

# In Search of Safe Havens during Market Uncertainties: Evidence from African Stock Markets

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**Abstract:** This paper examines the safe haven potential of global commodities and bitcoin, the leading digital currency, amid global crises. Applying a DCC-GARCH and the model proposed by Baur and McDermott (2010), we specifically investigate the safe haven abilities of some global commodities and the bitcoin against African equities during the 2008 Global Financial Crisis, COVID-19 pandemic and the Russia-Ukraine Conflict. Empirical findings indicate that alternative assets exist that play a safe haven role for investors in African equities during global crises. Overall, gold, cocoa, and coffee have proven to be good safe haven commodities for investors with exposure to most of the major African equity markets. However, the safe haven potential of bitcoin is limited in African stock markets.

**Keywords:** African stocks, Bitcoin, COVID-19, Global crisis, Gold, Safe haven asset.

**JEL:** C32, G10, G11, G15.

## 1. INTRODUCTION

Recent global crises have subjected economies and financial markets to severe shocks that have hit investors. During crises, investors require information about the conditional joint distribution of asset returns to implement dynamic portfolio rebalancing strategies (Chan et al., 2011). This prompts investors to pursue asset combinations that act as a safe haven<sup>1</sup> against financial turmoil. Over the past two decades, the most prominent unexpected events that shook the global economy include the 2008 Global Financial Crisis (GFC), the COVID-19 pandemic, and the current Russia and Ukraine conflict. Umar and Gubareva (2021) provided evidence of increased regional and global connectedness during GFC and the COVID-19 pandemic. Notably, shocks to equities, currencies, and commodities from these events have bigger impacts on weakening developing and emerging markets like Africa. Also, increasing exposure of the financial market to various types of economic shocks has contributed to quickening investors' appetite to search for other means to hedge their downside market-related risk (Boako and Alagidede, 2016).

The Russian invasion of Ukraine, which started on 24th February 2022, led to an unexpectedly severe impact on the global economy. This is due to the significant role of the two countries directly involved. Russia and Ukraine are major producers and exporters of international food, fuel, and energy. Yousaf et al. (2022) identified this conflict as one categorized as a black swan event (examples of such events are wars, terrorist attacks, epidemics, and natural disasters). As such, this event has a significant impact on stock markets worldwide. Thus, the Russia-Ukraine conflict has led to a decline in global equity prices (Izzeldin et al., 2023), rising energy prices, especially crude oil, and gas, as a result of supply disruptions (Huang et al., (2023; Mbah and Wasum, 2022; Prisecaru, 2022), a considerable loss of life and a massive influx of the refugee in many countries<sup>2</sup>. Russia has been slapped with several economic sanctions that are expected to detach it from international markets. These include a ban on the import of Russian oil and gas, a freeze on Russia's Central Bank assets in European Union, UK, US, and Canada, and removal of Russian banks from international financial messaging system SWIFT. This conflict has led to a considerable increase in geopolitical risk and has a far-reaching consequence on global markets. In this period of high uncertainty and turmoil, the connectedness of the financial markets increases as a result of transmission of risk and spillover effects (Umar et al., 2022; Wang et al., 2022). For global investors, events such as these are especially critical

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<sup>1</sup> Baur and McDermott (2010) defined safe haven as an asset that is negatively correlated (uncorrelated) with another asset or portfolio during only specific periods, such as a global crisis.

<sup>2</sup> Over 6.2 million refugees from Ukraine have been recorded globally. See: <https://data.unhcr.org/en/situations/ukraine>

as they induce reorganization and rebalancing of their portfolio, particularly the search for a safe haven during this uncertain period.

Specifically in the case of Africa, the Russia-Ukraine conflict and the tightening of global financial conditions have worsened the economies of many countries. This is hampering the recovery from COVID-19 shocks experienced globally. The Real GDP of Africa declined from 4.8% to 3.8% in 2021 and 2022, respectively. Supply disruptions, severe commodity and energy price shocks are causing reorientation and adjustments across several economies. (African Development Bank, 2023).

The COVID-19 pandemic that started in late December 2019 in China spread worldwide in less than three months. As a result of its fatalities, restrictions in movement, travel restrictions, and border closures, the pandemic brought the global economy to a near shutdown. Global commodities like crude oil and gold fell sharply, as well as a decrease in stock prices worldwide. For example, Kamal et al. (2022) reported an average decline of 36.3% and 35.4% in the G7 and G20 stock markets, respectively. Topcu and Gulal (2020) found a negative effect of COVID-19 on emerging markets. According to Smales (2021), the COVID-19 pandemic provided an appropriate setting to examine how financial markets respond to investor reactions during extreme periods of uncertainty. As such, several authors generated research on which asset mix provides an avenue for safe haven. For instance, Omrane-Adjepong and Alagidede (2021) explored safe havens for African stock markets during the epidemic and pandemic phases of the COVID-19 crisis. Their results suggest that the much-touted safe haven capabilities of gold and other precious metals have dwindled, especially as they fail to provide safety nets for emerging equity markets in Africa. However, its place has not been ceded to bitcoin, as it only acts as a complementary safe haven asset. Akhtaruzzaman et al. (2021) also confirmed that gold lost its hedging capability during the COVID-19 pandemic, mainly due to its hedging cost. Also, cryptocurrencies, well known as portfolio diversifiers, were observed to weaken portfolios' value during the COVID crisis (Colon et al., 2021). The COVID-19 pandemic presented worse consequences to stock markets as several recorded marked drops than any other period in history (Baker et al., 2020).

