases are the results of the C-19 virus' impact on SM. All stocks in the Hang Seng Index & Shanghai Stock Exchange Composite Index were analyzed using panel testing during the C-19 contagious infectious disease outbreak in China. The dependent variable was the Hang Seng & Shanghai Composite Indices, while the independent variable was the number of confirmed active cases &

deaths from C-19 in China. SM returns were negatively correlated with this pandemic disease. SRs were significantly correlated with both the daily growth in confirmed cases & death cases caused by C-19.

Huang (2020) analyzed China's agriculture & rural poverty under C-19. An analysis of C-19's impacts on Chinese agriculture & rural poverty is presented in the article. E-commerce & community home delivery services, along with short-distance transportation, have been found to significantly mitigate the negative effects. Reduced farmer losses were also due to the availability of labor & production facilities during the pandemic.

Mugableh (2017) focused on SM returns as a result of changes in oil Ps. In this study, the researchers examined the impact of the fluctuation in world oil Ps on the SM returns in Southeast Asia, including the Indonesia Stock Exchange, Kuala Lumpur Stock Exchange, Singapore Stock Exchange, Philippine Stock Exchange, & Stock Exchange of Thail&. From January 2003 to December 2013, the return of capital markets studied in each month is the dependent variable, while the return of WTI CO was the independent variable. The Malaysian capital market return (KLCI) & the Thai capital market (SET) were only significantly affected by changes in world oil Ps on a positive basis. The Indonesia Stock Exchange's SM return was insignificantly affected by changes in world oil Ps, but the sign of the regression coefficients indicated a possible negative impact. Moreover, it is found that there are no significant effects of fluctuating world oil Ps on SM returns in Singapore & the Philippines even though both countries' signs of regression coefficients were positive.

Benlagha, & El Omari, (2022) analyzed the evidence about the connectedness of SMs with G & oil the evidence was taken from the C-19 pandemic. In this study, researchers explored the effects of the C-19 pandemic on the dynamic connectedness among G, oil, & five leading SMs using the new DCC-GARCH framework. As compared to the pre-pandemic period, these markets are more connected during the C-19 pandemic. According to the researchers, G was a receiver of shocks from the five SMs during this pandemic, while oil was a net transmitter of shocks. The data was collected for G, oil, & the world's largest SMs, namely the US, UK, Germany, China, & Japan, from 14 November 2018 through 24 March 2021. The results showed that G receives shocks from the five SMs, while oil transmits them. According to these results, the structural connectedness patterns between the markets under investigation were influenced by global uncertainty resulting from the contagion during the COVID 19 period. In addition, the emergence of dynamic net connectedness replicates how SMs react to oil Ps & G in times of crisis.

Various studies have documented negative effects of C-19 pandemic lying on SMs worldwide. As a result of C-19, Al-Awadhi et al. (2020) found that stock returns of all Chinese companies were adversely affected. In 64 nations, Ashraf (2020) examined the impact of the pandemic on SM performance & found reverse relationships. C-19 had negative effects on US SRs (Alfaro et al. 2020). The SMs in Japan, Korea, & Singapore suffered adverse effects from C-19, according to (Zhang et al. 2020). February's SM was the most volatile, while March's was the smallest. Over the study period, the US SM st&ard deviation increased the most. According to He et al. (2020); Liu et al. (2020), C-19 had a negative impact on SMs of multiple countries. As a result of the pandemic, Asian, European, & American nations were affected. To reduce market crash risk, curtail volatility, & protect market stability, governments worldwide have imposed restrictions on SMs following C-19 (Kodres, 2020).

Ahmed et al., (2021) analyzed the stock & CM in South Asia under pandemic conditions. SMs in the countries most affected by C-19 as well as SMs in India were examined in this research. Researchers examined the impact of C-19 on the Indian SM & CM in 2020 & 2021 by examining the NSE, PSX, & DSE as dependent variables & G & oil as independent variables on a daily basis. As a means of achieving the above goals, the homogeneous variance test, Welch test, Games-Howell test, heteroskedastic independent t-test, & GMM test were used. COVID19 had a significant & negative impact on oil Ps & SM performance during the different phases of lockdown in India. On the other h&, G Ps were positively impacted. According to findings in the first wave of C-19 infections, this is also true. Results from the second wave of infection were contradictory, however. C-19 also significantly affected SM performance in certain South Asian countries, according to the study. During C-19's second wave, SM performance was short-lived in all of the selected South Asian countries.

