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The Role of Gold as a Hedge or Safe Haven in African Stock Markets during the COVID-19 Pandemic

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ABSTRACT
This study seeks to investigate the role of gold as a hedge or safe haven against African stock movements during the COVID-19 pandemic by using a two-state Markov Regime-Switching approach. The findings suggest that gold serves as a weak hedge in Malawi, Morocco, Nigeria, Tunisia, and Zambia, a weak safe haven in Ghana, Kenya, Mauritius, Rwanda, Uganda, and Zimbabwe, and a strong safe haven in Botswana and Tanzania. Furthermore, the findings reveal that gold co-moves with the South African stock market regardless of the market regime. These findings imply that, on average, gold offers limited protection for African equity investors.

KEYWORDS: *COVID-19, gold, hedge, Safe Haven, stock market.*

JEL CLASSIFICATION: *G01, G11, G15.*

1. INTRODUCTION

Countries around the world are experiencing economic turmoil due to the widespread transmission of COVID-19. The World Health Organisation (WHO) declared COVID-19 to be a global pandemic on March 11, 2020 (WHO, 2020). According to WHO (2022), two years later, the number of confirmed COVID-19 cases exceeded 455 million globally whilst the number of COVID-19 deaths exceeded 6 million as of March 13, 2022. In Africa alone, there were more than 8 million confirmed COVID-19 cases, including more than 170 000 deaths, as at March 13, 2022 (WHO, 2022). In order to curb the spread of this virus, governments across the globe have implemented strict social distancing policies and restrictions on travel (Ashraf, 2020). Whilst strict quarantine policies may help to 'flatten the curve', these policies have negatively affected the global economy, especially developing and emerging African markets (Kunjal, 2021).

The International Monetary Fund (IMF) has predicted that, in 2020, the global economy will contract by 3 percent (IMF, 2020). This contraction in the global economy is fuelled by: disruptions in global supply chains, reductions in import and export activities, reductions in international capital flows, and volatility in commodity prices, all of which have been brought about by the COVID-19 pandemic. According to Fernandes (2020), strict quarantine policies have disrupted global supply chains, subsequently leading to the closure of several companies around the world. As a result, there has been an increase in unemployment, subsequently, causing a decrease in consumer spending and consumption (Nicola et al., 2020). This decrease in consumer spending and consumption has led to a reduction in the future cash flows expected by companies (Mazur et al., 2020). Consequently, stock prices have experienced large declines because the value of stocks has been reevaluated by the market

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(Mazur et al., 2020). Hence, Mazur et al. (2020) argue that, in March 2020, the COVID-19 pandemic induced a crash in international stock markets. The COVID-19 pandemic has, therefore, exacerbated the volatility and uncertainty of financial markets. According to Zhang et al. (2020), the COVID-19 pandemic has created an unexpected level of market risk, which has caused investors to suffer significant losses.

Investor loss aversion refers to the tendency of investors to avoid losses rather than seek equivalent gains (Tversky and Kahneman, 1991). As a result, during periods of increased market volatility, investors' loss aversion leads them to seek shelter in safe assets. Safe assets are those assets that are less sensitive to market return and volatility and, therefore, these assets have low exposures to traditional risk factors (Kopyl and Lee, 2016). There is evidence that safe assets may include, government bonds (Flavin et al., 2014; Von Hagen et al., 2011), currencies (Grisse and Nitschka, 2015; Ranaldo and Söderlind, 2010), cryptocurrencies (Bouri et al., 2020; Wang et al., 2019), and gold (Areal et al., 2015; Beckmann et al., 2015). According to Dar and Maitra (2017) and Ji et al. (2020), gold is one of the most popular assets that is used as a hedge or safe haven against stock market volatility during periods of increased market stress. For instance, in the aftermath of the 2008-2009 global financial crisis, investors shifted away from equities towards gold, subsequently, causing gold prices to rise by 156% from November 2008 to September 2011 (Laing, 2020). Trück and Liang (2012) argue that gold has performed well during crises such as market collapses, inflation hikes, currency failure, rising national debt, and even social unrest.

Regarding the properties of gold during the COVID-19 pandemic, Ji et al. (2020) report that, during the COVID-19 pandemic, gold serves as safe havens for stock markets in China, Europe and the United States. Similarly, AlAli (2020) reports that gold acts as safe havens for the United States, China, Tokyo, Germany, Australia, and the United Kingdom stock markets. On the contrary, Kumar (2020) finds that the COVID-19 pandemic has compromised the safe haven status of gold for the equity markets in India, China, the United States, and France. Similarly, Cheema et al. (2020) report that gold loses its safe haven status during the COVID-19 pandemic for the stock markets in Brazil, China, Canada, Germany, France, India, Japan, United Kingdom, Italy, and the United States. Interestingly, Akhtaruzzaman et al. (2020) examine stock market indices in the United States, Europe, Tokyo, and China and report that gold serves as a safe haven only in the initial stages of COVID-19 and, thereafter, loses its safe haven properties when governments intervene with fiscal and monetary stimulus policies to combat the pandemic. Additionally, Akhtaruzzaman et al. (2020) find evidence that, during the COVID-19 crisis, gold is an effective hedge for portfolios in the surveyed markets. Based on the aforementioned studies, it is evident that existing research has provided inconsistent results regarding the ability of gold to serve as a safe asset during the COVID-19 pandemic. Furthermore, none of these studies have examined the effectiveness of gold as a safe haven or hedge during the COVID-19 pandemic for African stock markets. Therefore, the objective of this study is to evaluate the ability of gold to serve as a safe haven or hedge during the COVID-19 pandemic for the stock markets in African countries.

