Commodity dynamism in the COVID-19 crisis: Are gold, oil, and stock commodity prices, symmetrical?

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ABSTRACT

The current research intends to examine the commodities' dynamism connection with stock prices under the COVID-19 crisis. DCC-GARCH modeling was applied to the data of Asian economies, including China, India, Sri Lanka, Bangladesh, and Pakistan to achieve the study objectives. The study's results indicated a significant connection between gold prices with stock prices and oil prices for all Asian stock markets. The results of the study constructs were symmetrical. In general, the connection grows with the frequency. The lowest frequency months contributed the most to the total relationship, followed by more than 12 months. Overall, gold and oil prices influence the Asian stock markets. These research findings can avoid contagion in times of economic uncertainty. This study also suggested policy implications for better decision-making of key stakeholders. Dynamic coefficient values were about 0.8 of β2 because nations' internal markets were more closely linked. There are also dynamic relationship factors between crude oil and foreign currency markets, where the correlations in India and China have always been around 0.

1. Introduction

The current economic situation concerned about the monetary effect of different military and conciliatory struggles worldwide through the examination and exploration in 2017. International risks are broadly considered for their significant impact on the economy and governmental issues. Few scholars analyze geopolitical risks and the gold-oil link. Due to market interdependence, gold and oil have a stronger impact on the economy. As a result, it's critical to investigate the link between geopolitical concerns and gold and oil markets. Many studies have been conducted on the relationship between oil markets and geopolitical dangers, with the majority concluding that the two are inextricably linked. Nonetheless, few researchers focused on the association between stock, gold, and oil (Guo et al., 2022). The connection

between business sectors, gold, stock, and oil has greatly affected the economy. Hence, it is important to consider the collaboration while post-coronavirus circumstances on the stock market, gold market, and oil market.

Many studies examined the connection between oil markets and international risks. Most examinations have affirmed the nearby linkage that utilized the BEKK-GARCH model to consider the relationship between post-coronavirus circumstances on the stock exchange, gold, and oil markets (Rohr et al., 2022). International dangers are identified as a result of oil returns and instability (Bai and Dahl, 2018). established a powerful model averaging to consider the unique connection between oil commodity prices, gold commodity prices, and the stock market. They revealed that post-coronavirus is more precise in anticipating oil commodity prices for the time being (Kocher et al., 2006). used

multiracial indicators change examination to find the effects of various post-coronavirus circumstances on oil costs. They found that oil commodity prices strongly affected international conduct. Due to the supporting capacity of gold, more researchers have studied whether the gold market can avoid global dangers.

Gold is a fundamental monetary and actual resource because it performs three imperative capacities: money-related, non-creation (hold resource), and economics financial capabilities. First, due to its conscious bright spot, gold can be used as a trading method and tends to be used as a currency. This element is known as the financial capacity of gold, which was utilized as currency. Gold can be used as support against expansion hazards because of its financial ability. Besides that, gold has the non-creation (save resource) work is utilized for monetary and money-related purposes in modern creation cycles or purposes. Many nations have yet to use gold as piece of their unaccustomed stores to support their trade rate. These highlights make gold a significant resource for financial backers, national investors, and governments because it considered a considerable power, an import substantial piece of worldwide stores (Wang and Zhang, 2021).

Furthermore, gold has been utilized for supporting and portfolio expansion because it is seen as a place of refuge since it has negative connections with other monetary resources like stocks. Financial backers prefer gold as a haven during emergencies like the COVID-19 pandemic. This component is known as the economic capacity of gold. Gold is considered a refuge as it can be utilized as a supporting instrument against vulnerability during outrageous occasions in the monetary business sectors (Taghizadeh-Hesary and Taghizadeh-Hesary, 2020). Gold is considered a huge fence apparatus. It can cooperate with other monetary instruments, such as the swapping scale, oil (and different products), and financial exchanges.

This study revealed that gold has a settling power for a monetary framework by diminishing misfortunes despite outrageous negative market advancements. This finding implied that worldwide financial backers like to hold resources that secure their ventures when there are economic unsettling monetary influences. In addition, the gold price has had a consistent expansion in previous years following the blast across other ware classes. Thus, the equilibrium of the connectedness among gold and Indian monetary business sectors should be researched on whether gold is a safe interest in securing a financial '" 'backer's portfolio. Regardless of the significance of gold and oil commodities (Färe and Grosskopf, 2010), prices for cash supporting and exchanging, the unpredictability of these wares may lead to unfortunate results in monetary business sectors; it is believed that the expansion in oil, gold, and stock value instabilities can cause a hazardous venture condition. Thus, it is important to study the relationship between worldwide wares and monetary business sectors regarding the subsidiary valuation, supporting choices, economic business sectors, and the entire economy (Wilting et al., 2021).

Oil commodity prices are regularly researched for their impacts and connectedness with the stock exchange, money markets, and the general financial exhibition from the points of view of oil-bringing, oil-trading, and created and arising economies. Consider the stocks of growing company sectors and how their trade rates react to oil interest and supply shocks, for example. A comparable examination was conducted on oil-exporting and oil-bringing in economies. The South Asian counties were explored, some European oil-bringing in nations were studied, and the stocks of the United States were analyzed by and. Although this list is not exhaustive, it does show that financial and financial professionals regularly monitor the oil market, related stocks, monetary standards, and other financial resources and instruments. Saudi '" 'Arabia's oil trade commitments to the business sectors are recognized. However, this significant economic change that exposed Saudi Arabia to the external oil market shock has not been effectively addressed. There is no literature found in previous studies.

The results show that gold can keep at home during COVID-19. Most studies focus on the impact on isolated markets after the epidemic.

Although the markets are interconnected, less consideration is given to the effects of global risks on several business sectors. For instance, consider whether COVID-19 can be utilized to foresee the unpredictability of gold and oil. The outcomes showed that COVID-19 ould be used successfully to anticipate the unpredictability of gold and oil. The demonstrated that COVID-19 could clarify part of the adjustment of the instability of raw petroleum prospects. Due to the negative yield of gold, the unpredictability of unrefined petroleum prospects has expanded. The current studies revealed the relationship between COVID-19, gold, oil, and stock markets; yet, there is an absence of exploration in numerous business sectors. This study investigated the relationship between COVID-19 and gold oil markets to help market members settle the speculation choices and avoid hazards to help strategy creators form strategy plans. The overflow file method is used to design the model and the size of influence between factors.

This strategy can determine the course of overflow as well as the size of directional flood between any two business sectors. Nonetheless, the transient effect of COVID-19 on the gold and oil markets can cause changes in market costs via the changes in market interest. When the public authority declared their strategies, the economy recuperated and expanded its buying power. Hence, the drawn-out impact of international affairs on the gold, stock, and oil advertises steadily incapacitated. Likewise (Neralić and Kedžo, 2019), market members have various requirements for market data in recurrence areas due to their region multiple objectives, hazard resilience, and inclinations. The overflow file technique is appropriate for research in the time-space and could not mirror the force of data overflow between factors in various time-recurrence ranges. Most past research focused on singular nations or created nations. As the agents of arising economies, the South Asian countries (Banker et al., 1996) are assuming a significant part of the planet. For instance, the South Asian nations (Pakistan, India, Bangladesh, Nepal, Sri Lanka, Afghanistan, Maldives, and Bhutan) represented over 40% of the total population and 21.9% of the" 'world's GDP in 2018, in which" 'India's GDP was represented by 13%.