H_1: CMs has a significant impact on SM returns of APO member countries

3. METHODOLOGY

The research is done on the basis on convenient sampling by considering the time frame of before & during COVID. Commodities & SMs were the subjects of this study. DSE-30, Shanghai Stock Exchange, Hang Sang Index,

Nifty Fifty Index, Jakarta Stock Exchange Composite Index, Nikkei 225 Index, KOSPI Index, FTSE Bursa Malaysia, MNE TOP 20, KSE 100, PSEi Index, MSCIs, SPLK, SET, BIST 100, & VN Index are the selected SMs. Similarly, PMs (G & S), IMs (C & T), & agriculture (W & rice) make up the commodities markets selected internationally. Investopedia.com has provided all data from 2017 to 2022, which covers the period before & during COVID. The SM is the dependent variable, while commodities are the independent variables. All variables were approached from investing.com & there are 17,520 observations. STATA is used to analyze the significance of the variables.

The formula for measuring all variables used in the current study is shown below in table 1. All selected variables have the daily frequency from 2017 to 2022. The analysis has been done by creating the window of before (2017-2019) & during (2020-2021) COVID.

Table 1: Measurement of Variables

TYPE	NAME	MEASUREMENT	Website	REFERENCES
DEPENDENT	SM	$\frac{opening\ value - closing\ value}{closing\ value}$	Investing.com	(Mensi et al., 2014; Kang, Mclver& Yoon, 2017)
INDEPENDENT	PM	$\frac{opening\ value - closing\ value}{closing\ value}$	Investing.com	(Mensi et al., 2014; Kang, Mclver& Yoon, 2017)
INDEPENDENT	IM	$\frac{opening\ value - closing\ value}{closing\ value}$	Investing.com	(Kang, Mclver& Yoon, 2017)
INDEPENDENT	E	$\frac{opening\ value - closing\ value}{closing\ value}$	Investing.com	(Mensi et al., 2014; Kang, Mclver& Yoon, 2017)
INDEPENDENT	A	$\frac{opening\ value - closing\ value}{closing\ value}$	Investing.com	(Kang, Mclver& Yoon, 2017)

4. RESULTS & FINDINGS

Table 2 below describes SM returns before COVID for the selected countries of APO member countries by analyzing descriptive statistics. In addition, each variable is also given its mean, st&ard deviation, skewness, Kurtosis, min value, & max value covering the period before COVID (2017-2019). In this study, descriptive statistics have been used as the basis for the analysis since they provide basic information on the variables under study & highlight potential relationships between them.

The overall results in the table 2 reveals that Bangladesh, China, Malaysia, Pakistan, Srilanka, & Turkey has a positive average return meanwhile Hong Kong, India, Indonesia, Japan, Korea, Mongolia, Philippines, Singapore, Thail&, & Vietnam performance caused the negative average return. The corresponding st&ard deviation range from 0.005 (Malaysia) to 79.463 (Turkey). Singapore stock market shows the minimum returns among the stock market return of APO member countries, whereas Turkey showed the maximum returns among the stock market return of APO member countries. On the other h&, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mongolia, Pakistan, Singapore, Thail&, Turkey & Vietnam SM returns are positively skewed with positive kurtosis. Whereas, Bangladesh, India, Philippines & Sri Lanka a positive kurtosis is associated with negatively skewed SM returns. The value of skewness & kurtosis shows that the SM returns of APO member selected countries before COVID reveals that all variables are normally distributed (Wu et al., 2020; Yong, Ziaei, & Szulczyk, 2021).

The total number of observations presented in the table is 5,824 in case of commodity markets presented below. In addition, each variable is also given its mean, st&ard deviation, skewness, Kurtosis, min value, & max value. G, S, & R show negative returns before COVID. G has a lowest st&ard deviation of (0.008) while, silver has the highest st&ard deviation of (0.017). C has a minimum commodity return whereas; CO has a maximum commodity return among all the selected commodities sectors. On the other h&, G & W are negatively skewed with positive kurtosis, which indicates a skew to the left (the left tail is longer than the right tail). Whereas, S, C, T, coal, CO,

& R are positively skewed with a positive kurtosis. A positive value indicates a skew to the right (the right tail is longer than the left one).

