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Behavioural heterogeneity and stock market dynamics during the COVID-19 pandemic and Ukraine war: An empirical Markov Switching analysis of the GCC countries

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ABSTRACT

This study investigates the effects of two global crises: the COVID-19 pandemic and the Russia-Ukraine conflict, on stock market dynamics in GCC countries. The study employs the Markov Switching Model (MSM) to analyze investor behavior during three distinct subperiods: the quiet pre-crisis period, the COVID-19 pandemic, and the Russia-Ukraine conflict. The findings reveal that fundamentalists, contrary to traditional economic assumptions of price correction, often exhibited destabilizing effects, particularly in Kuwait, Oman, and Qatar during low-volatility periods. Chartists, by contrast, demonstrated a consistently positive and significant influence, reinforcing momentum-based trading patterns. Empirical results also indicate that during the calm period, Bahrain and Kuwait were believed to remain under stable market conditions for a longer duration, whereas Saudi Arabia showed lower stability and experienced extended periods of volatility. During the COVID-19 period, most GCC countries shifted toward high-volatility regimes, with longer durations of market instability. During the Russia-Ukraine war, Bahrain, Saudi Arabia, and the UAE continued to experience sustained high volatility and prolonged unstable periods. The practical implications of this paper show that heterogeneous investor behavior, especially the destabilizing actions of fundamentalists and momentum-driven chartists, significantly affect GCC market dynamics during crises. Regulatory strategies should focus on monitoring trading patterns, managing risk, and promoting long-term investment to enhance market stability in turbulent conditions.

Contribution/ Originality: This study pioneers the identification of market regimes in GCC stock markets during the two recent global crises using the Markov Switching Model. It shows that fundamentalist investors can increase market instability, while chartists help stabilize markets, challenging traditional assumptions and providing new insights and contributions into investor behavior, market risk, and dynamics in emerging economies.

1. INTRODUCTION

The financial world has faced several severe crises since the stock market crash of 1987. These crises were characterized by increased volatility and shifts in investors' behavior between optimism and fear. On October 19, 1987, the Dow Jones Index plummeted by more than 22% in a single day. Roll (1988) attributed this decline to the adoption of automated trading systems and "portfolio insurance" tactics. These strategies amplified the market decline and demonstrated how herd behavior can lead to even more significant fluctuations in market activity. Shiller (2000) argues that chartist investors focus more on price trends while ignoring economic fundamentals. Following the bursting of the tech bubble in 2000, the NASDAQ index fell by approximately $80 billion over two years. This

example illustrates how markets experience cycles of ups and downs. The subprime crisis of 2008 revealed how financial irregularities and unrestricted debt can trigger widespread disturbances. Reinhart and Rogoff (2009) noted that the ambiguity in derivatives, combined with the explosion of credit, led to this chaos. The collapse of Lehman Brothers caused a significant shock that overexcited financial markets and contributed to a global recession. The crisis had a notable impact on Gulf countries, particularly the Kingdom of Saudi Arabia (KSA) and the United Arab Emirates (UAE), as falling oil prices and reduced foreign investment increased volatility in local financial markets (Balcilar, Demirer, Hammoudeh, & Khalifa, 2013).

The COVID-19 pandemic emerged recently and has suddenly brought about unprecedented changes in the global financial markets. By March 2020, enormous volatility and some of the greatest one-day losses in the history of stock markets were recorded by stock indices. Baker et al. (2020) stated that the particularity of this crisis was its sudden and global nature, which caused investors to panic under the uncertainty of economic conditions. The fall in international trade and the drop in oil prices inflicted heavy losses upon the Gulf markets while simultaneously exposing the vulnerability of such economies to external shocks. From February 2022 onward, the war in Ukraine triggered a significant shift in investor sentiment, especially by demonstrating the interaction between fundamentalism and Chartism. From the first reports of the start of the war, Chartists those who make their decisions based on market movements began selling very high-risk assets, thereby increasing market volatility. This reaction aligns with the work of Kirman (2021) and Hommes and Veld (2017). They recognized that during moments of geopolitical uncertainty, chartist investors tend to act more on trends and speculation. Conversely, fundamentalist investors tend to be more conservative, focusing on economic fundamentals. After the initial chaos, fundamentalist investors began to see opportunities, particularly in industries experiencing shifts due to global changes, such as years of sanctions on Russia leading to increased commodity prices. This created potential for investors to sell off portfolio positions while seeking ways to fund renewable energy projects. This observation aligns with research by Mehmet Balcilar, Uzuner, Nwani, and Bekun (2023) especially regarding fundamentals during chaotic market conditions. This phenomenon was particularly pronounced in the Gulf Cooperation Council (GCC). Initially, geopolitical uncertainty and increased volatility affected financial markets. However, fundamentalists soon recognized opportunities with rising oil prices, prompting increased investments in local energy sectors. The case highlights the contrasting impacts of chartists and fundamentalists on financial markets during difficult times, especially in resource-dependent regions. Multiple crises in Ukraine underscore the influence of these two types of investor behavior. Although chartists initially contributed to volatility through their reactions, fundamentalists counteracted these effects, restoring a sense of order to price behavior. This illustrates the nuances and contradictions inherent in investment approaches. Additionally, these crises exemplify collective investor behavior and its impact on actions and investments during market shifts.