The occurrence of the 2008 Global Financial Crisis (GFC), which started in the United States and spread throughout the world, contributed to strong interest in theoretical and empirical investigations about relationships between asset markets internationally. That crisis became essential to the global economy since it affected stock prices and other assets in different markets. It is worth noting that such crises resulted in volatility spillovers to different markets (Creti et al., 2013; Sugimoto et al., 2014; Boako and Alagidede, 2016). Creti et al. (2013) analyzed the nexus between commodities and stock markets, focusing on the dynamics of the correlation between both stock and commodities markets to check if the correlation existed because of bullish or bearish in the stock market. Concentrating on the 2007-2008 financial crisis, they investigated if it boosted or disrupted the links between commodities and stock markets. They established that commodities cannot be considered a homogenous asset class

since the downfall of the stock market slackened the links between both markets in the short run. The highest correlations were seen in periods of financial turmoil, indicating increased links between commodities and stock markets. Boako and Alagidede (2016), in their study focusing on Africa's equity portfolio hedging capabilities, revealed that, due to the 2008-2009 GFC, a cross-market correlation between stocks in Africa and global commodities. Findings disclosed different reactions of international commodities investors during market calmness and crisis in Africa.

Of these events, it has been suggested that the Russia-Ukraine war may pose the greatest hit to the global economy as the increase in energy prices is not likely to counteract the economic repercussions of the sanctions imposed on Russia. Generally, the effect of war on the stock market is particularly essential for investors, practitioners, and policymakers (Yousaf et al., 2022; Izzeldin et al., 2023). This study, therefore, contributes to the literature by exploring safe haven candidates during the recent Russia-Ukraine conflict alongside that of the GFC and COVID-19 on African stock markets. Several researchers (Omane-Adjepong and Alagidede, 2021; Morema et al., 2020; Huang et al., 2022) focused on gold and/or oil as safe havens. However, this research will extend the search and include digital currency like bitcoin as a potential safe haven for investors.

Our results confirm both the strong and weak safe haven role of several equity-commodity pairs during crisis periods in African markets. However, the weak safe haven prevails over the strong one, suggesting natural hedging instruments for stock market risk, which is the element that can boost capital markets development in Africa and increase capital inflow from abroad. Generally, gold, cocoa, and coffee are better safe haven commodities than bitcoin. Thus, bitcoin shows minor safe haven capacity during the crisis in African markets. The evidence of safe haven suggests that African markets offer significant diversification benefits in periods of crisis. However, it should be pointed out that each African market portrays distinct asset pairs suitable for portfolio diversification.

The rest of the paper is structured as follows: Section 2 describes the data used in the analysis; Section 3 explains the econometric models used in the study; Section 4 presents the results obtained from the analysis of data; and Section 5 concludes the research, stating some conclusions and policy implications.

## 2. METHODOLOGY

We employ a two-stage dynamic conditional correlation model of Engle (2002), well known as the DCC-GARCH. This study, therefore, estimates the time-varying dynamic conditional correlations between the selected African stock indexes, the selected global commodities, and the cryptocurrency bitcoin. First, using the Maximum Likelihood Estimation method, we estimate the GARCH process to obtain standardized residuals of the return series. Specifically, we adopt an AR (p) - APGARCH in the volatility process to capture the stylized facts of financial time series (fat tails, volatility clustering, leverage effects, long memory, and co-movements in volatility in return series). The mean and variance equations are given by:

$$r_t = \mu + \varepsilon_t \quad (1)$$

$$h_t^\delta = \omega + \sum_{j=1}^p \beta_j h_{t-j}^\delta + \sum_{i=1}^q \alpha_i (|\varepsilon_{t-i}| - \gamma_i \varepsilon_{t-i})^\delta \quad (2)$$

Where  $\mu$  is the mean of returns,  $\varepsilon_t$  represents the error term (residuals). The  $\varepsilon_t$  is a sequence of *iid* random variables with mean zero and variance constant.  $\omega$ , a constant term;  $\gamma_i$  the leverage effect and  $\delta$  the leverage power.  $\delta > 0$ ,  $|\gamma_i| \leq 1$  for  $i = 1, \dots, r$ ,  $\gamma_i = 0$  for all  $i > r$ , and  $r \leq p$ .  $\alpha_i$  and  $\beta_j$  are ARCH and GARCH parameters.

Second, we estimate the DCC parameters. The DCC model is given by this expression:

$$Q_t = \omega + \alpha \varepsilon_{t-1} \varepsilon_{t-1} + \beta Q_{t-1} \quad (3)$$

Where  $\omega = (1 - \alpha - \beta)\bar{Q}$ . According to Engle (2002),  $\bar{Q}$  is considered the second moment of  $\varepsilon_t$ , represented by the estimated returns' sample moment in large systems.

Finally, the dynamic conditional correlations between assets  $i$  and  $j$  can be calculated by:

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}} \quad (4)$$

In the next stage, we adopted Baur and McDermott's (2010) principal regression model to test the safe-haven properties of African equities and global commodities. Extracted DCCs between African equities and the commodities are regressed on the global crises dummies as follows:

$$DCC_{ij,t} = \varphi_0(Const.) + \varphi_1(DCC_{ij,t-1}) + \varphi_2(D_{GFC})_t + \varphi_3(D_{Covid})_t + \varphi_4(D_{war})_t + u_{i,t} \quad (5)$$

where,

$$D_{war} = \begin{cases} 1, & 2/24/2022 \leq t \leq 3/10/2023 \\ 0, & otherwise \end{cases} \quad (6)$$

$$D_{GFC} = \begin{cases} 1, & 9/15/2008 \leq t \leq 5/29/2009 \\ 0, & otherwise \end{cases} \quad (7)$$

$$D_{Covid} = \begin{cases} 1, & 12/09/2019 \leq t \leq 8/11/2020 \\ 0, & otherwise \end{cases} \quad (8)$$

If one of the parameters  $\varphi_2$ ,  $\varphi_3$ , and  $\varphi_4$  are negative and statistically significant (insignificant), then we interpret global commodities as a strong (weak) safe haven for African equities, respectively, under the GFC, COVID, and war crisis periods. On the other hand, there is the absence of a safe haven if  $\varphi_2$ ,  $\varphi_3$ , and  $\varphi_4$  are positive.