Table 2: Descriptive Statistics (Before COVID)

Variables	Obs	Mean	Std.Dev	Min	Max	Skewness	Kurtosis
DSE 30	728	0.0002	0.0065	-0.0240	0.0230	-0.1193	3.7429
Shanghai Stock Ex	696	0.0001	0.0104	-0.0530	0.0591	0.5174	7.7827
Hang Sang Index	682	-0.0001	0.0103	-0.0404	0.05392	0.4239	4.7786
Nifty Fifty Index	676	-0.0003	0.0077	-0.0505	0.0274	-0.3241	6.3750
Jakarta Stock Ex	694	-0.0001	0.0079	-0.0259	0.0390	0.4903	5.0798
Nikkei 225 Index	690	-0.0002	0.0095	-0.0373	0.0527	0.8463	7.2827
KOSPI Index	681	-0.00002	0.0086	-0.0350	0.0456	0.5130	4.9490
FTSE/B Malaysia	685	0.00009	0.0054	-0.0161	0.03508	0.7634	6.7321
MNE TOP 20	680	-0.0005	0.0116	-0.0856	0.0937	0.0666	14.5773
KSE 100	678	0.0002	0.0116	-0.0396	0.0488	0.1780	4.0117
PSEi Index	682	-0.00007	0.0095	-0.0336	0.0304	-0.02976	3.2757
MSCIs	662	-0.00003	0.0074	-0.0259	0.0359	0.2640	4.2744
SPLK	724	0.0002	0.0067	-0.0425	0.0460	-0.1944	11.6145
SET	696	-0.00001	0.0061	-0.0224	0.0244	0.2996	4.6127
BIST 100	673	1017.136	79.4632	836.75	1208.45	0.3493	2.3668
VN Index	677	-0.0003	0.01014	-0.0363	0.0537	0.9161	7.0803
G	728	-0.0003	0.0084	-0.0561	0.0485	-0.2761	11.840
S	728	-0.0006	0.0172	-0.0698	0.1532	1.4968	18.8177
C	728	0.0002	0.0119	-0.0547	0.0708	0.32273	6.0196
T	728	0.0005	0.0106	-0.0628	0.0736	1.1569	11.5751
COAL	728	0.0002	0.0126	-0.0839	0.1102	1.1744	21.4996
CO	728	0.0013	0.0388	0.2495	0.3211	1.1126	23.7489
W	728	0.0001	0.0163	-0.0598	0.0553	-0.2895	3.7243
R	728	-0.0003	0.0124	-0.0699	0.0688	0.0095	6.7537

Table 3: Descriptive Statistics (During COVID)

Variables	Obs	Mean	Std.Dev	Min	Max	Skewness	Kurtosis
Nikkei 225 Index	595	-0.0001	0.0142	-0.0744	0.0647	0.0254	6.0594
KOSPI Index	604	-0.0004	0.0145	-0.0843	0.0807	0.0953	7.9087
FTSE/B Malaysia	600	0.0001	0.0095	-0.0653	0.0586	0.5631	11.8201
MNE TOP 20	604	-0.0008	0.0128	-0.0631	0.0527	-0.9411	8.1458
KSE 100	607	0.00009	0.0124	-0.0457	0.0736	1.1416	9.6708
PSEi Index	603	0.0004	0.0166	-0.0692	0.1539	1.9883	19.7038
MSCIs	623	0.0004	0.0123	-0.0629	0.0769	0.3943	9.5674
SPLK	544	0.0004	0.0223	-0.0979	0.2342	2.6273	28.5929
SET	589	0.00008	0.0137	-0.0736	0.1210	2.2758	23.8420
BIST 100	612	1489.778	421.62	842.46	2648.19	0.9674	3.1342
VN Index	608	-0.0002	0.0144	-0.0474	0.0715	1.3143	7.5610
G	557	-0.00005	0.0102	-0.0365	0.0518	0.8068	6.2681
S	557	0.0006	0.0186	-0.0653	0.1140	1.3329	10.5327
C	557	-0.0008	0.0146	-0.0492	0.0554	0.2731	4.0263
T	557	-0.0013	0.0160	-0.0492	0.1005	1.4753	10.2541
COAL	557	-0.0018	0.0464	-0.2775	0.6166	4.3759	67.6535
CO	557	- 0.001763	0.0282	-0.1536	0.1844	1.5222	16.1881
W	557	-0.0006	0.0209	-0.0794	0.1053	0.0216	5.5128
R	557	0.00004	0.0233	-0.0933	0.3494	6.2722	95.0928