Moreover, arising economies are vulnerable to the effect of COVID-19. With their fast turn of events, the South Asian nations are assuming a significant part in the worldwide stage and applying a developing influence on the stock, gold, and oil markets. It is worth considering the effect of post-coronavirus circumstances on gold, stock, and oil in South Asia. Past studies investigated the interaction among worldwide oil, gold costs, conversion scale, and financial exchange returns. It was revealed that value return is affected by worldwide product markets. Additionally, these studies focused on the created 'needs and did not focus on developing markets like India. Presently (Akpolat and Bakirtas, 2020), the Indian securities exchange is one of the top driving monetary business sectors in the South Asian nations. It aided the development of the Indian economic financial market by offering cutthroat types of assistance and foundation in advancing world" 'wide's acknowledgment and the importance of" 'Indian stock exchange. Consequently, this study intended (Hanssen et al., 2018) to investigate if the concerned factors are associated. In this investigation, we utilized the ARDL model with wavelet cognizance change structure to and explore the intercorrelation among worldwide oil costs, gold costs, and financial exchange lists in Hungary. Subsequently, the even-handed and essential commitment of the current investigation is intended to fill this gap.

This study explained the commitments of this article from the three viewpoints. First, this article utilized the COVID-19 pointers from the South Asian nations to investigate their effects on gold, oil, and stock markets. Second, this article answered whether the South Asian" 'nation's post-coronavirus circumstances affected gold, oil, and stock in the time-space and diverse recurrence areas. Finally, through the type of an 'organization's association outline, it presents the strength and direction of the overflow impact among the post-coronavirus effects on oil, gold, and stock market business sectors in South Asia. This study also investigated the impacts of post-coronavirus and this" effects of post-

coronavirus, and which nation's COVID-19 greatly affected oil, gold, and stock business sectors in South Asia. In contrast to the previous studies, the current article revealed the effect of oil, gold, and stock prices on South" 'Asia's monetary business sectors (stock and trade market) and the other way around in novel methodologies.

This study is organized as follows. Segment 2 introduces the theoretical framework, Section 3 depicts the information and the model, Section 4 presents the outcomes and results, Section 5 presents the robustness test, and Section 6 concludes the paper.

2. Literature review

Since the 21st century, peace and improvement have become the principal topics of worldwide relations; however, regular power and post-coronavirus circumstances have significantly changed the global political and financial scene (Zhu et al., 2018). Oil is an important key material and is powerless against international risks. Gold is a significant item and has the capacity to avoid hazards. The effect of gold, oil, and the stock market is vital. The exploration way is categorized into three classes for explicit investigation, COVID-19 and Oil Impact, COVID-19 and Gold Impact, COVID-19 and Stock Impact, Oil, Gold, and Stock Impact, COVID-19 and Stock Impact. Post-coronavirus circumstances may influence oil costs through the accompanying two channels. The primary channel is the inventory channel. COVID-19 may cause military movement, and pressures between nations may prompt the disturbance of supply channels, which thus influences oil costs (Scarpellini et al., 2019).

Global oil, gold, and stock prices have been viewed as critical elements impacted by COVID-19. Therefore, the effects of inconstancy in the three items attracted financial backers, strategy producers, and analysts (Munda and Nardo, 2009). Furthermore, fluctuating worldwide costs of products on various interests and supplies can change the stock and conversion standard of oil-bringing in the economy. For the oil-bringing in countries like India, these variances can lead to Indian rupees devaluation and increase the expansion rate. The crude oil price is affected by international and climate-related components, which may create sudden changes in the organic market and unpredictability in the oil price (Betarelli Junior et al., 2021). Understanding the volatility of oil is crucial because it may cause instability in many aspects of the economy and create instability in the economy, making it difficult for nations to enter. Analyzed the gold job in the global monetary framework and revealed that gold presents a place of refuge against supplies of major arising and agricultural countries. The creators propose that gold is both a fence and a class of shelter for South Asian financial exchanges (Dam Lam et al., 2019).

The subsequent channel is the interest channel (McCartney et al., 2021). COVID-19 has led to disturbance, monetary slumps, and frenzy among individuals along the lines of diminishing interest; thus, the cost of oil falls. Post-coronavirus circumstances may influence gold costs through the accompanying two channels. First, COVID-19 confused domestic law and economic issues, prompting a decrease in money engaging quality and a lot of assets streaming to the item market. Gold with supporting capacity is more appealing to financial backers so that COVID-19 can increase the cost of gold. The second is that COVID-19 can prompt political insecurity and decrease the underway, prompting a very precarious asset supply.

Nations and establishments pick gold with a supporting capacity as an essential save material, which will increase the cost of gold. COVID-19 circumstances may influence the stock market through the economic issues of the nations (Ibn-Mohammed et al., 2021). The accompanying channels can clarify the linkage between gold and oil costs. The main channel is the swelling channel. When raw petroleum costs rise, the general value level will also rise. At the end when swelling is strengthened, the cost of gold increases since it can secure the money's buying force during the oil value period. In this manner, gold can be utilized as a defensive instrument against expansion. The subsequent channel is the

fare income channel. Gold is a significant piece of the global hold arrangement of numerous economies. Any in oil costs will increase the payment of the public monetary forms of oil sending out to nations, and these nations will purchase more gold to solidify their hold portfolio.

Similarly, the increment increases gold values (Chen et al., 2010). The third channel is the unfamiliar trade market channel. All gold, oil, and stock are evaluated in USS dollars; when the USS dollar devalues, the cost of unrefined petroleum needs to increase to get a similar value. An enormous measure of capital will stream into the oil market, causing oil costs to rise (Wang and Huang, 2021). When the deterioration of the US. Dollar increases oil costs, financial backers who exchange US. Dollars endure misfortunes and may use gold for help (Vasylieva et al., 2019).

The present experimental writing on the interconnectedness between oil value, gold, conversion scale, and stock market file has been studied by different specialists. Their papers revealed the effect of the global products on life partner areas and the other way around. This section reviewed past research on the three variables under investigation. Several papers have considered the connectedness between oil price and stock exchange. Inspected the impact of underlying oil value shocks on the covariance of the US. Financial exchange return and economic exchange instability. The study showed positive developments in the request and oil market that impacted the covariance of return and instability. These discoveries supported the survey by that crude oil volatilities affected the stock exchange of all arising economies in the present moment. Another study revealed that most of the cost and unpredictability overflow were temporary, while the drawn-out assumed a minor part. The paper showed a more noteworthy level of intercorrelation between oil and monetary business sectors since the beginning of the USS subprime contract emergency (Narayan, 2005). investigated the interaction between oil value stocks and stock returns in the South Asian markets and recommended that oil value advancements impacted the stock returns in all cases.