According to Frankel and Froot (1990), the interaction between chartists and fundamentalists is a crucial component of the financial swings that cause bubble and bust cycles. While the Gulf Cooperation Council (GCC) markets are showing signs of healthy resistance, there is an exigent need for diversification of economies and, thus, better regulation to mitigate the effects of speculation-oriented euphoria and panic cycles. The interaction between fundamentalists and chartists can result in different market dynamics. Fundamentalists attempt to stabilize the market by focusing on long-term values, while chartists can increase volatility by amplifying short-term price changes. The coexistence of these two types of investors can lead to excessive volatility and unpredictable price behavior, as demonstrated by Brock and Hommes (1998). Lux and Marchesi (1999) suggest that speculative bubbles and crashes mostly occur because of shifts in power between chartists and fundamentalists. Farmer and Joshi (2002) point out that the way investors interact and mimic each other can cause financial imbalances. They may develop separate behavioral patterns that can undoubtedly lead to price bubbles, market dynamics encountering serious problems, and outright crashes. When analyzing market behavior, understanding the activities of these investor groups is essential for accurate measurement and prediction of market movements.

Studies of the behaviors of GCC investors in equity markets over the last 5 years have examined the differences between chartists and fundamental investors regarding their reactions and responses to market shifts and ongoing economic crises. Medhioub and Chaffai (2018) observed herding behavior in Islamic equity markets, attributing it to herders' sentiment, which causes prices to deviate from fundamentals. This finding aligns with the majority of behavioral finance literature, indicating that investors generally do not act as rational actors, especially around the Gulf Cooperation Council. Dammak, Hamad, De Peretti, and Eleuch (2023) explain how investors make decisions in currency options markets during volatile periods, focusing on the use of fundamentalist and chartist strategies when faced with uncertainty. Their study shows that chartists respond quickly to short-term market trends, while fundamentalists adjust their forecasts based on macroeconomic fundamentals. This contrast in investor behavior is particularly evident in the GCC equity markets, where oil dynamics and geopolitical issues significantly influence market movements. Additionally, Kassam, Gupta, and Chesworth (2024) concentrated on structural developments in GCC equity markets driven by increased foreign investment and economic diversification. Their research indicates that the relative importance of chartist and fundamentalist techniques fluctuates with changes in market structure. During stable periods, fundamentalist investors tend to have a greater influence, relying on economic indicators for decision-making. Conversely, in volatile times, chartist activity becomes more prominent, often amplifying temporary price fluctuations.

Despite extensive studies on investor behavior in global crises, limited research has focused specifically on GCC stock markets during recent extreme events, such as the COVID-19 pandemic and the Russia-Ukraine war. While previous studies examine chartists and fundamentalists separately, few have empirically analyzed their interaction under high volatility in emerging Gulf economies. Moreover, most existing literature does not employ dynamic models like the Markov Switching Model to capture regime changes in these markets. This study addresses these gaps by providing new empirical evidence on investor heterogeneity, market regimes, and the stabilizing or destabilizing roles of different investor types, offering insights relevant for both academics and policymakers.

This research analyzes how the COVID pandemic and the Russian-Ukrainian war impacted the behavior of stock market returns in six Gulf Cooperation Council (GCC) states, while also appreciating the various investors, particularly fundamentalists and chartists. Such crises can cause increased market volatility and explain how investors emotionally react to risk and make decisions. This paper is organized as follows: Section 2 reviews the literature on the structural aspects of both fundamentalists and chartists, incorporating the effects of shocks. Section 3 outlines the data sources, model assumptions, and methodology used in the empirical investigation. Section 4 presents the analysis's findings, which include the main results on the market processes and investor behavior during the crises. Section 5 presents the robustness test, and the final section concludes the study by highlighting the main findings, proposing policy measures, and recommendations for future research.