The motivation for this study surrounds the growing need for investors to diversify their portfolios, particularly, during periods of increased market stress such as the COVID-19 pandemic. In recent years, the demand for gold has increased, primarily, because of its role as a diversifier, safe haven, or hedge against stock market declines (Ghazali et al., 2020). According to Shakil et al. (2018), including gold in their portfolios allows investors the possibility to obtain greater portfolio diversification, decreased risk volatility, smoother returns, greater price predictability, and the possibility of generating higher returns. Recently,

AlAli (2020) and Ji et al. (2020) have confirmed the safe haven status of gold in the observed stock markets during the COVID-19 pandemic. On the contrary, Cheema et al. (2020) and Kumar (2020) have found that, during the COVID-19 pandemic, gold has lost its safe haven status. However, none of these studies has evaluated the role of gold as a safe asset during the COVID-19 pandemic from the perspective of African countries. The results of Akhtaruzzaman et al. (2020), AlAli (2020), Cheema et al. (2020), Ji et al. (2020), and Kumar (2020) cannot be applied to African markets because these studies have focused mainly on developed and emerging markets while Africa consists of emerging and frontier markets with greater financial instability and higher fluctuations in commodity prices (Thampanya et al., 2020). Moreover, Adewuyi et al. (2019) argue that the gold-stock nexus has been examined in virtually all regions across the globe, except Africa, thereby, necessitating the need for further research. Therefore, the main contribution of this study is that it provides information on the ability of gold to serve as a safe haven or hedge during the COVID-19 pandemic for investors trading in African stock markets.

Boako and Alagidede (2018) acknowledge that research on the response of African markets to global crises is scant. The ability of gold to serve as a hedge or safe haven during the 2008-2009 global financial crisis has been explored by Gürgün and Ünalmış (2014) and Seetharam and Bodington (2015) for a few African stock markets. However, Ji et al. (2020) argue that the underlying forces of the current COVID-19 crisis differ substantially from previous crises and are more complicated than previous crises. Therefore, the ability of gold to serve as a safe asset in African countries during the COVID-19 crisis requires further research. Hence, the second contribution of this study is that it provides insight into the response of African markets to the global COVID-19 pandemic. Moreover, Goodell (2020) notes that research on how financial markets have been impacted by the COVID-19 market remain scanty. Hence, the third contribution of this study is that it sheds light on the impact of the COVID-19 pandemic on financial markets, specifically, the market for gold.

From a methodological perspective, another contribution of this study is that it adopts a model that reduces biases associated with exogenous dummy variables. In particular, many related studies adopt Baur and McDermott's (2010) GARCH approach which relies on dummy variables to separate the data based on their quantiles of the return distribution in order to identify a safe haven (Bahloul et al., 2022; Chen and Wang, 2019; Gürgün and Ünalmış, 2014). However, the drawback of this approach is that the separation of the sample is exogenous, which could invalidate the results due to the sample selection bias (Li and Miu, 2023). Instead, this study adopts a Markov Regime-Switching approach in which the sample segmentation process is endogenously completed based on the market return data. Therefore, the advantage of this approach is that the determination of different volatility regimes in internally done, thus, reducing any biases associated with exogenous dummy variables (Li and Miu, 2023). To the authors' knowledge, there are only a few studies which adopt regime-switching models to examine the hedge or safe haven properties of gold; however, these studies were conducted prior to the COVID-19 pandemic (Boubaker et al., 2020; Chkili, 2017; He et al., 2018;) or limited to Islamic stock markets (Chkili, 2022). Therefore, this is the first study to employ Markov Regime-Switching models to investigate the role of gold as a hedge or safe haven in African stock markets during the COVID-19 pandemic to the authors' knowledge. Overall, the results of this study are of significant importance for investors seeking to diversify their portfolios, for investment management companies that guide investment decisions, for researchers in the field of portfolio and risk management, and for policymakers who are responsible for maintaining the stability of financial markets in Africa.

This paper is outlined as follows: Section 2 of this study provides a review of the existing literature surrounding the use of gold as a hedge or safe haven during periods of market stress. Section 3 outlines the data and methodology used by this study. Section 4 presents and discusses the results obtained.

2. LITERATURE REVIEW

During periods of high market volatility and uncertainty, investors tend to shift away from stock markets towards safe assets. This movement is commonly described as a flight-to-quality or flight-to-safety (Baele et al., 2020). As such, theories on investor behaviour during extreme market movements are of particular for importance for this study, specifically, the Ellsberg paradox put forward by Ellsberg (1961) and the Prospect theory introduced by Kahneman and Tversky (1979). The Ellsberg paradox is based on uncertainty avoidance and describes the tendency of individuals to prefer known risks over unknown risks (Ellsberg, 1961). During periods of uncertainty, individuals give too much weight to the 'worst' possibility (Ellsberg, 1961). Accordingly, Ghazali et al. (2015) argue that investors view gold as the best alternative in a worst-case scenario because a single regulator or central bank cannot influence the value of gold. The prospect theory is based on loss aversion and describes the tendency of investors to avoid losses rather than seek equivalent gains (Kahneman and Tversky, 1979). Therefore, during periods of high market volatility, gold gains a considerable amount of attention because they are expected to offset the losses from stock market declines (Ji et al., 2020). Other reasons for investing in gold include: protection against inflation hikes (Emmrich and McGroarty, 2013), increased portfolio diversification (Alkhazali and Zoubi, 2020), higher risk-adjusted returns (Arouri et al., 2015), higher price predictability (Shakil et al., 2018), and research on gold is less time-consuming (Shakil et al., 2018). There are several ways to invest in gold, including: purchasing gold jewellery, buying gold coins or bullion bars, and investing in gold exchange traded funds (ETFs) (Guha and Bandyopadhyay, 2016; Sharma, 2016). As a safe asset, gold can be classified either as a hedge or a safe haven, both of which are discussed in the following sections.