This finding implies that the Indian market is wasteful and delicate to the oil value changes. Examined the recurrence elements of instability overflows between oil and" 'India's stock exchange and revealed the unpredictability transmission driven by momentary overflows (Rempel and Gupta, 2021). stated the unbalanced overflow impact between the oil market and securities exchanges. A few studies have investigated the connectedness among gold value, stock, and oil business sectors. Discoveries by (Gürlek and Tuna, 2018) revealed that the gold market affects the securities exchange returns of huge arising South Asian economies and has an adverse consequence on the securities exchanges of India, Pakistan, Bangladesh, Sri Lanka, Maldives, and Bhutan. Revealed the causality connectedness between gold costs and financial exchange returns in India. The paper revealed the criticism causality among the factors. Found that gold commodity prices and rupee-dollar trade rates stayed extensively free from one another in a similar setting.

Several studies inspected the connection between oil and unfamiliar conversion scale returns. For instance (Kaakeh et al., 2021), affirmed that oil costs efficiently clarified the developments in the worth of the US dollar against significant monetary standards from the 1970s to 2018. Revealed that oil cost–swapping scale reliance is to some degree considered frail and is dynamic in the outcome of the worldwide monetary emergency. Mishra (Marttunen and Mustajoki, 2018) reported that oil commodity prices and trade rates are free during the pre-emergency; they have a positive reliance after the emergency begins. Analyzed the effect of oil value shocks on swapping scale developments in five significant oil-trading countries: Russia, Saudi Arabia, Iran, the UAE, and Iraq. The outcomes showed that the instability of trade rates related to oil value developments is critical in these nations. He explored the reliance structure between oil commodity prices and trade paces of South Asian countries. They found that both negative and critical tail reliance existed in all sets. Past investigations studied two of these factors to investigate further elements. While they explained the short and dynamic long-haul relationships among oil commodity prices, gold

commodity prices, and the stock market.

They claim that the prices of gold and oil commodities are inseparable. The DCC-MGARCH model in an observational study was used to determine a time-shifted long-term relationship between the gold, equities, and oil markets. The developers pointed out that these corporate sectors have long been interdependent and oil prices negatively correlate with the stock market. Studied the reactions of 14 significant cash/USD sets on two global products (oil and world value returns) under two procedures: As the shock passed and the average change approached, evidence of a large-scale (Gao, 2020) critical reaction emerged. Financial standards are similar to those following a particular rise in oil prices and a decline with the positive development of global value. India, analyzed the interrelatedness between Google trend information for gold inquiries, gold costs in India, the Indian financial exchange, and the USDINR conversion scale utilizing the ADCC-GARCH model. They showed the presence of bidirectional causality between gold pursuit patterns and gold spot cost besides the effects on the stock and conversion standard business sectors. In an equivalent, Johansen's tests utilizes on dependent cointegration, VAR and Granger causality test to investigate the causality relationship among gold costs, oil costs, and Indian rupee-dollar trade rates (USS Energy Information Administration, 2017). The discoveries proposed that gold costs, oil costs, and rupee-dollar trade rates are independent of one another. Another study distinguished the interrelatedness among worldwide costs of gold, unrefined petroleum, the USD-INR conversion scale, and the financial exchange in India utilizing the DCC-GARCH models.

Experimental outcomes showed that the decline in gold commodity prices and oil commodity prices reduced the worth of the Indian rupee and the benchmark stock market. According to, South Asia had a powerful connectedness among worldwide oil costs, gold costs, conversion scale, and stock exchange records. Survey results from South Asian countries show that crude oil prices significantly impact stock prices, while crude oil prices impact stock prices. In the long run, the price of petroleum products is leaning towards conversion-based returns, but the cost of gold has little impact on the conversion scale (Shahrestani and Rafei, 2020). examined the intercorrelation among factors of oil commodity prices, swapping scale, and stock exchange file in the South Asian economy dependent on gold, oil, and stock markets. In general, many of the examinations on the interaction between worldwide items markets and monetary market were analyzed in the bivariate and multivariate methodologies utilizing different econometric strategies in the time series (Hanif et al., 2019).

There is enough oil for South" 'Asia's economy as far as assembling exercises. The conversion scale is a pivotal financial variable and would significantly impact the monetary development of oil and gold in India. Also, there is no research on the relationship with the economic value of the project, not to mention how worldwide wares impacted the Indian financial business sectors. The regularly utilized strategies for the connectedness investigation in energy writing are cointegration tests and vector mistake rectification models, which did not suggest the basic time-recurrence changes that lead the slack pack construction (Filippini and Greene, 2016).

3. Research methodology

3.1. Estimation methodology

The computational advantages of" 'Engle's DCC-GARCH model have recently attracted more attention (Lang et al., 2021). identified the asymmetric DCC-GARCH version of the ADCC-GARCH model. The VAR-ADCC-GARCH model accounts for the interaction between climate bonds and financial markets. A revised DCC-GARCH model was used in the multivariate regression analysis. Researchers preferred the Engle DCC-GARCH model for its computational advantages. The asymmetric DCC-GARCH (ADCC-GARCH) model was introduced by (Genc, 2017). Markets and the climate bond index may respond similarly, resulting in

significant volatility. Hence, this study utilized the VAR-ADCC-GARCH. In the robustness analysis, we employed additional multivariate models such as the corrected DCC-GARCH. The following is the revised version of the model:

$$SP_t = l + GCP_{t-1} + OCP_{t-1} + \varepsilon_t \tag{1}$$

$$\varepsilon_t = H_t^{V_1} \varepsilon_t \tag{2}$$

Using Equation (1) and Equation (2) of the DCC-GARCH equation models, the symmetrical connections among gold commodity prices, oil commodity prices, and stock prices are computed through the following equations:

$$H_t = SP_t, GP_t, OP_t \tag{3}$$

$$SP_t = diog\left(\sqrt{GP_t}., OP_t\right) \tag{4}$$

$$GP_t = diog\left(\sqrt{SP_t}., OP_t\right) \tag{5}$$

$$OP_t = diog\left(\sqrt{SP_t}., GP_t\right) \tag{6}$$

To guarantee the robustness of study findings, the co. An integration test was used with a fitting technique to analyze recent study topicality. Therefore, the authors applied the Dicky-Fuller test to estimate the robustness of each series of commodity prices and stock prices.