### Data and Preliminary Analysis

Daily quantitative data from 14th January 2002 to 10th March 2023, obtained from DataStream, except for bitcoin<sup>3</sup>, were used in the empirical analysis with a total of 5520 ob-

servations. The data were made up of eight stock African indexes (Egypt, Ghana, Kenya, Mauritius, Morocco, Nigeria, South Africa, and Tunisia), spot prices in US dollars of six global commodities (gold, oil, cocoa, coffee, platinum, silver) and the spot prices in US dollars of the cryptocurrency bitcoin. The type of data was selected based on data availability and to enable the study to capture crises that occurred within the period. Furthermore, the African markets chosen represent the largest markets in the continent since they represent the largest stock market by market volume and size.

Table 1 presents the descriptive statistics of the returns of the variables. The series shows positive mean returns, albeit mostly smaller in values and closer to zero. Egypt exhibited the highest average daily returns (0.063), distantly followed by South Africa (0.036), Tunisia (0.034), and gold (0.034). Kenya and bitcoin had our sample's lowest average return (0.003). Although the African stocks and commodities used in the study show positive returns, they show higher volatilities in relation to the average returns. The standard deviation values suggest that silver, followed by crude oil, is the most volatile of all the assets analyzed, while bitcoin is the least volatile asset. It can be seen from the static standard deviations that commodities are generally more risky than equities, as concluded by authors like Buyuksahin and Robe (2014), Boako and Alagidede (2016), Omane-Adjepong and Alagidede (2022). This suggests the possibility of a safe haven in the combination of these asset classes with stocks.

From the table, our series deviates from the normal distribution, as evidenced by the skewness and kurtosis values. The skewness values show the assets used in the study peaked at the left except for Kenya, coffee, and bitcoin. Furthermore, all the assets analyzed show leptokurtic characteristics since their kurtosis values are greater than 3, indicating high peaks. Also, looking at the Jacque-Berra (JB) statistics values with their probabilities rejects the null hypothesis of normality in all the returns. Moreover, the null hypothesis of non-stationarity is rejected at a 1% significance level at the first difference.

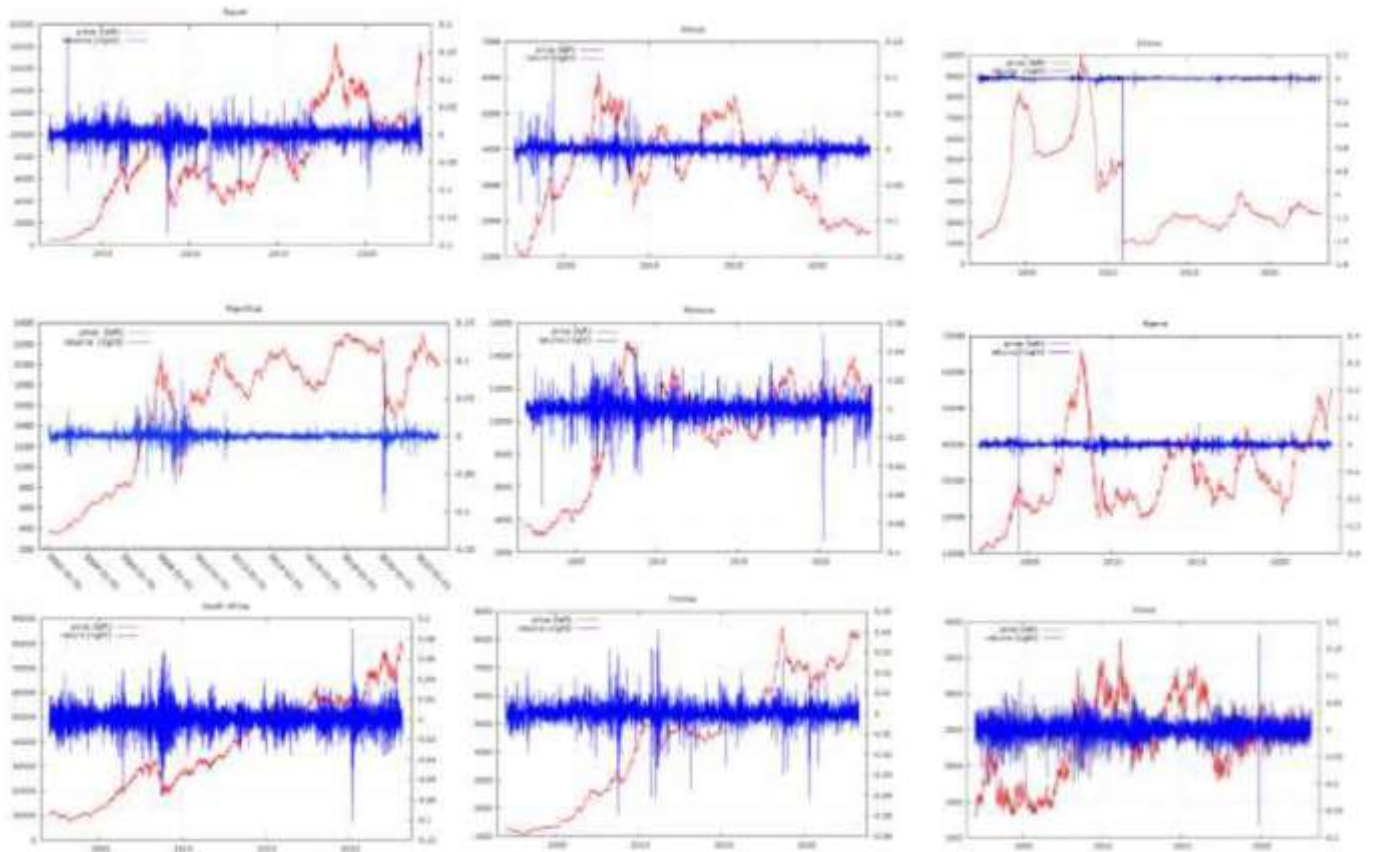
Fig. (1) shows the price-return graphs for the eight equities (Egypt, Kenya, Mauritius, Morocco, Nigeria, South Africa, Tunisia, and Ghana) with the global commodities (gold, coffee, oil, cocoa, silver, and platinum) and the cryptocurrency bitcoin. The titles in each graph are self-explanatory, and the primary and secondary axes refer to the price levels (left) and returns (right), respectively. It is seen that most of the assets have increasing trends at early stages except Kenya, which decreased initially. However, bitcoin appeared to be stable for some time before it rose in 2018. Noticeably, most asset markets were affected by the 2008 global financial crises and the recent COVID-19 crises due to high peaks during those periods, accompanied by sharp declines. However, gold was not affected.