2.1 Gold as a Hedge

Baur and McDermott (2010) define a weak (strong) hedge as an asset that, on average, is uncorrelated (negatively correlated) with another asset, portfolio, or variable. Gold has been documented as a hedge against many economic variables, including: inflation (Bampinas and Panagiotidis, 2015; Aye et al., 2017) and currency movements (Joy, 2011; Reboredo and Rivera-Castro, 2014). For investors, there is evidence that gold acts as a hedge against movements in the stock market because, on average, gold is negatively correlated or uncorrelated with the stock market (Baur and Lucey, 2010; Beckmann et al., 2015; Ghazali et al., 2020). However, during periods of market turmoil, a hedge may not reduce losses because the hedge may exhibit a negative or zero correlation on average, but a positive correlation during times of market stress (Baur and Lucey, 2010). This may be because, during periods of market turmoil, investors may be influenced by herding or contagion effects, which causes investors to sell many different assets at the same time (Calvo and Mendoza, 2000). As a result, gold, which is expected to hedge against stock market declines, may co-move with stocks (Kopyl and Lee, 2016).

2.2 Gold as a Safe Haven

According to Ji et al. (2020), in order for an asset to be classified as a safe haven asset, the asset needs to maintain or increase its value during times of market declines. This being so, a weak (strong) safe haven asset is an asset that is uncorrelated (negatively correlated) with

another asset or portfolio during periods of market declines or crises (Baur and Lucey, 2010). Although a safe haven asset is negatively correlated or uncorrelated with another asset or portfolio during market declines, it is possible that, on average or during normal market conditions, the safe haven may be positively correlated with the asset or portfolio (Hood and Malik, 2013). There is evidence that gold serves as a safe haven for changes in economic variables, including: changes in oil prices (Reboredo, 2013a; Selmi et al., 2018) and movements in currencies (Iqbal, 2017; Reboredo, 2013b). For investors, gold has been documented as a safe haven against adverse changes in the stock market (Chkili, 2017; Shahzad et al., 2020).

The main difference between a hedge and a safe haven lies in the length of the correlation. Specifically, a hedge is negatively correlated or uncorrelated on average, but a safe haven is negatively correlated or uncorrelated during times of falling market conditions (Baur and McDermott, 2010). A differentiation between the weak and strong properties of hedges and safe havens is also important. A hedge or safe haven is strong when it is negatively correlated with the other asset or portfolio (Baur and McDermott, 2010). As such, a strong hedge or safe haven displays positive returns when the return on the other asset declines.

2.3 Review of Empirical Studies

In recent years, the role of gold as a safe haven and hedge against stock market declines has been vastly studied. The role of gold as a hedge and safe haven against the stock market has been investigated for investors in Europe (Coudert and Raymond, 2011; Shahzad et al., 2020), America (Hood and Malik, 2013; Lucey and Li, 2015), Asia (Aftab et al., 2019; Ghazali et al., 2013), Australia (Baur and McDermott, 2010; Beckmann et al., 2015), and Africa (Adewuyi et al., 2019; Seetharam and Bodington, 2015). The role of gold as a hedge and safe haven for Islamic equity markets has also been documented by Ghazali et al. (2015) and Chkili (2017). One of the first studies to examine the role of gold as a hedge against the stock market was conducted by Baur and Lucey (2010). Baur and Lucey (2010) employ asymmetric GARCH models to analyse data on stock and gold prices from November 1995 to November 2005. The results of Baur and Lucey (2010) reveal that on average, gold serves as a hedge for stocks trading in the United Kingdom and the United States, but not in Germany. Baur and Lucey (2010) also found evidence that gold is a stronger hedge against stocks during bear market conditions relative to bull market conditions.

Baur and McDermott (2010) used GARCH (1,1) models to analyse a sample of developed and emerging stock markets from 1979 to 2009. Baur and McDermott (2010) report that gold acts as both a hedge and a safe haven against stocks trading in the United States and major European stock markets; however, gold is neither a hedge nor safe haven for stocks in Canada, Japan, Australia, and emerging BRIC countries. Baur and McDermott (2010) also discover that gold serves as a strong safe haven for most developed stock markets during times of market crises. Similarly, Coudert and Raymond (2011) employ the ARMA-GARCH model and document that gold acts as a safe haven against stocks from the United States, the United Kindgom, Germany, France, and G7 countries, even during crisis periods. Additionally, Coudert and Raymond (2011) discover that gold is a hedge for losses in most of the surveyed stock markets, but the results are less clear cut.