3.2. Data and measurements

The WDI index was utilized for gold and oil prices. The stock" markets' price data of South Asia were gathered. Gold, oil, and stock prices were utilized to construct a three-commodity portfolio. Commodities that can be traded are the most active trading commodities. Volumes are the highest in crude oil and gold transactions (He and Guo, 2021). The commodity futures prices with the shortest maturities were selected (Muhammad Mohsin et al., 2021). The data description used gold commodity futures ('g'), oil commodity futures ('o'), and stock prices ('SP'). The term is used for the normalized roll measure of liquidity, the commodity price, and the realized returns of commodity futures. The data were collected daily using Thomson Data Stream. The bid-ask spread built the commodity liquidity measure (Lt). Many financial studies, including those (Hatefi and Torabi, 2010). The proxy utilizes the bid-ask spread as a measure of the spread by incorporating the autocovariance of daily price changes. The trade assets are valued at the start of the roll, which id showed with V_t (see below):

$$V_t = V_{t-1} - \mu_t \tag{7}$$

where μ_t Reproduces novel facts, entrance expected to be self-regulating by the preceding historical material below the effectual arcade proposition. Roll signified St as the previous experiential oil commodity price on day t and takes up that St tracks the subsequent procedure:

$$S_t = V_t + \frac{1}{2} EQ_t \tag{8}$$

Equation (8) shows that E is the actual difference and Qt is the purchase/sale dimensions for the last oil commodity and gold commodity prices equal to 1 for the purchase and 1 for sale. Q_t Elaborates the maximum likelihood that it is possibly successively uncorrelated.

$$\Delta S_t = V_t + \frac{1}{2} E\Delta Q_t + \mu_t \tag{9}$$

Likewise, a first-order difference is also taken by lumping Equation (8) and Equation (9) that presented the commodities prices yield (e.g., gold prices yield, oil prices yield, and stock prices yield).

$$Cov(\Delta S_t, \Delta S_{t-1}) \ \frac{1}{2}E^2 \ or \ equll \ to \ E^2 \ 2\sqrt{Cov(\Delta S_t, \Delta S_{t-1})} \tag{10}$$

If such autocorrelation is mentioned in Equation (9) leftovers as positive, then the formula shall remain undefined. To cover the aspect, Equation (10) is revised into the following Equation (5):

$$l_t = spread = \left\{ 2\sqrt{-Cov(\Delta S_t, \Delta S_{t-1})} \ , Cov(\Delta S_t, \Delta S_{t-1}) \le 0, \ - Cov(\Delta S_t, \Delta S_{t-1}) > 0 \right\} \tag{11}$$

For the observed commodities prices measures, the statistical summary for gold commodity prices and oil commodity prices procedures in two typical commodity futures markets is presented in Table 1.

4. Results and discussion

Gold is a scarce thing that contributes to a" 'country's economic growth. Gold vitality has many causes for a business. It is maintained on the back of money as a backup and used as a means of exchange. Besides, it is a safe type of financing and other things. The worth of gold is decided on the international market, which is exchanged worldwide at the same price. Throughout the recession, investors treated gold as a haven (Kamyk et al., 2021). The economic model indicates that stock prices drop while gold prices increase throughout a crisis. Thus, investors prefer to invest in gold to cover the inflation risk. The stock market has a negative tendency, and in some instances, the market is smashed. Numerous studies showed that during a crisis, bonds are cheap, and investors purchase gold. When the glue is high, selling gold and buying stock.

4.1. Empirical findings

" 'Today's global economy relies heavily on oil. Oil consumption is increasing due to the modernization and growth of the transportation sector. The functioning of industries relies heavily on oil, and a small change in oil prices may have implications on stock market returns. This volatility depends upon the economy's system, which is imported or exported oil in the countries. Table 1 shows the future liquidities of oil prices and gold prices have the first and second biggest mean values, revealing that these two futures are less liquid. The low median value for study estimates of stock price trends in sample stock markets is the consequence of a high rate of trading days with zero training, which also indicates illiquidity. According to the research findings, size bias may also (Yoshino et al., 2021) be affected across various futures markets because the means and standard liquidity deviations in different commodity futures markets vary significantly. This study normalized the liquidity measurements to remove the size bias effects. Table 1 provides

a comprehensive statistical overview of five standard liquidity indicators. It shows that the size impact was removed across various commodity futures markets. The low average value for livestock futures comes from the high share of zero volume trading days, indicating illiquidity (Liu et al., 2013).

According to the research findings, the impacts on the size of various futures markets might be medium, and the standard deviations of liquidity metrics vary significantly across different commodity futures markets. We adjusted the liquidity metrics to minimize size bias effects. Table 1 provides a comprehensive statistical overview of five typical standard liquidity measurements to remove the size impact across various commodity futures markets. Table 2.

During a worldwide financial crisis, the global stock market and commodity shocks have the biggest effect on output and consumer prices. When the regression is run across two periods, all three residuals become non-static. Even with regulated time delays, they do not integrate despite the Granger causality (Callens and Tyteca, 1999). Time delays may not be the primary cause of residual non-stationarity. So, we proposed a factor that interferes with residues and makes them non-static. We searched for the interference component and removed it from the residual regression. Argued that Granger causality in both series must be in one direction since one variable may help predict the other. As a result, we ran Granger tests on the three commodity prices (gold, oil and stock) that revealed minimal or minor cointegration results, as tabulated in Table 4. Table 4 indicates the gold prices with γ, oil prices with α, and stock prices with ω. In both circumstances, the determinism from the regression problem is responsible for the relationship. There is a correlation between falling gold prices and a decline in the Indian Rupee's exchange rate, and this correlation can be shown by looking at the coefficients in the model. The fall in world gold prices would lead to a rise in demand for gold in India, leading to increased imports and a devaluation of the rupee (Ponce and Khan, 2021). As a result of the country's current bank imbalance, India's gold imports are a serious concern for the government.

In Table 5, study findings indicated less attraction to foreign institutional investors (FIIs) as the Indian rupee depreciates, and FIIs will subsequently sell assets and withdraw money from the market, causing a decline in the stock prices. The Indian Rupee's exchange rate and the stock market indexes of other sample countries are expected to be affected by a drop in petroleum prices. Crude oil prices seem to directly impact the currency and the S&P 500, according to the model's coefficients. Crude oil prices are becoming a global gauge for growth prospects, as has been previously highlighted. The Indian Rupee and the Sensex have both fallen in value due to the recent decline in crude oil prices. The stock and gold prices be connected in their downward spiral. While a decline in gold prices seems to induce a fall in oil prices, it appears that a fall in oil prices promotes a rise in gold prices. As the stock market plummets, people turn to more secure investments like gold. Gold prices show a significant rise due to the stock market's sell-off, while the index will fall due to a significant rise due to the stock

Table 1
The average monthly data of different parameters from Feb 2020 until Jan 2021

	Oil price ($)	Gold price ($)	Asian Stock Index
Feb-20	61.49	1596.11	478761.70
Mar-20	29.88	1588.94	512890.00
Apr-20	18.70	1679.21	690041.88
May-20	31.21	1721.88	986761.18
Jun-20	41.06	1728.18	1270631.12
Jul-20	51.39	1850.49	1916184.07
Aug-20	52.21	1970.59	1757231.00
Sep-20	39.60	1919.88	1595159.00
Oct-20	39.07	1800.31	1412361.70
Nov-20	39.59	1870.29	1345290.41
Dec-20	52.21	1861.39	1439131.01
Jan-21	60.41	1870.97	1150721.97

Table 2
Descriptive estimates.