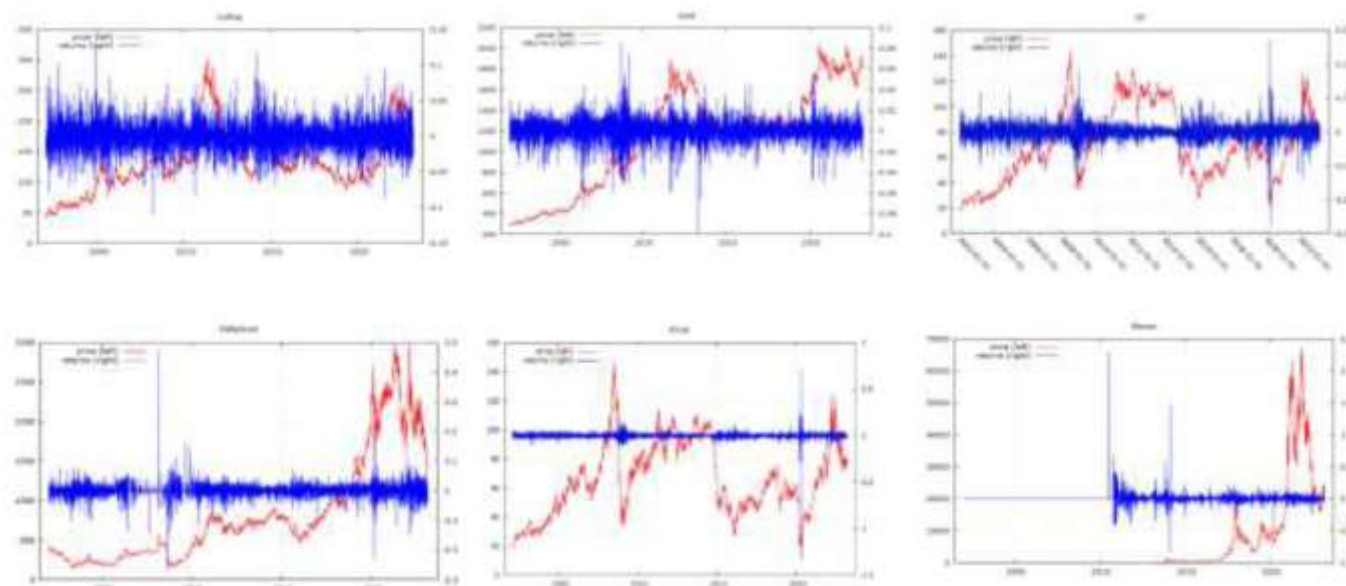
In terms of returns, there is high volatility persistence in South Africa, gold, oil, cocoa, and coffee. On the other hand, Ghana, silver, and bitcoin have low volatility persistence. Gold and coffee prices were not affected during the GFC and the COVID-19 crises, which means they can be considered a safe haven in volatile periods. Generally, African stock prices are less volatile in nature with reference to these plots.

<sup>3</sup> Data on bitcoin was solicited from: <https://coinmarketcap.com/>. The data starts from 19/07/2010, unlike the rest, which starts from 14/01/2002.

Table 1. Descriptive statistics for the daily returns.