Ibrahim and Baharom (2011) examine the Malaysian market using EGARCH models and find evidence that, from August 2001 to November 2005, gold serves as a hedge and safe haven against stock market losses. However, from December 2005 to March 2010, gold is neither a safe haven nor a hedge. Ibrahim (2012) also examines the Malaysian market using GARCH-

type models and reports that gold serves as an effective hedge against the stock market during times of stock market declines. Nguyen et al. (2016) employ various copula techniques and find that, during times of markets crashes, gold serves as a safe haven for stocks in Malaysia, Thailand, Singapore, the United States, and the United Kingdom, but not for stocks in Philippines, Japan, and Indonesia. Notably, by using probit and quantile regression models, Dee et al. (2013) find that, for Chinese investors, gold is an effective hedge against the stock market but only for long-term investments and not for short-term investments. Dar and Maitra (2017) report that gold is a weak hedge and a weak safe for investors in the major gold-consuming countries, that is, China, India and the United States. More recently, Thampanya et al. (2020) examined the Thai market from 2000 to 2019 using the autoregressive distributed lag (ARDL) framework, and discovered that gold does not act as a hedge against the stock market. Ghazali et al. (2020) find that gold hedges for stocks in the United States, China, and India, but not in Malaysia and the United Kindgom. Additionally, Ghazali et al. (2020) report that gold is a strong safe haven during periods of market turmoil for stocks in India, the United Kingdom, and the United States but not for stocks in Malaysia.

With regards to studies that have included African countries in their samples, Gürgün and Ünalmış (2014) examine the role of gold as a hedge or safe haven in several developed and emerging countries by applying GARCH models. The African markets included in their sample were Egypt, Kenya, Morocco, and South Africa. When the price of gold and equities is quoted in their domestic currencies, Gürgün and Ünalmış (2014) find that, for the full sample period, gold is a weak hedge in Morocco. Additionally, Gürgün and Ünalmış (2014) find that gold is a safe haven during extreme market declines for Egypt and Kenya. Gürgün and Ünalmış (2014) also find that gold was a weak hedge during the global financial crisis for Morocco and a weak safe haven for Kenya. However, when gold and equity prices are quoted in the U.S. dollar, Gürgün and Ünalmış (2014) find that gold is a strong safe haven for Egypt and a weak safe haven for Kenya, Morocco, and South Africa. Additionally, when gold and equity prices are quoted in the U.S. dollar, gold is found to be a strong hedge for Morocco and a strong hedge for Egypt during the global financial crisis. Overall, Gürgün and Ünalmış (2014) conclude that gold is not a hedge for equity investments in South Africa.

Beckmann et al. (2015) employed smooth transition regressions (STR) and report that, from January 1970 to March 2012, gold is a strong hedge against the stock markets in Russia, Turkey, and Indonesia, and a weak hedge for stock markets in Australia, Canada, Egypt, France, India, Italy, Japan, Korea, South Africa, Switzerland, and the United States. Interestingly, Seetharam and Bodington (2015) find that, for South African investors, gold provides a hedge against local equities but not foreign equities. However, Seetharam and Bodington (2015) report that, during the 2008-2009 global financial crisis, gold acts as a safe haven for both local and international equities. Bekiros et al. (2017) employ GARCH models and discover that gold does not act as a hedge or safe haven for stocks in BRICS countries. Wen and Cheng (2018) employ copula functions to analyse the role of gold as a hedge or safe haven for stock in emerging markets (South Africa, Chile, Brazil, Czech Republic, Thailand, Malaysia, India, Russia, and China). The results of Wen and Cheng (2018) reveal that gold is a safe haven for stock in emerging markets; however, the ability of gold to serve as a hedge weakened during the 2008-2009 global financial crisis. Remarkably, Adewuyi et al. (2019) employ VARMA-BEKK-AGARCH and quantile regression models to analyse the Nigerian and South African markets, and report that gold is an effective hedge against the stock market in Nigeria but not in South Africa. Naeem et al. (2022) report that gold is the strongest safe haven and hedge for African equity markets relative to platinum and palladium; however, the study did not consider the effects of the COVID-19 pandemic.

Regarding the role of gold as a hedge or safe haven during the COVID-19 pandemic, Ji et al. (2020) assess the tail stability of the return sequences and discover that, during the COVID-19 pandemic, gold serves as safe havens for stock markets in China, Europe, and the United States. Similarly, AlAli (2020) estimated OLS regressions and reports that gold acts as safe havens for the United States, China, Tokyo, Germany, Australia, and United Kingdom stock markets. On the contrary, Kumar (2020) employed GARCH-type models and finds that the COVID-19 pandemic has compromised the safe haven status of gold for equity markets in India, China, United States, and France. Likewise, Cheema et al. (2020) apply GARCH-type models and report that, even though gold was a safe haven during the 2008-2009 global financial crisis, gold loses its safe haven status during the COVID-19 pandemic for the stock markets in Brazil, China, Canada, Germany, France, India, Japan, United Kingdom, Italy, and the United States. Interestingly, Akhtaruzzaman et al. (2020) examine stock market indices in the United States, Europe, Tokyo, and China using GARCH-type models and report that gold serves as a safe haven only in the initial stages of COVID-19 and, thereafter, loses its safe haven properties when governments intervene with fiscal and monetary stimulus policies to combat the pandemic. Additionally, Akhtaruzzaman et al. (2020) find evidence that, during the COVID-19 crisis, gold is an effective hedge for portfolios in the surveyed markets. Moreover, Nkrumah-Boadu et al. (2022) report that gold provides safe haven and hedging benefits to African stock market investors, especially in Ghana, during the COVID-19 pandemic; however, their study is limited to four African stock markets. On the contrary, using a DCC-GARCH framework, Omane-Adjepong and Alagidede (2021) finds that gold offers no sanctuary for emerging African stock markets during the COVID-19 pandemic.