Table 3 below describes the SM returns during COVID for the selected countries of APO member countries by analyzing descriptive statistics. In addition, each variable is also given its mean, st&ard deviation, skewness, Kurtosis,

min value, & max value covering the period during COVID (2020-2021). On average, the SM of Bangladesh, China, & Korea was reacting positively before COVID but due to the pandemic these SM reacted negatively. Which the SMs of Hong Kong, Philippines, Singapore, & Thail & were reacting negatively before COVID but due to the COVID they reacted negatively. The SM of India Ahmed et al., (2021), Indonesia, Japan, Mongolia, & Vietnam reacted negatively before COVID & during COVID. Luckily, the SM of Malaysia, Pakistan, Sri Lanka, & Turkey remained positive in both time periods. Bangladesh & Mongolia are negatively skewed with positive kurtosis, which indicates that they are moderately skewed. China, Pakistan, & Philippines are positively skewed with a positive kurtosis, which indicates they are highly skewed. Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, & Turkey are positively skewed with a positive kurtosis. India, Sri Lanka & Thail& are highly skewed as they show the positive skewness with a positive kurtosis (Yong, Ziaei, & Szulczyk, 2021). The total number of observations is case of CM during COVID is 5,824. On average G, S & R have a negative mean. Whereas, C, T, W, coal & CO has a positive mean. G has the lowest st&ard deviation & coal has the highest st&ard deviation. On the other h&, G has the minimum return whereas, silver has the maximum return. The G & W are negatively skewed with a positive kurtosis Borgards, Czudaj, & Hoag, 2021). On the other h& S, C, T, coal, CO, & R are positively skewed with a positive kurtosis, which indicates it is a normal distribution.

The estimated results of correlation have been given in table 4 for the period before COVID. The results explain S has a positive & significant relation with G. C has a positive & significant relation with S. T has a negative & significant correlation with G & S. The calculated outcomes show that T has a positive & significant correlation with C. The estimated results revealed that coal has a positive & significant correlation with G & T. The coefficient values show CO has a positive & significant correlation with G but negative & significant relation with S, T, & coal. The estimated coefficient values show W has a positive & significant correlation with coal but a negative & significant correlation with CO. G, S, T, & W have negative & significant Pearson correlations with R, while coal has a positive & significant correlation with R. Overall results of the correlation matrix revealed that most of the explanatory have a significant correlation with each other (Bouri et al., 2021a). But this mutual correlation is not so high which creates the issue of multicollinearity among the selected explanatory variables. Thus, there is no issue of multicollinearity among the selected explanatory variables of the model.

Table 4: Correlation Matrix (CM-Before COVID)

	SR	G	S	C	T	Coal	CO	W	R
SR	1								
G	0.0009	1							
S	0.0027	0.1083***	1						
C	-0.0014	-0.0094	0.0292***	1					
T	-0.0015	-0.0218**	-0.0690***	0.0670***	1				
Coal	-0.0022	0.0870***	0.0076	-0.0133	0.0942***	1			
CO	-0.0015	0.0218**	-0.0735***	0.0085	-0.0449***	-0.0299***	1		
W	0.0002	-0.0134	0.008	0.004	-0.0109	0.0209**	-0.0189 **	1	
R	0	-0.0189**	-0.0189**	0.0007	-0.0417***	0.0423***	-0.0121	-0.0187 **	1

The table 5 shows the correlation analysis for the period covering during COVID. The results show that C has a positive & significant correlation between G & S. The calculated outcomes explain that T has a negative & significant correlation with S. The estimated results reveal that coal has a negative & significant correlation with S but a positive & significant correlation between C & T. The coefficient value shows that CO has a negative & significant correlation with a goal & a positive & significant correlation with coal. W has a positive & significant correlation with G, S, coal, & CO. The estimated results show that R has a positive & significant correlation with G. But a negative & significant correlation with C, T, coal, & W. This study denies the results of (Hassan & Riverso Gavilanes, 2021). The overall results of the correlation matrix revealed that most of the explanatory have a significant correlation with each other. But this mutual correlation is not so high which creates the issue of multicollinearity among the selected explanatory variables. Thus, there is no issue of multicollinearity among the selected explanatory variables of the model.

Table 5: Correlation Matrix (CM Returns-During COVID)

	SR	G	S	C	T	Coal	CO	W	R
SR	1								
G	0.0027	1							
S	-0.0005	0.0163	1						
C	0.0058	0.0286***	0.0945***	1					
T	0.0056	0.0048	-0.046***	0.0078	1				
Coal	-0.0014	-0.0146	-0.082***	0.0413***	0.1197***	1			
CO	-0.0006	-0.0198**	-0.0097	0.0116	0.0095	0.0267***	1		
W	-0.0002	0.0767***	0.0223**	-0.0161	0.0131	0.1144***	0.0455***	1	
R	-0.0017	0.0609***	-0.0051	-0.040***	-0.024**	-0.052***	0.0104	-0.0285***	1

This study has applied the Welch Robust test of equality of means to establish the difference between two data series, to check if the difference in the mean of the stock & CM during both phases that either the means were significant or insignificant. Table 6 shows that there is a significant difference among the means of all the three variables during the different phases of lockdown as the p-value is less than five percent level of significance (Ahmed et al., 2021).