	Mean	Std. Dev.	Skewness	Kurtosis	JB @ 1% level	ADF @1%
LEGY	0.063	1.554	-0.475	14.16	2.88E+04(0.00)	-62.95(0.00)
LKEN	0.003	0.857	0.204	34.36	2.26E+05(0.00)	-41.23(0.00)
LMAU	0.032	0.667	-0.399	47.84	4.63E+05(0.00)	-21.92(0.00)
LMOR	0.019	0.750	-0.903	15.65	3.75E+04(0.00)	-58.19(0.00)
LNIG	0.029	1.224	-0.585	372.0	3.13E+07(0.00)	-45.94(0.00)
LSA	0.036	1.182	-0.253	8.626	7.34E+03(0.00)	-73.68(0.00)
LTUN	0.034	0.499	-0.653	15.77	3.79E+04(0.00)	-43.48(0.00)
LGHA	0.012	2.289	-59.74	4127	3.91E+09(0.00)	-74.31(0.00)
LGOLD	0.034	1.094	-0.367	8.568	7.25E+03(0.00)	-75.33(0.00)
LOIL	0.028	2.3601	-0.1081	14.622	3.10E+04(0.00)	-73.08(0.00)
LCOC	0.013	1.811	-0.243	8.433	6.84E+03(0.00)	-74.78(0.00)
LCOFF	0.023	2.037	0.233	5.103	1.07E+03(0.00)	-75.92(0.00)
LPLAT	0.012	1.616	-4.535	162.4	5.86E+06(0.00)	-71.03(0.00)
LSILVER	0.025	3.282	-9.941	531.1	6.42E+07(0.00)	-37.83(0.00)
LBITCOIN	0.004	0.071	2.4689	76.12	7.38E+05(0.00)	-30.43(0.00)





**Fig. (1).** Time series plot of prices and returns.

**Table 2.** Dynamic conditional correlation results

	Cocoa	Coffee	Gold	Oil	Platinum	Silver	Bitcoin
<b>Egypt</b>							
$\rho$	0.028**	0.026**	-0.007	0.038*	0.026*	0.044***	-0.004
$\alpha$	0.000	0.000	0.007	0.010	0.000	0.024**	0.007
$\beta$	0.827***	0.837	0.889***	0.972***	0.856***	0.837***	0.885***
$\alpha+\beta$	0.827	0.837	0.896	0.982	0.856	0.861	0.892
LL	-20394.191	-21111.004	-17406.33	-21310.3	-19886.391	-21542.287	-51898.504
SIC	7.417	7.677	6.334	7.749	7.233	7.833	18.834
<b>Kenya</b>							
$\rho$	0.011	0.005	0.009	0.027*	0.018	-0.001	-0.011
$\alpha$	0.000	0.000	0.011	0.014**	0.000	0.016**	0.007
$\beta$	0.838***	0.834	0.537*	0.842***	0.866***	0.000	0.922***
$\alpha+\beta$	0.838	0.834	0.548	0.856	0.866	0.016	0.929
LL	-16541.79	-17258.591	-13552.265	-17465.4	-1.6033.082	-17700.541	-48043.789
SIC	6.021	6.281	4.938	6.356	5.837	6.441	17.437
<b>Mauritius</b>							
$\rho$	0.028**	0.018	-0.003	0.034**	0.032**	0.024	0.011
$\alpha$	0.012	0.021*	0.011	0.005	0.000	0.026*	0.002
$\beta$	0.326	0.000	0.000	0.913***	0.847	0.299	0.878**
$\alpha+\beta$	0.338	0.021	0.011	0.918	0.847	0.325	0.88
LL	-13860.366	-14576.653	-10873.297	-14786.5	-13352.232	-15015.08	-45365.226
SIC	5.049	5.309	3.967	5.385	4.865	5.468	16.466

Morocco							
$\rho$	0.000	0.005	-0.029*	0.013	0.014	0.012	-0.011
$\alpha$	0.006**	0.000	0.004	0.021	0.003	0.010**	0.016*
$\beta$	0.979***	0.821	0.967***	0.502	0.946***	0.961***	0.938***
$\alpha+\beta$	0.985	0.821	0.971	0.523	0.949	0.971	0.954
LL	-16061.891	-16781.148	-13072.583	-16988.7	-15555.77	-17214.982	-47563.982
SIC	5.847	6.108	4.764	6.183	5.664	6.265	17.263
Nigeria							
$\rho$	-0.022*	0.023*	0.004	0.032**	0.027**	0.025*	0.012
$\alpha$	0.000	0.000	0.002	0.028*	0.000	0.029	0.000
$\beta$	0.834**	0.836	0.836**	0.284	0.861***	0.359*	0.877*
$\alpha+\beta$	0.834	0.836	0.838	0.312	0.861	0.388	0.877
LL	-18020.018	-18736.497	-15032.329	-18944.2	-17511.266	-19176.875	-49523.404
SIC	6.557	6.816	5.474	6.892	6.372	6.976	17.973
South Afr.							
$\rho$	0.055**	0.028	0.059***	0.1931	0.184***	0.236***	-0.189
$\alpha$	0.009**	.0.003**	0.000	0.0067**	0.023***	0.009	0.006
$\beta$	0.980***	0.995***	0.833**	0.9929***	0.953***	0.989***	0.993
$\alpha+\beta$	0.989	0.998	0.833	0.9996	0.976	0.998	0.999
LL	-18769.311	-19489.029	-15788.578	-19495	-18180.311	-19768.364	-50418.376
SIC	6.828	7.089	5.748	7.091	6.615	7.19	18.285
Tunisia							
$\rho$	0.001	0.005	-0.026*	0.022	0.011	0.015	-0.009
	0.013**	0.004	0.000	0.024**	0.008	0.016*	0.015
$\beta$	0.907***	0.96***	0.829**	0.161	0.794	0.000	0.444*
$\alpha+\beta$	0.92	0.964	0.829	0.186	0.802	0.016	0.459
LL	-13855.581	-14573.796	-10866.975	-14781.9	-13348.835	-15014.703	-45359.559
SIC	5.048	5.308	3.965	5.383	4.864	5.468	16.464
Ghana							
$\rho$	0.003	-0.007	-0.013	-0.015	0.003	-0.017	0.003
$\alpha$	0.000	0.000	0.000	0.00	0.007	0.000	0.021*
$\beta$	0.864***	0.876	0.875**	0.875	0.000	0.879	0.827***
$\alpha+\beta$	0.864	0.876	0.875	0.875	0.007	0.879	0.848
LL	-21046.175	-21762.595	-18056.813	-21973.5	-20536.81	-22204.905	-52545.588
SIC	7.653	7.913	6.57	7.989	7.469	8.073	19.068