It is evident from the survey of existing literature that research on the role of gold as a hedge or safe haven, especially during periods of increase market stress, has provided mixed results. Moreover, research on the role of gold as a hedge or safe haven in African markets is limited. Therefore, this study fills a gap in the existing literature by examining the role of gold as a hedge and safe haven for African stock markets during times of market turmoil, specifically, the COVID-19 pandemic.

3. DATA

This study surveys 16 African equity markets which includes stock markets in Botswana, Côte d'Ivoire, Ghana, Kenya, Malawi, Mauritius, Morocco, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe. Each country's stock market is represented by its broad market index, as described in Table 1. Daily data on the stock market indices and the spot price of gold are obtained from EquityRT. Returns for the stock market indices and gold are computed as the natural logarithm of the ratio of the current and previous prices multiplied by 100, that is, $R_t=\ln(P_t/P_{t-1})\times100$. It is noteworthy that each African country reported their first case of COVID-19 on different dates, therefore, the sample period for this study commences on the date that the WHO declared COVID-19 to be a global pandemic, that is, 11 March 2020. The sample period for this study ends on 10 March 2022.

Table 1. African Stock Markets Surveyed in the Study

No.	Country	Stock Exchange	Broad Market Index
1	Botswana	Botswana Stock Exchange	Botswana Domestic Company Index
2	Côte d'Ivoire	Ivory Coast Stock Exchange	Ivory Coast BRVM - Composite Index
3	Ghana	Ghana Stock Exchange	Ghana Composite Index

No.	Country	Stock Exchange	Broad Market Index
4	Kenya	Nairobi Stock Exchange	Nairobi All Share Index
5	Malawi	Malawi Stock Exchange	Malawi All Share Index
6	Mauritius	Mauritius Stock Exchange	Mauritius SEMDEX Index
7	Morocco	Casablanca Stock Exchange	Casablanca All Share Index
8	Namibia	Namibian Stock Exchange	Namibia FTSE JSE Overall Index
9	Nigeria	Nigerian Stock Exchange	NGX All Share Index
10	Rwanda	Rwanda Stock Exchange	Rwanda All Share Index
11	South Africa	Johannesburg Stock Exchange	FTSE/JSE All Share Index
12	Tanzania	Dar es Salaam Stock Exchange	Tanzania All Share Index
13	Tunisia	Tunisia Stock Exchange	Tunis TUNINDEX
14	Uganda	Uganda Securities Exchange	Uganda ALSI Index
15	Zambia	Lusaka Stock Exchange	Zambia All Share Index
16	Zimbabwe	Zimbabwe Stock Exchange	Zimbabwe All Share Index

Source: Authors' own work

4. METHODOLOGY

The key step to identifying the optimal methodological approach for this study is to define a hedge and a safe haven. Several definitions exist in current research; however, the majority of studies agree that a strong (weak) hedge is an asset that is negatively correlated (uncorrelated) with another asset on average whilst a strong (weak) safe haven is negatively correlated (uncorrelated) with another asset in durations of market stress (Bouri et al., 2017; Chemkha et al., 2021; Madani and Ftiti, 2022). This study adopts a two-state Markov Regime-Switching approach, introduced by Hamilton (1989), which distinguishes between bull and bear market regimes based on the return distribution. The bear market regime is associated with periods of high volatility and, thus, market stress (Kunjal et al., 2021). Therefore, gold would need to be negatively correlated (uncorrelated) with the stock market in the bear regime in order to be considered a strong (weak) safe haven. On the contrary, the bull market regime is associated with periods of low volatility. Thus, if gold is negatively correlated (uncorrelated) with the stock market in the bull regime, it would be regarded as a strong (weak) hedge.
The univariate regression used to examine the association between gold and stock markets is adapted from the seminal work of Baur and McDermott (2010) as follows:

$$R_{Gold,t} = \alpha_0 + \beta_1 R_{Stock,t} + \varepsilon_t \quad (1)$$

In Equation (1), the dependent variable, $R_{Gold,t}$, is the return on gold on day t while the independent variable, $R_{Stock,t}$, is the return on the stock market index on day t. Additionally, α_0 is a constant term, β_1 captures the influence of the independent variable, and ε_t is the error term. However, the Markov Regime-Switching model assumes that all variables in the model are dependent on the regime and, as a result, Equation (1) is modified into the following Markov Regime-Switching equation:

$$R_{Gold,t} = \alpha_{St} + \beta_{St} R_{Stock,t} + \varepsilon_t \quad (2)$$

where α_{St} is a state-dependent intercept and β_{St} is a state-dependent slope coefficient, whilst ε_t is the error term which is normally and independently distributed. Given that there are two states in this analysis, the parameter estimates are α_1 and β_1 in State 1 and α_2 and β_2 in State 2. In order to identify the bull and bear regimes, the state-dependent standard deviations (σ_{St}) need to be examined. In particular, the state with the higher standard deviation would be regarded as having higher volatility, and, thus, the bear regime. A negative and significant (insignificant) β_{St} in the bull market would suggest that gold is a strong (weak) hedge, whilst a negative and significant (insignificant) β_{St} in the bear market would suggest that gold is a strong (weak) safe haven.