	Bangladesh	Sri Lanka	India	China	Pakistan
Mean	0.236	0.157	0.349	0.478	0.501
Median	0.096	0.022	0.016	0.034	0.311
Max	11.89	10.27	9.76	14.01	14.44
Min	4.11	3.35	4.41	5.68	2.01

Table 3
ARCH effect test.

	Bangladesh	Sri Lanka	India	China	Pakistan
ADF (level)	−11.15	−17.39	−10.91	−9.33	−23.45
Significance	0.002	0.001	0.031	0.000	0.006
ADF 1st difference	−16.79	−24.51	−12.01	−17.06	−13.99
Significance	0.000	0.007	0.000	0.005	0.000
Q statistics	6.70	5.16	7.01	8.91	9.33
Significance	0.008	0.000	0.000	0.000	0.000
LM test	92.03	90.11	89.47	88.09	94.44
Significance	0.001	0.000	0.000	0.004	0.000
ARCH test	134.00	270.98	213.35	335.40	200.05
Significance	0.022	0.011	0.000	0.000	0.001

Significance level: p-value < 0.05.

Table 4
The results obtained by the unit root test.

Empty Cell	ADF test		
	Form	Test statistic	P-Value
L Stock Index	Level	−2.325	0.81
Empty Cell	First diff	−3.255	0.0075
L Oil Price	Level	−4.5	0.08
L Gold Price	Level	−3.215	0.46
Empty Cell	First diff	−7.325	0.0000

Table 5
Maximum likelihood estimates of the t-DCC model on Asian stock prices.

	GP_t	OP_t	Significance	$1 - (GP_t - OP_t)$
Bangladesh	0.67	0.38	0.000	0.0356
Sri Lanka	0.71	0.69	0.000	0.0219
India	0.89	0.44	0.000	0.0111
China	0.45	0.21	0.000	0.006
Pakistan	0.76	0.85	0.000	0.073

Significance level: p-value < 0.05.

market's sell-off, while the index will fall due to the increased demand.

The study included four Granger causality tests for the commodities in the first row. Granger's capacity to forecast future gold prices is limited to cattle and corn prices. However, a study suggested that other commodities may drive them (see Tables 3 and 4). Fig. 1.

" 'Granger's copper and oil prices are causative to gold futures prices.

Commodities have a small influence on other commodity prices, while metals and oil dominate the whole commodity. Hence, we rerun the gold cointegration test without cattle and oil prices as gold prices are un-predictable. Also, the non-stability of residuals is not due to temporal delays, and we run two cointegration tests for different delays and (Sigala, 2020) check residual stability. Throughout the one-period timeframe, both livestock and gold residuals but oil futures residues remained stagnant. When the regression is run across two periods, all three residuals become non-static. We tried to detect the interference component and filtered it from the residual regression so that it may become stationary.

Due to COVID-19, the demand for gold and base metals has decreased. This situation has caused major car manufacturers world-wide to suffer from the virus epidemic. Similarly, the epidemic has reduced the demand for zinc and end-use aluminum. The epidemic has led to the end-use demand for mining and a decrease in worldwide de-mand for basic metals. Aluminum seems to be less impacted by the epidemic than oil consumption by the main metals and minerals. Throughout the whole duration of the outbreak, prices of precious metals have been quite steady. Gold prices continued to grow (Lansana, 1992), while silver and platinum prices followed a similar pattern at a lower trend. The prices of all the precious metal gold only dropped in March 2020, with some indications of a rebound as seen in their price indices in April 2020. Fig. 2.

It is essential to remember whether conditions affect farm com-modities like wheat. In addition, unlike industrial demand, which pro-tects the investor and speculative demand, it can determine the key question of why precious metals and gold continue to rise. This result is not unexpected for the Asian oil market since climate bonds are put on the market to finance environment-friendly initiatives such as (Kabir et al., 2022) renewable energy projects. Renewable energy businesses aim to supply a replacement for crude oil, and the price hike of crude oil would stimulate economic agents to switch to other energy sources. Due to demand pressures, renewable energy costs could be expected to rise after the increase in crude oil prices.

A favorable connection between oil and climate bond markets was expected. It is close to 0.67% of the relationship between oil prices and stock prices, suggesting possible shelter for investors in oil markets. On the other hand, the gold market seems to have the best relationship with climate bonds, which means that gold does not provide strong protec-tion for ethical investing. During the economic depression, gold and climate bonds may be utilized as haven assets, and there is a positive
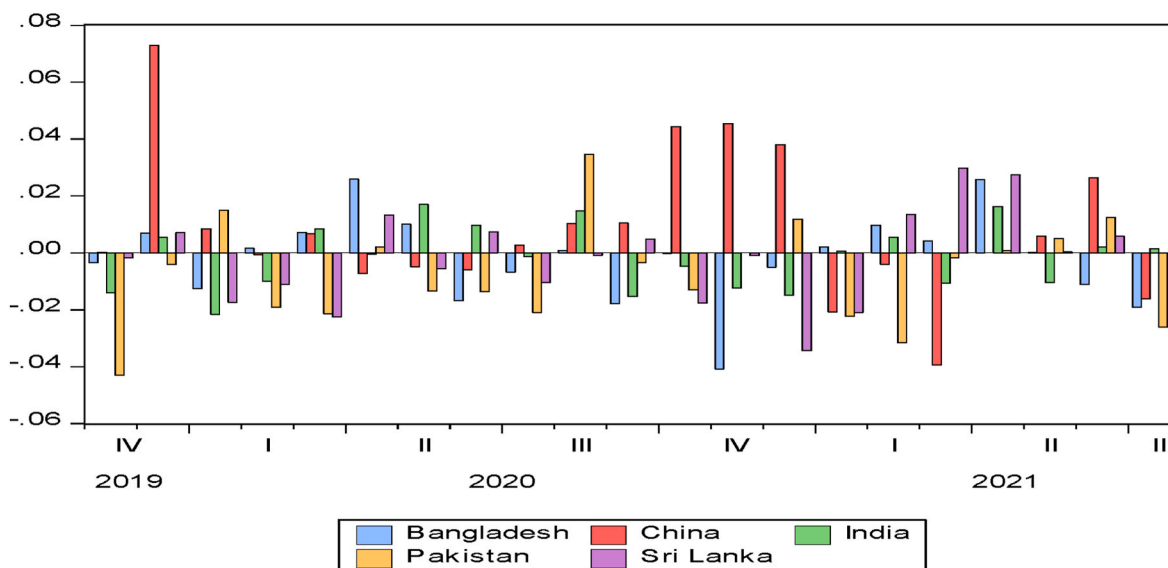