Notes: This table shows the results of Engle DCC-GARCH (1,1) estimates.  $\alpha$  and  $\beta$  are ARCH and GARCH parameters, respectively, which under the non-negativity assumption,  $\alpha+\beta < 1$ .  $\rho$  is a measure of correlation, LL represents log-likelihood, and SIC is the Schwarz Information Criterion. \*\*\*, \*\*, \* denotes statistical significance at 1%, 5% and 10% levels respectively.

Table 3. Estimation results of safe havens during crisis for African markets.

	Cocoa	Coffee	Gold	Oil	Platinum	Silver	Bitcoin
<b>Egypt</b>							
$\varphi_0$	0.0052***	0.0047***	-0.0008***	0.0007***	0.0040***	0.0059***	-0.0005***
$\varphi_1$	0.8170***	0.8214***	0.8999***	0.9811***	0.8478***	0.8660***	0.8921***
$\varphi_2$	<b>-3.59E-08</b>	1.01E-06**	<b>-2.05E-05</b>	0.0016**	<b>-1.37E-07</b>	0.0030*	0.0001
$\varphi_3$	1.58E-07	<b>-4.28E-07</b>	0.0008	<b>-0.0001</b>	<b>-5.81E-08</b>	0.0030*	0.0011***
$\varphi_4$	<b>-1.92E-07**</b>	<b>-7.65E-07**</b>	0.0005	<b>-0.0004</b>	1.75E-07**	<b>-0.0003</b>	0.0002
<b>Kenya</b>							
$\varphi_0$	0.0019***	0.0009***	0.0040***	0.0037***	2.61E-03***	-0.0013***	-0.0006***
$\varphi_1$	8.28E-01***	8.30E-01***	0.5671***	0.8610***	0.8535***	0.0218	0.9380***
$\varphi_2$	1.37E-07	2.82E-08***	<b>-0.0003</b>	0.0020**	1.41E-07	0.0017	0
$\varphi_3$	<b>-2.88E-09</b>	<b>-2.68E-08***</b>	1.48E-03*	0.0020*	3.52E-07	0.0027**	0.0005
$\varphi_4$	<b>-4.26E-08</b>	<b>-2.46E-08***</b>	<b>-1.94E-04</b>	<b>-0.0007</b>	5.01E-07***	0.0015	2.82E-05
<b>Mauritius</b>							
$\varphi_0$	0.0181***	0.0173***	-0.0028***	0.0027***	0.0050***	0.0148**	0.0012***
$\varphi_1$	0.3521***	0.0339**	0.0218	0.9192***	0.8443***	0.3695***	0.8839***
$\varphi_2$	0.0007	0.0026*	<b>-0.0020**</b>	0.0008*	2.26E-05**	0.0018	<b>-1.53E-05</b>
$\varphi_3$	<b>-0.0008</b>	0.0029*	2.58E-05	0.0010**	6.85E-06	0.0032*	<b>-3.01E-05</b>
$\varphi_4$	<b>-0.0006</b>	0.0014	0.0002	<b>-0.0002</b>	<b>-1.36E-05</b>	<b>-0.0007</b>	<b>-7.68E-05</b>
<b>Morocco</b>							
$\varphi_0$	1.18E-05	0.0009***	-0.0009***	0.0058***	0.0007***	0.0003*	-0.0006***
$\varphi_1$	0.9844***	0.8182***	0.9704***	0.5461***	0.9485***	0.9711***	0.9514***
$\varphi_2$	2.55E-05	1.48E-05**	0.0002	0.0032**	<b>-8.91E-05</b>	0.0011	0.0002
$\varphi_3$	0.0002	3.69E-06	<b>-3.54E-05</b>	0.0050***	4.87E-05	0.0018**	0.0020***
$\varphi_4$	<b>-0.0005</b>	1.11E-05**	<b>-0.0004</b>	<b>-0.0006</b>	0.0002	0.0003	0.0011*
<b>Nigeria</b>							
$\varphi_0$	-0.0048***	0.0038***	0.0006***	0.0215***	0.0040***	0.0149***	0.0015***
$\varphi_1$	0.8249***	0.8326***	0.8379***	0.3269***	0.8509***	0.4064***	0.8767***
$\varphi_2$	9.31E-09	4.16E-07	<b>-5.14E-05</b>	0.0015	<b>-5.67E-07**</b>	0.0014	9.17E-10
$\varphi_3$	<b>-1.03E-09</b>	3.92E-07	0.0002	0.0028	7.86E-07***	<b>-0.0001</b>	1.37E-08
$\varphi_4$	<b>-5.92E-09</b>	<b>-3.38E-07</b>	<b>-3.37E-05</b>	<b>-0.0014</b>	4.00E-08	0.0008	<b>-1.55E-09</b>
<b>South Africa</b>							
$\varphi_0$	0.0006***	9.24E-05	0.0097***	0.0004**	0.0051***	0.0007***	4.55E-05
$\varphi_1$	0.9872***	0.9965***	0.8284***	0.9984***	0.9706***	0.9965***	0.9967***
$\varphi_2$	0.0021***	0.0012***	4.81E-08	0.0009*	<b>-0.0011</b>	0.0012*	<b>-0.0001</b>
$\varphi_3$	0.0001	0.0004	<b>-6.14E-08</b>	<b>-0.0005</b>	0.0001	0.001	0.0018***
$\varphi_4$	0.0002	<b>-0.0002</b>	7.63E-08	<b>-0.0005</b>	0.0021	<b>-0.0002</b>	0.0010**