The unobserved state variable, St, is based on a first-order Markov-switching process which assumes that the probability of moving from Regime m in period $t-1$ to Regime n in period t is as follows:

$$prob(S_t = n|S_{t-1} = m) = p_{m,n} \quad (3)$$

The average duration of Regime m is computed using the formula below:

$$D = \frac{1}{1-p_{m,m}} \quad (4)$$

When m or n is equal to 1 or 2, the transition matrix is as follows:

$$prob(S_t = 1|S_{t-1} = 1) = p$$
$$prob(S_t = 2|S_{t-1} = 1) = 1-p$$
$$prob(S_t = 2|S_{t-1} = 2) = q$$
$$prob(S_t = 1|S_{t-1} = 2) = 1-q$$

where p and q are fixed transition probabilities of being in Regime 1 or Regime 2.
The Markov Regime-Switching model presented in Equation (2) is estimated for each of the 16 African stock markets outlined in Table 1.

5. PRESENTATION OF RESULTS

Prior to the estimation of the Markov Regime-Switching models, the stationarity of the series was confirmed.

5.1 Identification of Regimes

In order to identify the regime that represents periods of market stress or high market volatility, it is important to differentiate between the bull and bear market regimes based on their state-dependent standard deviations. The implied standard deviation for each regime is presented in Table 2. The regime with the higher standard deviation is associated with periods of high market volatility and, therefore, represents the bear market regime. On the contrary, the regime with the lower standard deviation is associated with periods of low market volatility and, subsequently, represents the bull market regime. For each country, Table 2 aligns the respective state-dependent standard deviation with the associated market regime (that is, bull or bear) which is needed to proceed with the analysis of the Markov Regime-Switching models.

Table 2. Identification of Regimes

Country	Regime 1		Regime 2	
	Std. Dev	Market Condition	Std. Dev	Market Condition
Botswana	5.0923	Bear	1.5752	Bull
Côte d'Ivoire	1.5663	Bull	5.6624	Bear
Ghana	1.5978	Bull	5.6114	Bear
Kenya	5.7644	Bear	1.5759	Bull
Malawi	5.7351	Bear	0.9517	Bull
Mauritius	1.5953	Bull	6.6417	Bear
Morocco	1.5115	Bull	4.3939	Bear
Namibia	4.2062	Bear	1.4883	Bull
Nigeria	5.5992	Bear	1.5923	Bull
Rwanda	5.6148	Bear	1.5878	Bull
South Africa	3.7024	Bear	1.4328	Bull
Tanzania	1.5377	Bull	4.8183	Bear
Tunisia	1.5918	Bull	5.8562	Bear
Uganda	5.9407	Bear	1.5839	Bull
Zambia	5.5753	Bear	1.5757	Bull
Zimbabwe	1.5674	Bull	5.6672	Bear

Source: Authors' own work

5.2 Transition Probabilities and Durations

The first-order Markov-switching process used in this study assists with the computation of probabilities for transitioning across different market regimes. The benefit of this computation is that interested participants are able to determine the likelihood of a particular state or regime and its respective duration. Table 3 provides the Markov Regime-Switching transition probabilities, whilst its associated durations are provided in Table 4. For each country, there is a higher probability of being in a bull regime, with the probability of transitioning from a bull regime to bull regime equal to approximately 0.99 for all countries. Based on the results, Ghana has the highest probability of transitioning from bull to bull (0.9952). Moreover, the probabilities of transitioning from bear market conditions to bull market conditions is higher than transitioning from bull market conditions to bear market conditions. For instance, Mauritius displays the highest probability of transitioning from bear to bull (0.1319), which exceeds its likelihood of transitioning from bull to bear (0.0062). Together, the results of the transition probabilities imply that markets are more likely to be in bull regimes, that is, periods of low volatility. It is noteworthy that the markets stay in bull regimes at least 6 times longer than bear regimes based on the estimated durations in Table 4. Remarkably, the expected duration of a bull regime (155.1034 days) exceeds the expected duration of a bear regime (8.3693 days) more than 18 times for Uganda. These durations suggest that the markets are characterised by bullish conditions, on average, thereby, supporting the evaluation of bull regimes to identify any possible hedges, since hedging assesses asset correlations on average. Overall, the estimated transition probabilities and duration suggest that periods of low market volatility were more prominent in African markets during the COVID-19 pandemic relative to high market volatility.

Table 3. Markov Regime-Switching Transition Probabilities

Country	*Prob* (Bull, Bull)	*Prob* (Bull, Bear)	*Prob* (Bear, Bull)	*Prob* (Bear, Bear)
Botswana	0.9946	0.0054	0.0435	0.9565
Côte d'Ivoire	0.9945	0.0055	0.0506	0.9494
Ghana	0.9952	0.0048	0.0464	0.9536
Kenya	0.9947	0.0053	0.0523	0.9477
Malawi	0.9946	0.0054	0.0496	0.9504
Mauritius	0.9938	0.0062	0.1319	0.8681
Morocco	0.9873	0.0127	0.0759	0.9241
Namibia	0.9892	0.0108	0.0797	0.9203
Nigeria	0.9947	0.0053	0.0467	0.9533
Rwanda	0.9951	0.0050	0.0432	0.9568
South Africa	0.9845	0.0155	0.0928	0.9072
Tanzania	0.9927	0.0073	0.0548	0.9452
Tunisia	0.9949	0.0051	0.0527	0.9473
Uganda	0.9936	0.0064	0.1195	0.8805
Zambia	0.9947	0.0053	0.0512	0.9488
Zimbabwe	0.9941	0.0059	0.0518	0.9482

Source: Authors' own work.