2. LITERATURE REVIEW

There have been crises and speculative bubbles throughout the history of financial markets. These patterns are often explained by human behavior. There are two opposing patterns of action within these cycles, commonly known as chartists or fundamentalists. Chartists, also called trend followers, decide what to do based on past price movements and technical indicators that lead them to make decisions. Thus, because chartists buy when prices are rising and sell when they are dropping, this increases market volatility. In contrast, fundamentalists consider the underlying financial and economic conditions when analyzing the intrinsic value of assets and use them as a reference for their decisions. Baumol (1957) was one of the first advocates of the view that chartists are disruptive to markets and that fundamentalists stabilize them. Day and Shafer (1987) considered key elements of financial instability and market volatility when discussing how the psychology of investors and various trading techniques affect the market. Frankel and Froot (1986) conceptualize these groups of actors in the foreign exchange market: fundamentalists and chartists. They show how these investors create demand for foreign currency, which displays their important function in the

global financial system. Heterogeneous expectations presume that financial markets react differently to asset prices and market conditions but do not solely depend on risk assessment, information processing, and methods of forecasting. Frankel and Froot (1986), (Frankel & Froot, 1990), and Barberis, Shleifer, and Vishny (1998) illustrate how these heterogeneous views create market volatility and speculative bubbles, subsequently leading to complete price falls. Kirman (1993) suggested that fundamentalist and chartist investors may, over time, interact and adjust their strategies. Based on behavioral theory, the author emphasized that markets do not usually reach equilibrium and that price fluctuations often result from feedback loops created by investor sentiment and herd behavior.

Considering that stock prices are sensitive to all available information, the Efficient Market Hypothesis (EMH) ensures that asset valuation is correct and prevents possible bubbles or deviations from the underlying value (Fama, 1970). However, Kurz (1994) challenged this theory by proposing a method in which investors set different expectations based on experience. The EMH has been extensively examined by Kurz (1994) who identified a significant limitation of the hypothesis in the subjective opinions of investors and how these opinions influence market functioning, providing crucial insights into the mechanisms behind market inefficiencies. The model studied by Brock and Hommes (1998) includes agents who update their forecasts based on past price information rather than on the maximization of future returns. These agents perform tasks corresponding to either one of two competing strategies: fundamentalist or chartist. Their research revealed challenges to neoclassical economic theory and offered a more comprehensive account of market ambiguity by emphasizing the role of adaptive expectations in generating inefficiencies. Using real commodity price data, the authors assessed the relationship between the behavior of speculators and price dynamics. Empirical tests indicated that fundamentalists tend to restore prices toward equilibrium when prices deviate significantly from actual values. Commodity prices result from the interaction between chartists' trend-following behavior and fundamentalists' adaptive reactions.

Chiarella, Iori, and Perelló (2009) propose a model of market microstructure governed by orders. In this regard, traders are grouped into three categories of investors: long-term investors, trend followers, and irrational speculators. Empirical studies examined the implications of this situation on the statistical properties of stock prices and returns. The tests showed that fat tails are largely due to chartist strategies. This finding indicates that extreme price movements and volatility are partly caused by the herding behavior of chartists moving according to a price trend and momentum. Similarly, Alfi, Cristelli, Pietronero, and Zaccaria (2009) proposed a minimalist agent-based approach that rationalizes the complexity of market dynamics. This model demonstrates how chartist behavior can destabilize markets through speculative trading strategies, while fundamentalists work to reestablish equilibrium. The point at which actors shift from one to the other under the influence of herd behavior renders price movements unpredictable and complex. Together, chartists and fundamentalists can lengthen the tail of a distribution of returns, which means that extreme price changes or collapses occur with a much higher frequency than predicted by the normal distribution.

In general, the interplay between chartists and fundamentalists creates a nonlinear behavior of market situations. Little changes in market conditions or actions taken by traders can translate into disproportionate changes affecting prices, rendering the market completely unpredictable at times. Xu, Zhang, Xiong, and Zhou (2014) developed a model of heterogeneous multi-asset agents that enabled them to examine the behavior of agents when fundamentalists and chartists interact in their investment decisions. In this study, the authors demonstrated how these agents allocate their wealth across different assets and how this behavior influences overall market dynamics. According to Stockermans (2015), the interaction between chartists and fundamentalists also introduces a certain degree of non-linearity in market behavior. Thus, small deviations in the relationship between these actors can disproportionately affect market stability. In this context, Leal (2015) shows that feedback mechanisms between chartists and fundamentalists yield price-reacting mechanisms that amplify price changes, resulting in volatility that exceeds conventional model predictions. Pruna, Polukarov, and Jennings (2016) are interested in how various market participants continuously change their expectations and plans over time, employing a stochastic volatility model to capture the evolving state of the market. Similarly, Bouchaud, Gefen, Potters, and Wyart (2017) consider how such

relationships influence price changes, arguing that actions taken by chartists and fundamentalists give rise to feedback loops that cause prices to oscillate around their fundamental value.