Table 6: Welch Robust Test of Equality of Means

		Statistic	Sig
PMs	G	185.32	0.000***
	S	165.36	0.000***
IM	C	135.73	0.000***
	T	195.33	0.000***
Energy	Coal	165.2	0.000***
	CO	107.63	0.000***
Agriculture	W	145.63	0.000***
	R	162.93	0.000***
SM		183.72	0.000***

Table 7: Homogeneity of Variance

		Levene Statistic	Sign.
PMs	G	7.32	0.000***
	S	8.91	0.000***
IM	C	10.21	0.000***
	T	9.12	0.000***
Energy	Coal	8.12	0.000***
	CO	6.92	0.000***
Agriculture	W	7.03	0.000***
	R	8.21	0.000***
SM		9.12	0.000***

This study has applied the homogeneity of variance using the Levene test to establish the difference between two data series. Either the variance or volatility is significant or insignificant. As shown in table 7, the Levene test indicates that the data is not homogeneous in all the cases: G, S, C, coal, CO, W, & R. with p-values less than 1%, implying that the study can proceed with further tests (Ahmed et al., 2021). The T & stock's variance is homogenous.

ADF (Augmented Dickey-Fuller) test is used to test the model. This test was developed by Dickey & Fuller for the situations in which ut are correlated. By adding the lagged value of the dependent variable to the preceding equation, this test is conducted Δ. It can test for a larger & more complex set of time series data. The equation of the ADF unit root test is given by:

$\Delta Y_t = \alpha 0 + \alpha 1t + \delta Y t{-}1 + \sum \gamma i\ \Delta Y t{-}i + \varepsilon t$

while α0 is an intercept term, $\alpha 1t$ is the trend variable, $\delta Y t{-}1$ is the lagged level, & $\sum \gamma i\ \Delta Y t{-}i$ is the total lagged changes in variables. Δ is the first difference operator, where εt is the white noise error term. Moreover, εt will be auto-correlated if there was autocorrelation in the dependent variable of the regression (ΔYt) which has not been modeled. The null hypothesis of Augmented Dickey-Fuller is a unit root or the time series is non-stationary while the alternative is the time series is stationary. We will reject the null hypothesis if the p-value is smaller than 5%, otherwise, we do not reject the null hypothesis (Chohan et al., 2014). The Augmented Dickey-Fuller (ADF) Unit Root Test is used for the stationary test for the variables at the level. It was utilized to determine how a time series data responds to unexpected shocks & to evaluate behavior time series data. At level one of the model, all of the variables are non-stationary because they were all assessed using the Augmented Dickey-Fuller (ADF) unit root test (Natarajan et al. 2021).

ADF tests are one-sided: the alternative hypothesis is assumed to be the stationarity hypothesis by default. The presence of a unit root is taken into account as the null hypothesis, which implies that the series are non-stationary. The study compares the result of the test to the critical value (p-value = 0.01). If the value equals the significance equation 0.01 then this series can be considered stationary (the hypothesis of a single root). There is no reason to reject the hypothesis that the series is non-stationary if the test value is greater than the critical one (Mikhniuk, 2020).

Table 8: ADF Test (Before & During COVID)

	Before COVID	During-COVID
	Z-Stat(Sig.)	Z-Stat(Sig.)
DSE 30	-15.271 ***	-13.411***
Shanghai Stock Exchange	-12.018***	-10.305***
Hang Sang Index	-10.734***	-14.31***
Nifty Fifty Index	-8.665***	-11.161***
Jakarta Stock Exchange	-14.422***	-9.52***
Nikkei 225 Index	-12.449***	-15.178***
KOSPI Index	-10.989***	-12.584***
FTSE Bursa Malaysia	-16.922***	-11.912***
MNE TOP 20	-12.739***	-11.838***
KSE 100	-14.436***	-11.44***
PSEi Index	-12.115***	-11.666***
MSCIs	-10.456***	-12.151***
SPLK	-14.133***	-10.182***
SET	-14.172***	-10.036***
BIST 100	-81.875***	-24.252***
VN Index	-10.379***	-8.10***
G		
S	-10.382***	-12.492***
C	-13.477***	-11.126***
T	-10.473***	-8.058***
Coal	-10.723***	-8.35***
CO	-12.471***	-7.256***
W	-13.242***	-11.779***
R	-10.885***	-6.842***