Table 4. Markov Regime-Switching Durations

Country	Bull	Bear
Botswana	185.0268	22.9762
Côte d'Ivoire	183.0751	19.7495
Ghana	207.7952	21.5387
Kenya	187.4183	19.1163
Malawi	183.6830	20.1623
Mauritius	160.8661	7.5826
Morocco	78.7418	13.1686
Namibia	92.2677	12.5409
Nigeria	188.8838	21.4260
Rwanda	202.0381	23.1448
South Africa	64.6786	10.7769
Tanzania	137.3257	18.2524
Tunisia	194.6627	18.9689
Uganda	155.1034	8.3693
Zambia	187.9069	19.5260
Zimbabwe	170.7031	19.2961

Source: Authors' own work

5.3 Results for the Bull Regime

The parameter estimates for the bull regimes that are needed to evaluate the role of gold as a hedge are provided in Table 5. The results show that there exist negative relationships

between gold returns and returns of stock markets in Malawi, Morocco, Nigeria, Tunisia, and Zambia. Given that these negative relationships are not statistically significant, this finding implies that gold serves as a weak hedge against stock movements in Malawi, Morocco, Nigeria, Tunisia, and Zambia. On the contrary, gold does not serve as a hedge against stock market movements in the remaining African countries. Remarkably, the results suggest that there are significant co-movements between the returns on gold and the returns on the South African and Tanzanian stock markets. These results are discussed further in Section 6.

Table 5. Markov Regime-Switching Parameter Estimates for the Bull Regime

Country	Coeff.	Std. Error	Z-statistic	Prob.
Botswana	0.5904	0.4888	1.2078	0.2271
Côte d'Ivoire	0.0594	0.1084	0.5475	0.5840
Ghana	0.0400	0.0809	0.4943	0.6211
Kenya	0.0565	0.0827	0.6833	0.4944
Malawi	-0.0495	0.1507	-0.3286	0.7424
Mauritius	0.0848	0.0970	0.8742	0.3820
Morocco	-0.0361	0.1453	-0.2484	0.8038
Namibia	0.0049	0.0101	0.4838	0.6285
Nigeria	-0.0684	0.0969	-0.7063	0.4800
Rwanda	0.9226	0.6749	1.3669	0.1717
South Africa	0.1611**	0.0714	2.2575	0.0240
Tanzania	0.2253***	0.1258	1.7909	0.0733
Tunisia	-0.1134	0.1878	-0.6039	0.5459
Uganda	0.0108	0.0760	0.1425	0.8866
Zambia	-0.0872	0.0978	-0.8916	0.3726
Zimbabwe	0.0084	0.0320	0.2634	0.7923

Notes: *, **, *** denotes significance at a 1%, 5%, and 10% level of significance, respectively.
Source: Authors' own work

5.4 Results for the Bear Regime

The coefficient estimates for the bear regimes which are needed to evaluate the role of gold as a safe haven are provided in Table 6. There are several differences in the results obtained for the bear markets, which is consistent with the findings of Baur and Lucey (2010) who report that the role of gold varies in bull and in bear markets. For instance, the stock market in Tanzania exhibits a significant, positive relationship with gold in the bull market but a significantly negative relationship in the bear market. Therefore, whilst gold co-moves with the Tanzanian stock market in bullish market conditions, gold serves as a strong safe haven during periods of bearish market conditions. Overall, gold exhibits negative relationships with stock markets in Botswana, Ghana, Kenya, Mauritius, Rwanda, Tanzania, Uganda, and Zimbabwe. However, these negative relationships are only statistically significant for Botswana and Tanzania. This implies that gold serves as a strong safe haven against stock movements in Botswana and Tanzania but a weak safe haven in Ghana, Kenya, Mauritius, Rwanda, Uganda, and Zimbabwe. Similar to the bull market, gold display significant co-movements with the South African stock market in the bear market. Additionally, gold exhibits significant, positive relationships with the stock market in Morocco and Namibia. These results are discussed further in Section 6.

Table 6. Markov Regime-Switching Parameter Estimates for the Bear Regime

Country	Coeff.	Std. Error	Z-statistic	Prob.
Botswana	-9.9068**	4.1929	-2.3627	0.0181
Côte d'Ivoire	0.3542	1.6107	0.2199	0.8259
Ghana	-2.6907	1.7527	-1.5352	0.1247
Kenya	-0.1763	0.5176	-0.3406	0.7334
Malawi	2.6838	3.4837	0.7704	0.4411
Mauritius	-0.4283	0.4241	-1.0099	0.3125
Morocco	0.8822*	0.2957	2.9830	0.0029
Namibia	0.5754*	0.1473	3.9073	0.0001
Nigeria	0.3413	0.6704	0.5091	0.6107
Rwanda	-34.2684	39.2755	-0.8725	0.3829
South Africa	0.8495*	0.1607	5.2869	0.0000
Tanzania	-1.7387*	0.6635	-2.6205	0.0088
Tunisia	0.4626	0.7680	0.6024	0.5469
Uganda	-0.0007	0.5310	-0.0013	0.9990
Zambia	1.8022	3.6255	0.4971	0.6191
Zimbabwe	-0.1150	0.4975	-0.2311	0.8173

Notes: *, **, *** denotes significance at a 1%, 5%, and 10% level of significance, respectively.
Source: Authors' own work

6. DISCUSSION OF RESULTS

Although gold is generally perceived as an effective hedge or safe haven, the results of this study prove otherwise for African stock markets during the COVID-19 period. The results of this study highlight three important findings. Firstly, gold acts as a weak hedge against stock market movements in Malawi, Morocco, Nigeria, Tunisia, and Zambia. Similarly, Naeem et al. (2022) find that gold has hedging capabilities in Morocco. Contrary to Gürgün and Ünalmış (2014) who report that gold is a hedge for most emerging and developing stock markets, the findings of this study suggest that gold does not act as a hedge for most African stock markets, but rather its hedging capabilities are weak and limited to a few African stock markets. This finding implies that, on average, African stock market investors may not be able to offset their losses by investing in gold.