Recent studies seem unanimous in showing that global events, prevailing market conditions, and investor behavior, particularly among fundamentalists and chartists, combine to create a rather complex situation. Boutouria, Ben Hamad, and Medhioub (2020) concentrate on the French options markets, revealing behavioral differences between these two kinds of investors through their application of a sentiment variable into a Black-Scholes framework combined with the Markov-switching model. Their empirical study further supports the heterogeneity of investor strategies applied to firms listed in the CAC40 market. Bahrini and Filfilan (2020) also document further analysis of the Coronavirus pandemic on stock returns in Gulf states; they find that there are differences in reactions by fundamentalists and chartists to the market instabilities created by the crisis. The same conclusion is reported by Karamti and Jeribi (2023) who studied the effect of the COVID-19 and the Russia-Ukraine crisis on international stock markets and established structural breaks and differential influences on nations and investors' behavior, particularly for countries economically and politically closer to the region of conflict. Li and Miu (2022) challenge earlier research by examining market volatility, investor sentiment, and economic factors that influence the mix of chartists and fundamentalists in the market. They demonstrate that investors are heterogeneous. Memon, Aslam, Naveed, Ferreira, and Ganiev (2024) study G20 stock markets during global crises and conclude that herding behavior increased, which has been shown not to improve market efficiency.

3. DATA AND METHODOLOGY

This section outlines the sample used, provides the descriptive statistics, and explains the empirical methodology applied in our analysis.

3.1. Data Description

Our empirical study focuses on the GCC region (Table 1), which has undergone significant shocks over the past decades. We consider the daily closing stock market indices of six countries during the period from 1st January 2018 to 31 December 2022. All stock market indices data are collected from the DATASTREAM database.

Table 1. Data description.

Region	Country	Stock Market Index	Symbol
Panel A: GCC	Bahrain	Bahrain All Share Index	PBH
	Kuwait	Kuwait Al Shall General Index	PKW
	Oman	Oman Muscat Securities Market Index	POM
	Qatar	Qatar SE All Share Index	PQA
	Saudi Arabia	Saudi Tadawul All Share Index	PSA
	United Arab Emirates	Dubai Financial Market Price Index	PAE

We removed from the dataset cases for which the stock market index was missing for a particular day, usually because that day fell on a weekend or holiday. Then, the sample contains a total of 1,305 observations per country.

The quotidian index return for each country, denoted Rit, is calculated based on the daily index Pit using the following formula.

$$R_{i,t} = Ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \qquad (1)$$

To elucidate the influence of the Covid-19 crisis as well as that of the Russia-Ukraine conflict, the complete sample period is divided into three separate subperiods: one stable period, ranging from January 2, 2018, to December 30, 2019, inclusive, with 520 observations; the other for the Covid-19 period, which starts on December 31, 2019, and

ends on February 23, 2020, yielding 562 observations; and the Russia-Ukraine conflict period, from February 24, 2022, to December 31, 2022, yielding 222 observations[1]. Figures 1 and 2 display, respectively, the evolution of the daily stock market index and returns for the Gulf countries.

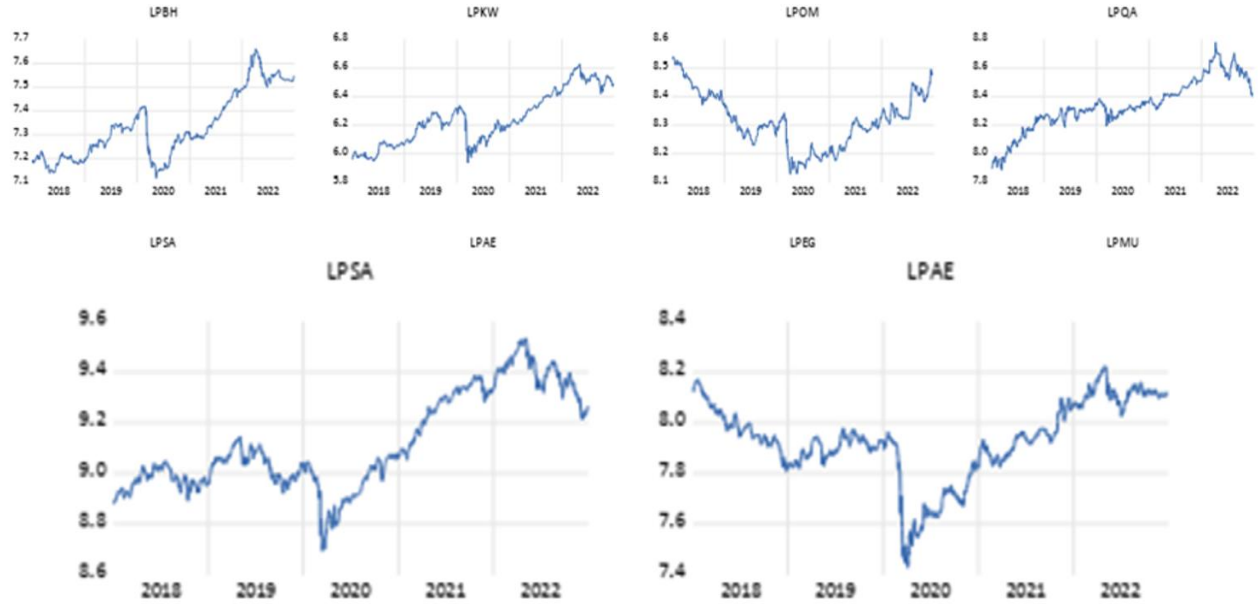

Figure 1. Evolution of GCC stock market indices.