Table 8 presents the stationarity of SRs by using ADF for the unit-roots test. The table shows that all series are stationary & significant at a 1% significance level in both cases before & during COVID. Before running the regression analysis one should first check whether the variables are stationary or not. The SM returns are stationary at level one as mentioned in chapter 4. The data was made stationary by using the formula of return, opening P minus closing P, & then divided by closing P. First, the study gathered the data on the Ps of the SM & then calculated the Ps returns (Umar, Jarenom & Escribano, 2021). The ADF test for stationarity of commodity market returns are also shown in table 8 covering both windows of before & during COVID. The table shows that the all series are stationary Yong, Ziaei, & Szulczyk, (2021) & significant at a 1% significance level. The commodity

market returns are stationary at level one. First, the study gathered the data on Ps of the commodity market & then calculated the P returns. Regression methods that are traditionally used include least squares, fixed effects, & r&om effects (Ahmed et al., 2021). Individual-specific effects are assumed to be correlated with independent variables in fixed effects models. Table 9 reports the result of fixed-effects regression by using with-in method in the case of before COVID. From column 1 to column 2 the independent variables named G & S are gradually added.

The results of table 9 reveal that the p-values of the F-test will be less than the significance level (5%), which means that all the regression models will fit the data better than models with no predictor variables. The results show that a 1% increase in the SR creates a (0.2373915) percent increase in G. The coefficient of G shows the positive & insignificant relationship between G & SM returns. The results show that a 1% increase in the SR creates a (0.2258073) percent increase in S. The coefficient of S shows the positive & significant relationship between S & SM returns. The results in case of IM reveal that all the p-values of the F-test are less than the significance level (5%), which means that all the regression models fit the data better than models with no predictor variables. The results show that a 1% increase in the SR creates a (0.0535351) percent increase in C. The coefficient of C shows the positive & significant relationship between C & SM returns. The results show that a 1% increase in the SR creates a (0.-.0129777) percent decrease in T. The coefficient of T shows the decreasing relationship between T & SM returns. The results in case of A reveal that all the p-values of the F-test are less than the significance level (5%), which means that all the regression models fit the data better than models with no predictor variables. The results show that a 1% increase in the SR creates a (0.0387075) percent increase in W. The coefficient of W shows the positive relationship between W & SM returns. The results show that a 1% increase in the SR creates a (-0.0961213) percent decrease in R. The coefficient of R shows the negative & significant relationship between R & SM returns. The results in case of E reveal that all the p-values of the F-test are less than the significance level (5%), which means that all the regression models fit the data better than models with no predictor variables. The results show that a 1% increase in the SR creates a (-.0407693) percent decrease in coal. The coefficient of coal shows the negative & significant relationship between coal & SM returns. The results show that a 1% increase in the SR creates a (0.977398) percent increase in CO. The coefficient of CO shows the positive & insignificant relationship between CO & SM returns.

Table 9: Fixed Effect Regression (Before COVID)

Variable	Coefficient	Std.Error	t-statistic	Prob.
LG	0.2373	0.1366	1.74	0.086
LS	0.2258	0.0974	2.32	0.023
LC	0.0535	0.0312	1.71	0.087
LT	-0.0129	0.0254	-0.51	0.61
LCOAL	-0.0407	0.0237	-1.71	0.087
LCO	0.9773	0.8095	1.21	0.227
LW	0.0387	0.0305	1.27	0.205
LR	-0.09612	0.0307	-3.13	0.002

Table 10 shows the results for the fixed effect regression in the period of during COVID. The results reveal that the p-values of the F-test will be less than the significance level (5%), which means that all the regression models will fit the data better than models with no predictor variables. The results show that a 1% increase in the SR creates a (-0.1838409) percent decrease in G. The coefficient of G shows the negative & insignificant relationship between G & SM returns. The results show that a 1% increase in the SR creates a (-0.0277041) percent decrease in S. The coefficient of S shows the decrease & insignificant relationship between S & SM returns. The results in case of IM shows that a 1% increase in the SR creates a (-0.0095495) percent decrease in C. The coefficient of C shows the negative or decreasing relationship between C & SM returns. The results show that a 1% increase in the SR creates a (0.102001) percent increase in T. The coefficient of T shows the positive & significant relationship between T & SM returns. The results in case of A reveal that all the p-values of the F-test are less than the significance level (5%), which means that all the regression models fit the data better than models with no predictor variables. The results show that a 1% increase in the SR creates a (0.0234778) percent increase in W. The coefficient of W shows the positive relationship between W & SM returns. The results show that a 1% increase in the SR creates a (.0161607) percent increase in R. The coefficient of R shows the negative & significant relationship between R & SM returns. The results of table 7. reveal that all the p-values of the F-test are less than the significance level (5%), which means that all the regression models fit the data better than models with no predictor variables. The results