Fig. 1. Estimated volatilities of gold prices during the COVID-19 crisis.
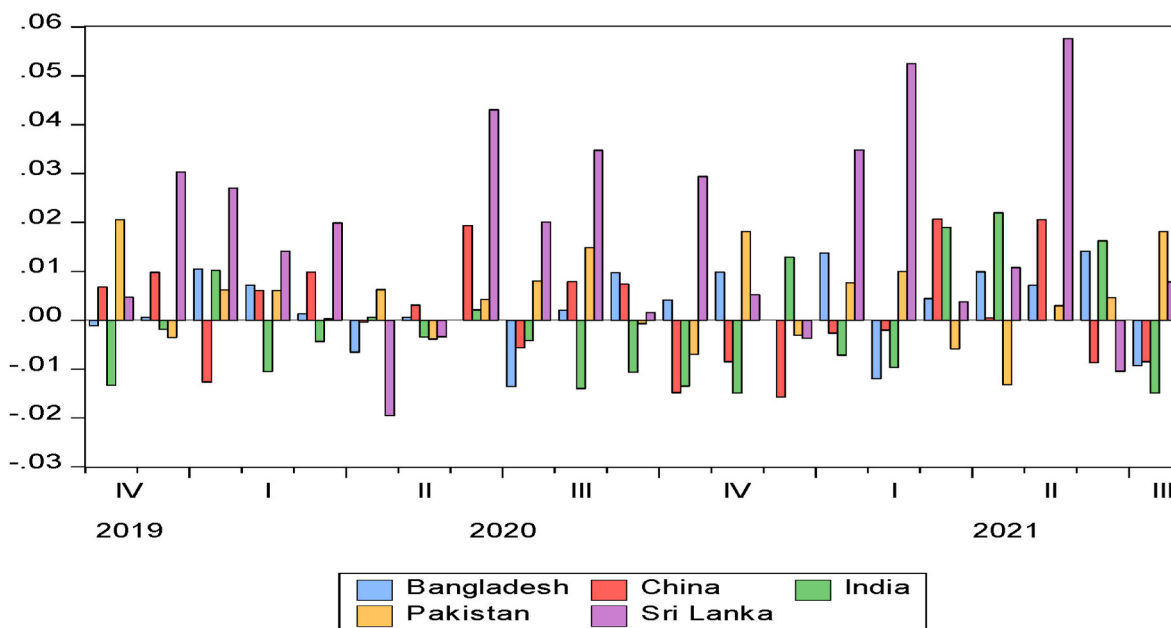
Fig. 2. Estimated changes in oil prices during the COVID-19 crisis.

connection between both asset types (Cline et al., 2020).

According to commodities futures are associated negatively with equities and bonds, making diversification possible. – Opposite to popular belief, several research studies have shown no advantages to diversifying, raising questions about the common consensus about products' rebalancing potentials. Evidence suggests that diversifying advantages for portfolio shareholders with portfolios including resources, equities, and bonds have diminished." For a long time, gold's actual research was dwarfed by those of other capital assets (Kassi et al., 2020). In recent years, market players have paid special focus to gold, especially during the beginning of the global financial crisis (GFC) in 2007–2008. Gold's ability to hold its value during volatile times is noteworthy. Inflationary pressures and excessive stock market losses have already been shown to have a major impact on the function of gold as an outstanding hedge and haven.

Argued that Granger's causality must be one-way in both series, as one variable can help predict the other. Therefore, repeated Granger tests on the prices of three commodities (cow, corn and gold) revealed that they had only moderate co. Integration or no co. Integration. This study includes four (Muhammad Mohsin et al., 2022) Granger causality tests for first-line products. Granger's ability to predict the future value of gold is limited to the prices of cattle and corn. However, there is some evidence that other products other products can cause it can cause it. Table 6.

According to Granger, copper and oil prices are responsible for gold futures prices. Agricultural products have little effect on the prices of other commodities, but metals and oil are the two most important commodities. Gold prices fluctuate, so we revised the gold co. Integration test without the cow and corn prices. Furthermore, the residual instability is not due to delays. Crude oil, the currency exchange, and gold are shown in Table 5 as dynamic statistical parameters between the three. Gold and foreign currency markets in the countries of Sri Lanka, Pakistan and Bangladesh are more closely linked through moment possibility of occurrence. At this latter stage,'. India and China, the world's fastest-growing economies, have a lot in common. A country's exchange markets have limited dynamic connections because of the country's exchange markets have limited dynamic connections because of the country's exchange markets have limited dynamic connections

Table 6
Summary of ARCH models simulations between study constructs.

Economies	Simb	Mean	SD	2.50%	25%	50%	75%	97.5%
Bangladesh	Γ	0.8884	0.0448	−0.0592	0.0641	0.2379	−0.0789	−0.0074
	Ω	−0.0407	1.2605	−0.0708	0.1197	−0.0038	−0.1554	−0.0315
	A	0.3378	−0.0376	0.04596	0.6385	−0.0024	0.0608	0.2077
	B	0.9433	0.7257	−0.0294	0.1739	−0.0369	−0.1582	0.3246
Sri Lanka	Γ	0.1552	0.3974	−0.0022	0.5999	0.0415	−0.0398	0.0358
	Ω	−0.086	0.5815	−0.0416	−0.0127	−0.1214	0.3475	0.1676
	A	−0.0024	0.5309	0.01343	−0.0185	0.9308	0.1109	−0.0526
	B	0.3567	0.1646	−0.0365	0.4666	−0.0265	−0.0134	−0.055
India	Γ	0.0947	−0.0653	−0.0562	0.0089	−0.0529	0.0786	−0.0382
	Ω	−0.1943	0.0908	−0.0188	−0.0028	−0.0338	0.5584	−0.0016
	A	0.1835	0.6032	−0.0029	−0.0184	−0.1249	0.6705	−0.0472
	B	−0.0148	−0.0829	−0.0035	0.2426	0.1468	−0.1378	0.3048
China	Γ	−0.0082	0.1318	0.8043	−0.0403	7.8806	−0.0756	−0.0349
	Ω	0.5889	0.2935	0.0173	0.1639	0.134	−0.1898	0.1007
	A	0.2815	0.1053	0.01893	0.09652	−0.2528	0.0826	−0.0384
	B	0.4096	0.2267	0.01913	−0.0314	0.9566	0.7939	−0.0022
Pakistan	Γ	0.1912	0.2091	0.03389	0.04871	−0.0324	0.1933	−0.0555
	Ω	0.1479	0.0937	0.9966	−0.0011	−0.0435	−0.0031	−0.0033
	A	0.1395	0.2202	−0.0569	0.0553	0.5517	−0.0482	0.5282
	B	0.0448	0.8846	−0.0462	−0.0015	−0.0872	−0.0672	−0.0309

Table 7

Results of the asymmetric causality test between crude oil and gold spot prices.

Null Hypothesis	Test-statistic value	Bootstrap Critical Value at 1%	Bootstrap Critical Value at 5%	Bootstrap Critical Value at 10%
Oil$^+$ $\neq>$ Gold$^+$	11253.21	42.33	8.36	3.21
Gold$^+$ $\neq>$ Oil$^+$	11244.32	4.21	0.58	0.21
Oil$^-$ $\neq>$ Gold$^-$	11.00	12.35	5.32	3.21
Gold$^-$ $\neq>$ Oil$^-$	13.56	13.52	4.32	6.32

Table 8

Results of the asymmetric causality test between crude oil and gold futures prices.