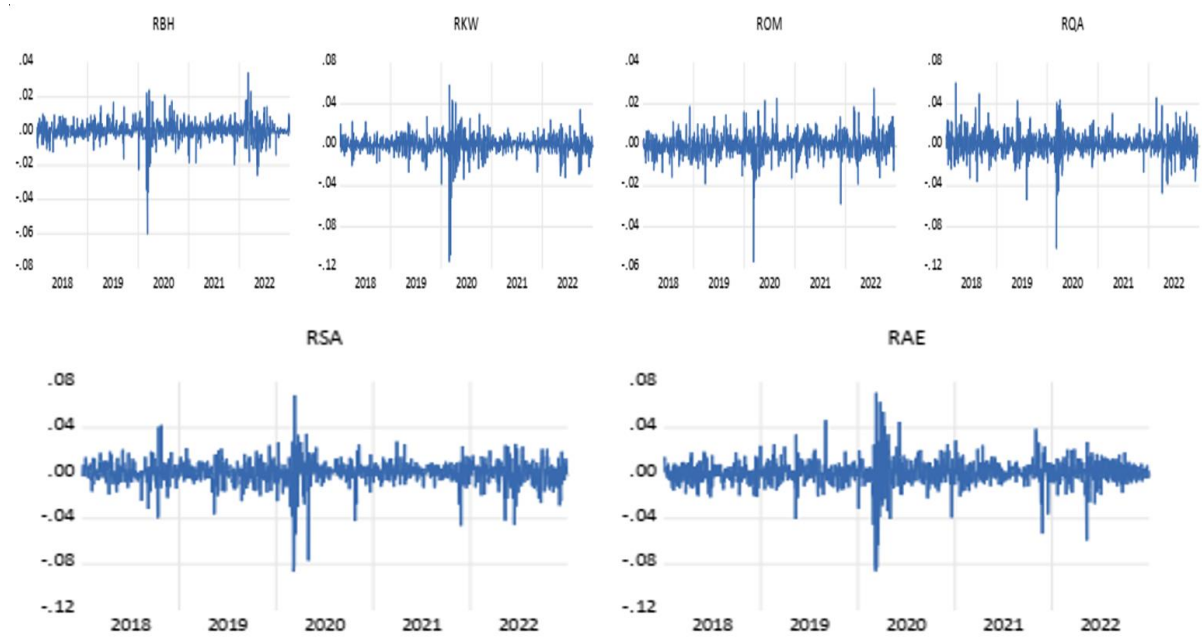

Figure 2. Evolution of GCC stock market returns.

Figures 1 and 2 present the Gulf stock market indices and returns for Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates between 2018 and 2022, focusing on the effect of two main crises: the COVID-19 pandemic and the Ukraine war. The stock market indices of the GCC countries showed a modest upward trend in the first period, 2018-2019. This observation is based on the stabilization of oil prices and persistent economic activity. Some markets, such as Saudi Arabia (LPSA) and Qatar (LPQA), benefited from economic reforms and infrastructure

[1] Like previous studies, the beginning of COVID-19 was documented by the end of December 2019 and 24 February 2022 as the starting date of the Russia-Ukraine conflict.

investments. In the second period, associated with the COVID-19 event, the year 2020 was characterized by a stock market slump in the first quarter due to a decline in demand for oil and health restrictions across the globe. In particular, Oman (LPOM) and the UAE (LPAE) indices fell drastically before gradually recovering towards the end of the year, supported by economic stimulus plans and increased oil prices. *The third period, between 2021-2022*, is related to the repercussions of the conflict in Ukraine and the effects of COVID-19 vaccinations. The GCC stock market indices have been trending upwards since 2021, especially Qatar (LPQA) and Saudi Arabia (LPSA), driven by rising energy prices. The situation worsened in 2022 when the war in Ukraine caused oil and gas prices to increase further, providing additional impetus to Gulf stock market growth. The Bahraini, Kuwaiti, and Omani indices, LPBH, LPKW, and LPOM, reached high levels before becoming more volatile toward the end of the year. Considering all these observations, we can deduce that the returns of the GCC stock market indices occurred between 2018 and 2022 and show a strong correlation with global economic crises. The recovery from the downward trend in 2020, primarily due to COVID-19, stabilized in 2021 and was significantly accelerated in 2022 due to energy price increases following the outbreak of the Ukraine war. These trends highlight the region's economies' heavy reliance on the energy sector, underscoring the urgent need for Gulf countries to adopt diversification policies.