Secondly, gold acts as a strong safe haven against equity movements in Botswana and Tanzania, and a weak safe haven in Ghana, Kenya, Mauritius, Rwanda, Uganda, and Zimbabwe. This finding implies that domestic equity investors in these African countries can seek refuge in gold markets because they can minimise their losses by taking positions in gold markets. In Botswana and Tanzania, however, investors will be able to offset their losses and generate additional returns because a 1% decrease in the stock market is associated with a 9.91% and 1.74% increase in gold returns, respectively. Gold, however, does not provide safety protection on Africa's largest stock markets (South Africa and Nigeria). Similarly, Omane-Adjepong and Alagidede (2021) also report that gold does not provide safety nets in South Africa and Nigeria during the COVID-19 pandemic.

Thirdly, gold co-moves with stock markets in South Africa and Tanzania during bull markets and in South Africa, Morocco, and Namibia during bear markets. Bekiros et al. (2017) also

report that gold is neither a hedge nor a safe haven for the South African stock market. The inability of gold to provide protection for South African investors may be a result of the significant cross-market shock spill-over from the stock market to the gold market (Adewuyi et al., 2019). This finding is an important regulatory concern because volatility shocks are transmitted from gold markets to some African stock markets, and vice versa (Nkrumah-Boadu et al., 2022).

According to Baur and Lucey (2010), in theory, gold may exhibit a negative relationship with stock movements on average (in periods of market stress) but a positive relationship in periods of high volatility (low volatility). The results of this study agree with this notion. In particular, the results indicate that gold co-moves with the stock market during periods of low volatility but becomes a safe haven during periods of high volatility – as is the case in Tanzania. On the contrary, gold has hedging capabilities during periods of low volatility, but co-move with the stock market in periods of high volatility – as found for Morocco. Furthermore, gold does not serve as both a hedge and a safe haven in any of the African stock markets. The role of gold in African stock markets is summarised in Table 7.

Table 7. Summary of the Role of Gold

Country	Role of Gold
Botswana	Strong Safe Haven
Côte d'Ivoire	-
Ghana	Weak Safe Haven
Kenya	Weak Safe Haven
Malawi	Weak Hedge
Mauritius	Weak Safe Haven
Morocco	Weak Hedge
Namibia	-
Nigeria	Weak Hedge
Rwanda	Weak Safe Haven
South Africa	-
Tanzania	Strong Safe Haven
Tunisia	Weak Hedge
Uganda	Weak Safe Haven
Zambia	Weak Hedge
Zimbabwe	Weak Safe Haven

Source: Authors' own work.

These findings have important implications for investors and policymakers. Ultimately, these findings indicate that the effectiveness of gold as a hedge or safe haven has deteriorated for African stock markets. In most cases, gold is a weak hedge or weak safe haven, with the exception of Botswana and Tanzania, where gold is a strong safe haven. As a result, investors in Botswana and Tanzania should include gold in their portfolios in order to achieve better performance during periods of increased market uncertainty and volatility. However, for investors in other African countries, adding gold to their portfolios will not necessarily offset their losses and optimise their portfolios. This inability of gold to serve as an effective hedge or safe haven may be due to the increasing financialisation of commodity markets, which has improved the accessibility to gold investments, thus causing gold to behave like stocks (Bekiros et al., 2017). Therefore, investors need to explore alternative assets which may provide safety protection on average or in periods of market stress – based on their investment objectives. These findings may inform policymakers and governments to regulate commodity

markets to enhance their hedging and safe haven capabilities or reduce their co-movement with stock markets.

7. CONCLUSION

Global crises, such as the COVID-19 pandemic, create volatility in financial markets causing investors to seek alternative investments to minimise their losses. Traditionally, investment in gold is a prominent risk management tool due its tendency to perform well during financial crises. However, the COVID-19 pandemic differs significantly from previous financial crises and, therefore, further research into the efficiency of gold is needed. Therefore, this study seeks to investigate the role of gold as a hedge or safe haven against stock movements in African markets during the COVID-19 pandemic. To achieve its objective, the study assesses stock markets in 16 African countries over a two-year period from 11 March 2020 to 10 March 2022. A two-state Markov Regime-Switching approach is employed in order to distinguish between bull and bear market regimes. The findings of this study suggest that gold serves as a weak hedge against stock movements in Malawi, Morocco, Nigeria, Tunisia, and Zambia. Gold also serves as a weak safe haven in Ghana, Kenya, Mauritius, Rwanda, Uganda, and Zimbabwe, but a strong safe haven in Botswana and Tanzania. Furthermore, the findings reveal that gold co-moves with the South African stock market regardless of the market regime. These findings imply that, on average, gold offers limited protection for African equity investors.

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