Null Hypothesis	Test-statistic value	Bootstrap Critical Value at 1%	Bootstrap Critical Value at 5%	Bootstrap Critical Value at 10%
Oil$^+$ $\neq>$ Gold$^+$	1325.32	18.36	8.36	5.62
Gold$^+$ $\neq>$ Oil$^+$	11254.32	0.52	0.02	0.00
Oil$^-$ $\neq>$ Gold$^-$	23.62	12.63	7.32	5.32
Gold$^-$ $\neq>$ Oil$^-$	18.63	14.52	8.32	6.23

because of the country's proper management of the floating exchange rates ($\beta1$). In the meantime, the dynamic covariance among crude oil and gold markets remains in flux. For the COVID-19 crisis, the dynamic coefficient values of all the markets show the world of possibilities of unpredictability, showing that disruptions will influence their dependency Table 7.

Statistically relevant coefficients on the term indicate wherein each variable has short-term persistence, and in each instance, the short-term persistence is smaller than the long-term challenge. It is clear from the predicted coefficients that long-term durability is critical to the outcome. The statistical importance of the and terms indicates that implied volatility is occurring. The projected asymmetry term is statistically significant for both oil and stock prices ($\gamma1$ $\omega1$). Shocks of equal size that have negative residuals have a greater effect on unpredictability than surprises that have positives multicollinearity. Investing in emerging economies stocks while hedging one's tail risk within a strategy has substantial ramifications for individuals who desire greater returns. Hedging developing market stock prices is made easier by a volatility indicator like VIX, which is currently the -best. The third-highest hedging efficacy is provided by gold. 'Investing in emerging-market assets, gold is seen as an effective tail-risk hedge because of its cheap overlay costs and poor correlation with many different asset classes Table 8.

The present research objectively explores the protracted vibrant links between WTI crude oil and transnational gold price. The study results test checks short-run equilibrium among variables. The research found worldwide gold prices impact Mexico's stock price favorably, but oil prices adversely. When oil prices rise, stock prices fall. Long-term oil prices adversely affect exchange rates, as seen by the 17.8% decline in the peso's value versus the dollar since early 2019. This analysis finds that gold prices affect the exchange rate. This study has substantial implications for emerging Asian" economies' portfolios and risk management. Considering the impact crude oil prices put on stock markets and currency rates, and it also communicates monetary and fiscal policy. This study helps comprehend how oil price variations affect emerging Asian economies. Crude oil, the most volatile commodity, significantly affects the Indian and Chinese exchange rate and stock market index (Maltini, 2015). Crude oil and gold were amongst the top five exporting resources in Mexico.

This article examines the short- and long-run asymmetric influence of gold and oil and their volatility on developing market stock prices. Gold and oil's tradable volatility indexes estimate their long-term influence on stock prices. Gold and oil volatility indices are tradable instruments and may be utilized to create successful strategies. Gold prices have a favorable on stock prices, but gold volatility hurts developing markets. Understanding commodity prices volatility is critical for valuing derivatives and hedging. Volatility indices may assist in anticipating stock market developments, particularly for developing economies. Moreover, developing stock markets' reactivity to commodity price movements and volatility makes them more exposed to unfavorable news/events that lead to a turbulent and unpredictable economic climate. A nonlinear cointegration study of gold and oil volatilities reveals investing hazards.

4.2. Robustness analysis

The study findings have assessed the robustness of analysis in selecting the DCC model. Asymmetric DCC-GARCH model yielded the same results for return and volatility spillover. The disparity" 'model's contingent connections between climate bonds and Asian countries, as well as gold and oil markets, showed similar patterns. The" 'study's outcomes are gold, oil, and inventory prices; hence, we estimated them and published the results in the Appendix. We also showed the symmetrical DCC-GARCH time disparities. The study findings are presented in the study results Table 9.

For mature Islamic share industries, such as those in Africa studied by (Paswan and Mahto, 2020), gold, silver, platinum, and palladium are good diversification strategies for portfolios utilizing Pedroni panel cointegration research and the full modified ordinary least square technique (FMOLS). Use a SVAR-DCC-GARCH model to explore the dynamic links between commodity and share prices in Egypt and find that time-varying co-movements and stock market volatility are present. An analysis by (Wang and Zhang, 2020)of the dynamic friendship among the Chinese share industry, resource industries, and world oil prices found an important horizontal return spillover effect from the crude oil market, implying a share price reliance on crude oil as a haven throughout periods of unpredictability.

Diversification's investment advantages can't be guaranteed in all

Table 9

Robustness analysis.

	$\gamma1$	$\omega1$	$\beta1$	$\gamma2$	$\omega2$	B2
Gold Prices	0.1338	0.3581	−0.0211	−0.0096	0.1816	0.5487
$\alpha1$	0.4881	0.2832	−0.0555	0.2627	0.7408	0.1421
Oil Prices	2.2505	−0.1251	0.4413	0.4372	−0.0131	−0.0922
$\alpha2$	0.4042	0.3064	0.1647	0.2243	−0.0372	0.5359
Stock Prices	0.4213	−0.0634	0.1562	−0.0131	−0.0943	−0.0088

Table 10
Maximum likelihood estimates of the Gaussian DCC model on Asian stock prices.

	GP_t	OP_t	Significance	$1 - (GP_t - OP_t)$
Bangladesh	0.71	0.26	0.000	0.0119
Sri Lanka	0.79	0.77	0.000	0.0204
India	0.73	0.58	0.000	0.0471
China	0.32	0.35	0.000	0.023
Pakistan	0.72	0.89	0.000	0.005

Significance level: p-value < 0.05.

situations, as the previous point out Table 10.

Moreover, the hedge ratio trends for the three cases are similar to Fig. 3, especially during the pandemic Table, 8 demonstrates the highest hedging efficiency for bond stock, which is affected by COVID-19. We also re-examined the study using the corrected DCC model which can manage covariance matrix estimator biases. Unreported statistics showed that properly implementing DCC did not impact our main hedge ratios or hedging efficiency. The results of this study indicated that the reporting findings are resilient in terms of model choice and DCC process parameters that reflected Asian gold, oil, and stock prices.

5. Discussion

Following the worldwide stock market volatility shock, commodities prices increase for three months until the global financial crisis. The three-month gap between global stock market volatility and commodity prices has widened. It was hypothesized that the first three months of the sample showed a larger drop in commodity prices, which eroded further in the following months. In summary, global stock market volatility shocks have affected the USS production, inflation, interest rates, and commodity prices. The" variables' reactions to global stock market volatility shocks are typically sluggish and slow to reach their peak. The most severe impacts occurred between the sample periods, which peaked with the global financial crisis. Until the mid-1990s, the effects on the USS production were minimal, with most impacts happening within a year. With the global volatility shock, the consumer price index indicated an increasingly negative effect.