show that a 1% increase in the SR creates a (.0256485) percent positive in coal. The coefficient of coal shows the positive relationship between coal & SM returns. The results show that a 1% increase in the SR creates a (-1.210469) percent decrease in CO. The coefficient of CO shows the decreasing relationship between CO & SM returns.

Table 10: Fixed Effect Regression (During COVID)

Variable	Coefficient	Std.Error	t-statistic	Prob.
LG	-0.1838	0.2403	-0.76	0.449
LS	-0.0277	0.2784	-0.1	0.921
LC	-0.0095	0.0354	-0.27	0.788
LT	0.1020	0.0322	3.16	0.002
LCOAL	0.0256	0.0275	0.93	0.352
LCO	-1.2104	1.3480	-0.9	0.369
LW	0.0234	0.0362	0.65	0.518
LR	0.0161	0.0305	0.53	0.597

Table 11: Hausman Test (Before COVID)

LSR	Coef.	Std.Err.	t	P> |t|	[95% Conf. Interval]
LG	.2373	.1366	1.74	0.086	-.0347 .5095
LS	.2258	.0974	2.32	0.023	.0317 .4199
LC	.0535	.0312	1.71	0.087	-.0077 .1147
LT	-.0129	.0254	-0.51	0.610	-.0628 .0368
LCOAL	-.0407	.0237	-1.71	0.087	-.0874 .0058
LCO	.9773	.8095	1.21	0.227	-.6100 2.5648
LW	.0387	.0305	1.27	0.205	-.0211 .09857
LR	-.0961	.0307	-3.13	0.002	-.1563 -.0358

Table 11 highlights the findings of Hausman Test that states that fixed effect model is appropriate. The p value is 0.0000 which is less than 0.05 meaning that the study rejects the null hypothesis. Hence the appropriate model used in the study is fixed effect model. This suggested that there was up to .2373915 unit increases in SR for each unit increase in LG & .2258073 unit increases in SR for each unit increase in LS. In case of IM the findings of Hausman Test states that fixed effect model is appropriate. The p value is 0.0000 which is less than 0.05 meaning that the study rejects the null hypothesis. Hence the appropriate model used in the study is fixed effect model. This suggested that there was up to .0535351 unit increases in SR for each unit increase in LC & -.0129777 unit decreases in SR for each unit decrease in LT. In case of A the findings of Hausman Test states that fixed effect model is appropriate. The p value is which 0.0000 less than 0.05 is meaning that the study rejects the null hypothesis. Hence the appropriate model used in the study is fixed effect model. This suggested that there was up to .0387075 unit increases in SR for each unit increase in LW & -.0961213 unit decreases in SR for each unit decrease in LR.

Table 12 highlights the findings of Hausman Test in period of during COVID that states that fixed effect model is appropriate. The p value is 0.0000 which is less than 0.05 meaning that the study rejects the null hypothesis. Hence the appropriate model used in the study is fixed effect model. This suggested that there was up to - .1838409 unit decreases in SR for each unit decrease in LG & -.0277041 unit decreases in SR for each unit decrease in LS. The findings of Hausman Test in case of IM state that fixed effect model is appropriate. The p value is 0.0000 which is less than 0.05 meaning that the study rejects the null hypothesis. Hence the appropriate model used in the study is fixed effect model. This suggested that there was up to -.0095495 unit decreases in SR for each unit decrease in LC & .102001 unit increases in SR for each unit increase in LT. In case of E the findings of Hausman Test states that fixed effect model is appropriate. The p value is which 0.0000 less than 0.05 is meaning that the study rejects the null hypothesis. Hence the appropriate model used in the study is fixed effect model. This suggested that there was up to -.0407693 unit decreases in SR for each unit decrease in LCoal & .977398 unit increases in SR for each unit increase in LCO. In case of E the findings of Hausman Test states that fixed effect model is appropriate. The p value is which 0.0000 less than 0.05 is meaning that the study rejects the null hypothesis. Hence the appropriate model used in the study is fixed effect model. This suggested that there was up to .0256485 unit increases in SR for each unit increase in LCoal & -1.210469 unit decreases in SR for each unit decrease in LCO. In case of A the findings

of Hausman Test states that fixed effect model is appropriate. The p value is which 0.0000 less than 0.05 is meaning that the study rejects the null hypothesis. Hence the appropriate model use in the study is fixed effect model. This suggested that there was up to .0234778 unit increases in SR for each unit increase in LW & .0161607 unit increases in SR for each unit increase in LR.