3.2. Descriptive Statistics

The statistical characteristics of the GCC stock market returns during the period from January 2, 2018, to December 30, 2019, are reported in Table 2.

Table 2. Descriptive statistics of GCC Stock market (All period).

Panel A:	Mean (%)	Std. Dev (%)	Skw	Kur	J-B (10^3)	Q(10)	ARCH(10)
Bahrain	0.027	0.547	-1.565	21.193	18.516***	87.236***	33.449***
Kuwait	0.041	0.971	-3.180	40.444	78.377***	78.199***	76.933***
Oman	-0.003	0.530	-0.990	16.651	10.337***	121.640***	8.611***
Qatar	0.039	1.081	-0.463	12.424	4.872***	28.760***	12.309***
Saudi Arabia	0.029	1.035	-1.359	15.206	8.497***	46.222***	39.342***
UAE	-0.001	1.109	-0.938	15.430	8.586***	47.752***	62.860***

Note: Mean = Mean; Std. Dev = Standard Deviation; Skew = Skewness; Kur = Kurtosis; J-B = Jarque and Bera (1980) test statistic for normality; Q(10) = Ljung-Box test statistic for serial correlation, adjusted for heteroscedasticity, with 10 lags; ARCH (10) = Engle (1982) ARCH test statistic degrees of freedom, with 10 lags for conditional heteroscedasticity. ***, statistically rejects the null hypothesis at the 1% level.

As shown in Table 2, the average returns across all GCC countries are positive but remain small, with the largest being 0.041% for Kuwait, followed by Qatar and Saudi Arabia. The lowest returns, less than zero, are observed in Oman and UAE. Volatility is quantified by standard deviations, with the highest at 1.109% for UAE and Qatar at 1.081%. Both the means and volatility of the Gulf equity market returns are low, suggesting that over the observed period, the market is not increasing at a robust level and shows a lack of dynamic growth opportunities. All stock market returns exhibit skewness less than zero and kurtosis greater than 3, indicating the presence of unexpected returns. This conclusion is supported by the normality test findings of Jarque and Bera (1987), which demonstrate that none of the equity market returns follow a normal distribution. The Ljung-Box test indicates serial dependence, and the ARCH test shows heteroscedasticity for all series of stock market returns. Table 3 presents the means and standard deviations of the GCC returns across subperiods (Calm period, Covid-19 period, and Russia-Ukraine crisis).

Table 3 supports reasonable fluctuations in each of the three subperiods. Throughout the pandemic interval, the average returns of the majority of the stock market decreased, while all volatilities increased during the COVID-19 period. This supports the substantial impacts of the pandemic on the GCC stock markets. Similarly, the average of the majority of stock markets decreased, whereas all fluctuation parameters increased during the Russia-Ukraine conflict period. This could be attributed to the severe impact of the Russia-Ukraine war on Gulf equity markets.

Table 3. Descriptive statistics of GCC stock market returns for each subperiod.

Panel A:	Calm period		Covid-19 period		Russia-Ukraine War	
	Mean (%)	Std. Dev (%)	Mean (%)	Std. Dev (%)	Mean (%)	Std. Dev (%)
Bahrain	0.036	0.396	0.036	0.634	-0.016	0.608
Kuwait	0.068	0.647	0.036	1.216	-0.012	0.902
Oman	0.000	0.436	0.004	0.576	0.084	0.594
Qatar	0.088	1.084	0.040	0.969	-0.082	1.312
Saudi Arabia	0.029	0.887	0.072	1.127	-0.078	1.109
UAE	0.038	0.826	0.033	1.362	0.000	0.964

Note: Calm period is from 2 January 2018 to 30 December 2019 (520 observations). COVID-19 period is from 31 December 2019 to 23 February 2020 (562 observations), and the Russia-Ukraine conflict period is from 24 February 2022 to 31 December 2022 (222 observations).

3.3. Econometric Methodology

This section presents the econometric methodology used to analyze the influence of the COVID-19 crisis and the Russia-Ukraine War on the dynamics of GCC stock market returns in the presence of heterogeneous investor behavior. First, we develop the econometric model. Second, we present the Markov switching regime model.