Tunisia							
$\varphi_0$	0.0001	0.0002***	-0.0046***	0.0177***	0.0021***	0.0141***	-0.0048***
$\varphi_1$	0.9202***	0.9638***	0.8253***	0.2013***	0.8054***	0.0365***	0.4891***
$\varphi_2$	-0.0004	0.0003	-7.01E-08	0.0043**	0.0014***	0.0009	0.0001
$\varphi_3$	-0.0002	0.0002	-2.96E-08	0.0008	0.0011**	0.0023**	0.0016**
$\varphi_4$	-6.36E-05	-0.0002	-1.71E-08	0.0003	-0.0005	-0.0004	-0.0002
Ghana							
$\varphi_0$	0.0034***	0.0004***	-0.0017***	-0.0012***	0.0025***	-0.0016***	0.0004***
$\varphi_1$	0.0384***	0.9031***	0.8704***	0.7940***	0.1005***	0.8628***	0.8886***
$\varphi_2$	-0.0014**	-0.0004	-1.72E-08	-0.0013	-5.37E-05	-0.0011***	-9.96E-06
$\varphi_3$	-0.0002	0.0001	-7.86E-09	-0.0005	-3.21E-05	-2.80E-05	-2.43E-04
$\varphi_4$	-0.0002	-0.0003	1.27E-08	-5.51E-06	-0.0003	7.69E-05	3.51E-05

\*\*\*, \*\*, \* denotes statistical significance at 1%, 5% and 10%.

### 3. RESULTS AND DISCUSSION

Table 2 presents the DCC-GARCH estimation. Results show that selected African stocks possess low correlations with returns on commodities and bitcoin, in line with Creti et al. (2013) and Boako and Alagidede (2016). It is observed that most of the assets have positive and significant correlation coefficients, except for Morocco-gold, Tunisia-gold, Nigeria-cocoa, and Ghana-oil. These negative correlations of gold and cocoa support the safe-haven phenomenon.

Similarly, the following assets have significant ARCH ( $\alpha$ ) and GARCH ( $\beta$ ) effects: Egypt-Silver, Morocco-Cocoa, Morocco-Silver, Morocco-bitcoin, South Africa-cocoa, South Africa-coffee, South Africa-platinum, Tunisia-cocoa and Ghana-bitcoin suggesting volatility persistence. Also, there are long-term relationships between cocoa, gold, oil, platinum, bitcoin, and most African stock indexes since their GARCH ( $\beta$ ) effects are significant and close to one. Most of the  $\alpha+\beta$  values are close to one, meaning they are highly persistent. Noticeably, Morocco’s and South Africa’s equities are highly persistent with global commodities, which indicates that both countries are more integrated into the world’s economy.

Table 3 presents estimation results for possible safe havens in the African markets during crises. The results are based on the estimation of equation 5. Our utmost interest is the coefficients associated with the dummy variables for the various crisis periods (GFC, COVID-19, and Russia-Ukraine war). Unsurprisingly,  $\varphi_0$  and  $\varphi_1$  are highly significant in all estimations.

During the GFC, strong, safe haven opportunities were detected in Ghana-Cocoa, Ghana-Silver, Mauritius-Gold, and Nigeria-platinum. However, it was revealed that weak safety nets were recorded for Gold in five markets (Egypt, Ghana, Kenya, Nigeria, and Tunisia), platinum in four markets (Egypt, Ghana, Morocco, and South Africa), bitcoin in three markets (Ghana, Mauritius, and South Africa), and two in cocoa (Egypt and Tunisia). In addition, crude oil acted as a

weak safe haven for Ghana since its coefficients were less than zero.

Kenya-coffee was the only market pair that showed strong safe haven ties during the recent COVID-19 pandemic. Weak safe havens were also seen in cocoa and five markets (Ghana, Kenya, Mauritius, Nigeria, and Tunisia), gold in four markets (Ghana, Morocco, South Africa, and Tunisia), oil in three markets (Egypt, Ghana, and South Africa), two markets each in platinum (Egypt and Ghana), silver (Ghana and Nigeria) and bitcoin (Ghana and Mauritius), as well as Egypt-Coffee market pair.

Further examining the results, Egypt-cocoa, Egypt-coffee, and, once again, Kenya-coffee offered the strongest safe haven pairs during the Russia-Ukraine war period. The weak safety nets during the Russia- Ukraine war were cocoa in all the markets except South Africa, oil in all the markets except Tunisia, coffee (Ghana, Nigeria, South Africa, and Tunisia), gold (Kenya, Morocco, Nigeria, and Tunisia), and silver (Egypt, Mauritius, South Africa, and Tunisia) in four markers, platinum (Ghana, Mauritius, and Tunisia), and bitcoin (Mauritius, Nigeria, and Tunisia) in three markets.

Cocoa and gold emerged as the front runners for commodity-Africa equity pair during periods of crisis as they provided safety nets in almost all the African markets. The overall effect of the safe haven pair indicates that investors are compensated for shocks during crisis periods when these two assets are in the portfolios along with African stocks. Hence, investors can seek refuge in these pairs of assets to avert huge losses during crises.