Table 12: Hausman Test (During COVID)

LSR	Coef.	Std.Err.	T	P> |t|	[95% Conf. Interval]
LG	.2373	.1366	1.74	0.086	-.0347 .5095
LS	.2258	.0974	2.32	0.023	.0317 .4199
LC	-.0095	.0354	-0.27	0.788	-.0791 .0600
LT	.1020	.0322	3.16	0.002	.0386 .1653
LCOAL	.0256	.0275	0.93	0.352	-.02835 .0796
LCO	-1.2104	1.3480	-0.90	0.369	-3.8541 1.4331
LW	.0234	.0362	0.65	0.518	-.0477 .0946
LR	.0161	.0305	0.53	0.597	-.0437 .0760

5. CONCLUSIONS

This study aims to determine how commodity returns relate to SMs returns of selected APO Members. The results reveal that before C-19 W & CO have a positive & insignificant relation: G, S, & C have a positive & significant relation, T has a negative & in-significant relationship whereas, R & coal have negative & significant relation. In the case of during C-19 W, R, & coal have positive relation, T is positively significant, whereas, G, S, C & CO have negative relation. Overall time period shows positive relation with C & W, whereas, G, S, & T are positively significant & R is negatively significant. Based on the findings of this study, the research objectives were reasonably met as global commodity index & SM of Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Mongolia, Pakistan, Philippines, Singapore, Sri Lanka, Thail&, Turkey, & Vietnam. Individual & institutional investors, brokers & traders interested in global commodity P indexes in their respective countries will find the results in this paper useful. In all, the paper improves the knowledge about the interaction between global commodity index & SM in respective countries. The study only examined the relationship between SMs & commodities markets. The research was conducted only on the SM of the APO member countries & commodity market indices of only four sub sectors. Therefore, it is recommended to do this same research on different regions as a comparative or Meta study such as GCC, CEE, G20, UN, EU member countries. On the other h&, the current study has selected the four sectors of the commodity market & from those only two are short listed for each category. So, this research can be carried forward considering other sectors or adding full elements of each category.

5.1. PRACTICAL IMPLICATIONS

The study contributes to the 'uncertainty theory' considering that uncertainty causes hasty investment & selling decisions, we believe that the nexus between C-19 cases & their consequences on the stock & commodities markets must be analyzed based on the uncertainty postulate. Finally, this study has implications for the policymakers too as they can benefit from analyzing the relationship between the returns of stock & CMs to assess the impact of a shock to prices in one market on the others, their levels, & scope, & thus frame regulatory policies. The analysis of the impact of CM on stock market risk transmission may also be important for policymakers, as it may allow policymakers to introduce the mechanisms to control the transmission of risk across the different markets.

5.2. LIMITATION/FUTURE RESEARCH

When still using commodities as hedging tools, investors & practitioners would benefit much more from studying volatility & time-varying interactions between commodities & SMs after analyzing the effects on commodities markets as well as the shocks that occurred to the economy (Bouri et al., 2021). In light of the study's inability to compare developed & developing countries, considering the spillover effects of changes in the commodity market as a whole between developed & developing countries can enhance future research. A study that examined the relationship between SMs & commodities markets found several limitations. The research was conducted only on the SM of the APO member countries & commodity market indices of only four sub sectors. Therefore, the result can only be applied to APO members, whereas the result may differ if applied to other countries than APO members. An ADF model, as well as a fixed effect model, have been used in the study. A study was conducted that focused only on the overall relationship between SMs & commodity markets in Bangladesh, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Mongolia, Pakistan, Philippines, Singapore, Sri Lanka, Thail&, Turkey, & Vietnam. Thus,

the results of this study are interpreted on the basis of the fixed effect model, which means that the results are fairly static & have an average meaning as a result. This study was limited by the inability to collect data for the remaining members of the APO. The study uses daily data; according to Dobrev &Szerszen (2010), daily frequency can be derived almost as precisely as volatility data derived from high-frequency data. Only two variables from each selected category of the commodity market are examined in the study which are precious metal, energy, agricultural, & industrial metals.

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