Specification of the model: Following previous heterogeneous agent models as advanced by Day and Huang (1990), Brock and Hommes (1998), and Chiarella, He, Huang, and Zheng (2012) we examine an asset pricing model that permits the existence of different types of traders with different behaviors regarding the asset value as well as trading policies. These are the fundamentalists and the chartists. It is assumed that fundamentalists will adjust the spot price P_t^F, derived from the present value using the Gordon growth model and based on real economic conditions, and trade according to their beliefs about what the expected price of the stock in the future will be.

$$E_{t-1}^F(P_t \quad) = P_t^F = \frac{d_t}{r-g}(1+g) \qquad (2)$$

Where dt, g, and r are respectively the dividend, average growth rate of dividend, and required rate of return. Therefore, they maintain that the market index P_t, is tends to move back toward its fundamental value. They buy (sell) the stock when the present price P_{t-1} is lower (greater) than the intrinsic value of the stock P_t^F. Thus, their demand behaviour is defined as.

$$D_t^F = \alpha^F(E_{t-1}^F(P_t) - P_{t-1}) = \alpha^F(P_t^F - P_{t-1}) \qquad (3)$$

Where $\alpha^F > 0$ represents the speed at which the market price reverts to its fundamental value. Long-term investors seek to benefit from this mean reversion, so their demand increases when the market is undervalued (and decreases when overvalued). Chartists, due to their transaction styles or the costs of obtaining information, do not have access to current prices. Instead, they adjust their trades based on market conditions and past values, influencing the current market index P_{t-1}through the divergence of the price from the short-term value $P_{t-1} - v_{t-1}$, this means.

$$E_{t-1}^c(P_t) = P_{t-1} + \beta^C(P_{t-1} - v_{t-1}) \qquad (4)$$

Where $\beta^c \neq 0$ is the projection factor of the chartists. Then, their demand function can be written as.

$$D_t^c = (E_{t-1}^c(P_t) - P_{t-1}) = \beta^c(P_{t-1} - v_{t-1}) \qquad (5)$$

All chartists believed that short-term market value Vt, during any period, reflects and updates market conditions. However, the trading strategies of these chartists are twofold, which helps us classify chartists into two groups: momentum and contrarian agents. When $\beta^c > 0$ chartists are considered trend followers (momentum investors), they use historical prices to estimate the short-term market price. However, when$\beta^c < 0$ chartists operate as Contrarians; they envisage the price moving in the opposite direction in the future.

As in Chiarella et al. (2012), we consider that the change in stock price from period $t-1$ to period t can be written as.

$$\Delta P_t = P_t - P_{t-1} = D_t^F + D_t^C = c + \alpha^F(P_t^F - P_{t-1}) + \beta^C(P_{t-1} - v_{t-1}) + \varepsilon_t \quad (6)$$

Where D^F, D^C represent the demand for fundamentalists and chartists, respectively, and c is the constant, α^F and $\beta^c$are the corresponding adjustment speed and $\varepsilon_t \sim N(0, \sigma^2)$. In order to estimate the long-run intrinsic value of the stock price, several models have been considered like the present value of expected future dividends of Gordon and

Shapiro (1956) growth model 1956. In this paper, we apply the Hodrick and Prescott (1997) filter technique. Several authors have applied this method. It consists of decomposing a recorded variable into its long-term trend and transitory fluctuations (cycle component)[2].

Presentation of the Markov regime-switching model: The Markov regime-switching model, proposed by Hamilton (1989) is one of the most predominant nonlinear frameworks. It involves multiple equations that can describe time series dynamics in diverse regimes. The characteristic of this approach is the switching system, as explained by a hidden variable distributed according to a first-order Markov chain. We define an unobservable state[3] variable with 0 or 1, and we assume that there are two regimes: Regime 1 when the state is state 1 ($s_t = 0$) and vice versa. Regime 2, when the state is state 2 ($s_t = 1$). To model the dynamics of the market return of each country under the presence of fundamentalists and chartists, we consider the two-state Markov regime-switching model given by.

$$R_{i,t} = c + \alpha_{s,i}^{F} \ \ detrend_{s,i,t} + \beta_{s,i}^{C} \ R_{i,t-1} + \varepsilon_{s,i,t} \qquad (7)$$

Where $\alpha_{s,i}^{F}$ is the coefficient of the fundamentalist of country i in the state S. $\beta_{s,i}^{C}$ is the coefficient of the chartist of country i in the state s. $\varepsilon_{s,i,t}$ are independent and identically distributed (i.i.d.) normal errors with 0 mean and variance σ_s^2. The transition probabilities of the hidden state variable s_t are defined as a first-order Markov chain and the matrix of transition probabilities is given by the following matrix.

$$p = \begin{pmatrix} p(s_t = 0|s_{t-1} = 0) & p(s_t = 1|s_{t-1} = 0) \\ p(s_t = 0|s_{t-1} = 1) & p(s_t = 1|s_{t-1} = 1) \end{pmatrix} = \begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix} \qquad (8)$$

Where $p_{ij}(i, j = 0,1)$ represents the transition probability of $s_t = j$ considering that $s_{t-1} = i$. The likelihood transition is as follows $p_{11} + p_{12} = 1$ and $p_{21} + p_{22} = 1$. Based on the estimated transition probabilities, it is possible to deduce, for each of the states of the regime, the expected duration according to the following ratio.

$$E(d_s) = \frac{1}{1-p_{ij}} \qquad (9)$$

The variables of the Markov regime-switching model are derived from the maximum likelihood method as described in Hamilton (1994).