These results showed that the stock market is changing the economy and causing endogenous propagation and volatility in both stock prices and output. The link between stock market volatility and American macroeconomics (Zhou et al., 2006) shifted over time. Production and

inflation shifted the responses to global stock market volatility shocks. During the global COVID-19 crisis, gold price shocks increase the Asian bond prices and decrease oil prices at 12 and 60 months of forecasts. It illustrates the effects of commodities shocks on output and global stock market volatility in the first few months. During the COVID-19 crisis, the oil price shock greatly impacted the Asian financial markets. In conclusion, endogenous commodities prices boost the effect of Asian stock prices on industrial output.

These results indicated that the stock market affected the economy gradually, resulting in a significant endogenous propagation mechanism and high stock and product price volatility. The relationship between stock market volatility and the USS macroeconomic condition shifted over time. During the global financial crisis (M. Mohsin et al., 2018), fluctuations in production and inflation were more impacted by global stock market volatility shocks. In the 12- and 60-month projections, the global COVID-19 crisis caused a higher rise in Asian stock values and a sharp decline in oil prices. The proximity of cumulative responses to industrial output and Asian stock market prices for the fourth and sixteenth months demonstrated the effect of commodities price shocks on production and global stock market volatility. During the COVID-19 crisis, the oil price shock had a considerably greater impact on Asian financial markets. These results suggested that endogenous commodity price responses can intensify the effect of Asian stock prices on Asian industrial output.

Increases in commodity prices (particularly oil and metal) can lead to a decline in collective stock prices. According to a theory, the changes in commodity prices will likely have the opposite effect on actual production. The connection between oil and gold (and other metals) can also be explained through the inflation channel. The costs of transportation and production increase parallel with the rise in the price of crude oil. As a result, inflation will rise, particularly in oil-importing countries. Regarding long-term inflation hedges (Drachal, 2021), metals and precious metals are ideal. Investors buy gold and other precious metals to keep their portfolios. According to the inflation channel, oil and metal prices have a positive connection. The aggregate demand model predicted that increasing income would lead to a rise in demand for all assets, which will lead to an increase in their prices and vice versa.
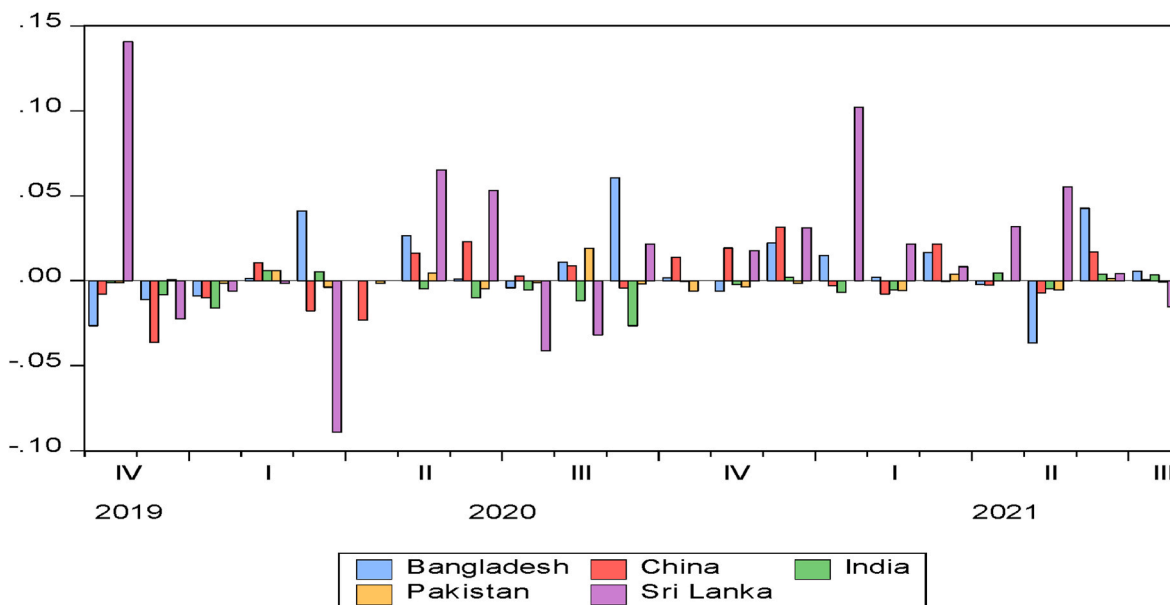

Fig. 3. Estimated changes in stock prices of Asian economies during the COVID-19 crisis.

6. Conclusion and policy implications

The rising of gold and oil prices may not significantly affect the world economy in terms of commodity price. Higher metal prices may have a long-term detrimental effect on industrial production. By diversifying their economies, many nations have managed to mitigate the negative impact of increasing oil prices. It is in the interest of decision-makers to guarantee global competitiveness and regulation. The findings on net volatilities in gold, stock, and oil prices study can help policymakers discover the net transmitters and receivers of information and information connectedness inside the return series analysis. Policymakers should create a framework for information network connection in these markets to preserve market stability and the free flow of metals and oil. The study findings can also maximize the advantages of portfolio diversification. Understanding how shocks and volatility spread across markets may create strategies to reduce contagion risk during economic uncertainty.

The policies should pay more attention to titanium, platinum, gold, and silver markets as they contribute significantly to volatility. If no action is taken, steel, crude oil, stock prices, and palladium markets would also be impacted. To understand the changes in precious metals, oil, and stock prices, one must examine the" investors' behavior and the underlying variables that influence the behavior (including economic news, political developments, and leadership changes). If you are an investor, you should diversify with gold. Businesses may also add gold reserves to their portfolios to hedge against inflation." 'gold's value grows with inflation. It may be good news for families, investors, and businesses. For example, increasing inflation may lead to higher gold prices. An assumption would suggest buying gold to profit from rising gold returns while also hedging against inflation. Individuals or businesses that buy gold must put a lot of effort into diversifying their portfolios with other assets or savings. However, this study has its limitations.

The study findings have significant implications for stakeholders such as investors and portfolio managers in the Asian stock and commodities market. In addition, the investors may readily monitor the forthcoming trends in the stock market by investigating the changes in other factors that affect the stock market. It is also useful in the short- and long-term adoption of risk hedging techniques. Moreover, the results provided policymakers with insights to develop suitable methods for minimizing the detrimental impacts on the Indian stock of macroeconomic factors via conservation measures. The fiscal and monetary policy considers the impacts of changes in global crude oil prices on currency rates and stock markets.

Credit author statement

Muhammad Sadiq, Lam Minh Trung: Writing- Original draft preparation, Supervision, proofreading. Chia-Yang Lin, Kuan-Ting Wang: Methodology, Writing- Reviewing and Editing, Khoa Dang Duong, Thanh Quang Ngo: Software, Validation. Conceptualization.

Data availability

Data will be made available on request.

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