The findings revealed that African asset prices were volatile across time. Results confirmed that gold could be a consolidated safe-haven asset during a financial crisis. Interestingly, cocoa followed a similar pattern, although many authors have not been regarded as such. African markets should be considered an integral part of the global diversified portfolio of stocks and commodity markets since significant diversification benefits and their prospect as emerging markets. The diversification benefits from African markets are country-



**Table 4: Safe havens pairs from the analysis**

	Cocoa			Coffee			Gold			Oil			Platinum			Silver			Bitcoin		
	GFC	COVID	WAR	GFC	COVID	WAR	GFC	COVID	WAR	GFC	COVID	WAR	GFC	COVID	WAR	GFC	COVID	WAR	GFC	COVID	WAR
Egypt	GFC		WAR		COVID	WAR	GFC				COVID	WAR	GFC	COVID				WAR			
Kenya		COVID	WAR		COVID	WAR	GFC		WAR			WAR									
Mauritius		COVID	WAR				GFC					WAR			WAR			WAR	GFC	COVID	WAR
Morocco			WAR					COVID	WAR			WAR	GFC								
Nigeria		COVID	WAR			WAR	GFC		WAR			WAR	GFC				COVID				WAR
South Africa						WAR		COVID			COVID	WAR	GFC					WAR			
Tunisia	GFC	COVID	WAR			WAR	GFC	COVID	WAR						WAR			WAR			WAR
Ghana	GFC	COVID	WAR	GFC		WAR	GFC	COVID		GFC	COVID	WAR	GFC	COVID	WAR	GFC	COVID		GFC	COVID	

specific. Hence, each country portrays distinct asset pairs that are favorable for use as portfolio diversification. Overall, gold, cocoa, oil, and coffee are considered good safe-haven commodities in most markets. Therefore, investors may invest in them jointly with other assets during crises rather than the recent inclination to bitcoin.

#### 4. CONCLUSION AND RECOMMENDATIONS

This paper examined alternative assets that played the role of safe haven assets during crises in the context of investors taking positions in the most active African stock markets. The crises and assets considered in the analysis, based mainly on the DCC-GARCH econometric model, are summarised as follows:

- I. Crisis analysed: a financial crisis (GFC), a health crisis (COVID-19), and a war crisis (Russia-Ukraine war).
- II. African stock markets: Egypt, Kenya, Mauritius, Morocco, Nigeria, Nigeria, South Africa, Tunisia, and Ghana.
- III. Alternative assets that can potentially play a safe haven role: precious metals (gold, silver, and platinum), commodities with relevance to the African economy (cocoa, coffee, and oil), and bitcoin as the main global cryptocurrency.

The results obtained from the econometric analysis are summarised in Table 4.

Based on the analysis in this paper, the main conclusions and recommendations to investors with positions in African stock markets can be summarised as follows:

- I. Both African investors in African equities and those from outside the region have alternative assets that play a safe haven role in the event of global crises of different origins. However, it should be noted that the weak relationship outperforms the strong one from the analyses. This means that, to some extent, there are natural hedging instruments for stock market risk, which is an element that can boost the much-needed development of capital markets in Africa, as well as the inflow of capital from abroad.
- II. Gold, the safe haven asset par excellence, is a relevant safe haven asset in global crises for investors in African stocks. According to our results, it is the main safe haven asset.
- III. Cocoa plays a role as a safe haven asset at a similar level to gold, especially in the COVID-19 crisis and the Russia-Ukraine war. Concerning the latter crisis, cocoa is a safe haven asset for 7 of the eight stock markets analysed. Investors who use cocoa as a safe haven asset may turn to the futures markets, mainly in New York and London. Greater use of cocoa futures markets by investors with no interest in the physical cocoa market could have a double effect. On the one hand, they would provide counterparties for hedging companies wishing to hedge

cocoa market risk. On the other hand, they could also add unwanted volatility to the cocoa market, especially if investments in the exchanges are essentially speculative and unstable.

- IV. Coffee is a less relevant safe haven asset than cocoa, except for Kenya, a major producer and exporter of this commodity in Africa. As seen in Table 4, coffee has shown a strong, safe haven role in the COVID-19 and Russia-Ukraine war crises.
- V. The role of oil as a safe haven for stock market investments in Africa has been generally weak. Although, some authors concludes of strong safe haven capabilities of crude oil, it is merely reduced to a weak safe haven in African markets during crises.
- VI. The other two precious metals analysed (silver and platinum) have a much smaller safe haven role than gold, although platinum has been more prolific than silver.
- VII. The bitcoin cryptocurrency has emerged as a safe haven when crises affect two stock markets in two countries analysed: Mauritius and Ghana and to some extent Nigeria and Tunisia. For the rest, bitcoin is of little importance as a safe haven asset. This latter conclusion about bitcoin is in line with other studies that question the role of bitcoin as a safe haven asset for stock market investments in markets other than the African bourse. The radically different behavior of gold and bitcoin in market distress is pointed out by Klein et al. (2018). On the other hand, Long et al. (2021) highlight the different properties of gold and bitcoin as safe-haven assets. This study concludes that investors can reduce losses by increasing gold and decreasing bitcoins positions.
- VIII. In terms of country analysis, two issues stand out. On one hand, Ghana has the most safe-haven asset alternatives detected: 17 cases out of a possible 21. However, on the opposite side are South Africa and Morocco, with only six and five safe haven alternatives respectively.

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