The hypotheses to be tested: This study aims to analyze how the two strategies, fundamentalists and chartists, affect market dynamics through the Markov Switching Model, which provides a framework for investigating market regimes and their transitions. The model suggests that financial markets can shift between different regimes. One is the fundamentalist regime, where prices are mainly determined by economic fundamentals. The other is the chartist regime, where prices are influenced by trends and speculative behavior, often moving in the opposite direction.

In this context, a few hypotheses can be formulated to test and compare the effects of these regimes on market parameters. Thus, we will study the coefficients of fundamentalists' and chartists' behavior, transition probabilities between the regimes, and duration of regimes, to observe whether regimes are affected by exogenous forces and the persistence and transition of the regimes. The following hypotheses are considered according to previous empirical studies.

Hypothesis 1: α is assumed to be positive and statistically significant under the first regime, reflecting the effect of fundamental investors. Similarly, β is assumed to be positive and significant under the second regime, representing the effect of technical analysts.

Hypothesis 2: We assume that the probability of moving from Regime 1 to Regime 2 increases with increasing market uncertainty, which implies that the preponderance of technical analysts increases and that of fundamental analysts decreases.

Hypothesis 3: We assume that Regime 1 lasts longer on average than Regime 2 because fundamentalists are more stable, while technical analysts change more frequently in response to market trends.

[2] The Hodrick-Prescott filter technique has been applied by numerous authors like Koutmos and Payne (2021) to extract the fundamental value of the bitcoin price.

[3] In the empirical section, we will use regime 1 to refer to state 0, and regime 2 to refer to state 1.

4. EMPIRICAL FINDINGS

This section presents and discusses the empirical findings of the two-state Markov regime-switching model, as defined in Equation 6, for each country, taken alone, and for each of the three separate subperiods (Calm period, Covid-19 period, and Russia-Ukraine conflict period). The model identifies (Table 4-a) two distinct regimes: a low-volatility regime and a high-volatility regime, based on estimated values of the conditional standard deviation (σ), derived from the log of volatility (Log (SIGMA)). The following Table 4-a summarizes the regime-specific volatility estimates for each country, providing insight into the changing risk environment of GCC equity markets.

Table 4-a. The regime-specific volatility estimates.

Country	Regime 1		Regime 2	
	Log sigma	Volatility	Log sigma	Volatility
Bahrain	5.858	0.002	-4.523	0.010
Kuwait	-5.258	0.005	-3.733	0.023
Oman	-5.755	0.003	-4.659	0.009
Qatar	-5.174	0.005	-4.027	0.017
Saudi Arabia	-5.007	0.006	-3.783	0.022
UAE	-4.921	0.007	-3.572	0.028

In all six GCC countries, Regime 1 is consistently associated with lower fluctuations and higher short-term market value, reflecting the characteristics of a bull (calm) period, while Regime 2 is linked to increased instability (higher risk) and lower short-term market value, indicative of a downturn period. Below, Table 4-b summarizes the subperiods related to the regimes for each country, with the lengths calculated using Stata.

Table 4-b. Regimes, subperiod lengths across GCC countries.

Country	Main Period	Regime	Subperiod (Obtained by STATA)
Bahrain (BH)	Calm	Regime 1	Jan 2, 2018 – Jul 2019
		Regime 2	Aug 2019 – Dec 2019
	COVID-19	Regime 1	Dec 31, 2019 – Feb 23, 2020 (562 observations)
		Regime 2	Mar 2020 – Jun 2020
	Ukraine War	Regime 1	Jan 2022 – Feb 2022
		Regime 2	Mar 2022 – Dec 2022 (222 observations)
Kuwait (KW)	Calm	Regime 1	Jan 2, 2018 – Jul 2019
		Regime 2	Aug 2019 – Dec 2019
	COVID-19	Regime 1	Dec 31, 2019 – Feb 23, 2020 (562 observations)
		Regime 2	Mar 2020 – Jul 2020
	Ukraine War	Regime 1	Jan 2022 – Feb 2022
		Regime 2	Mar 2022 – Dec 2022 (222 observations)
Oman (OM)	Calm	Regime 1	Jan 2, 2018 – Jul 2019
		Regime 2	Aug 2019 – Dec 2019
	COVID-19	Regime 1	Dec 31, 2019 – Feb 23, 2020 (562 observations)
		Regime 2	Mar 2020 – Jul 2020
	Ukraine War	Regime 1	Jan 2022 – Feb 2022
		Regime 2	Mar 2022 – Dec 2022 (222 observations)
Qatar (QA)	Calm	Regime 1	Jan 2, 2018 – Aug 2019
		Regime 2	Sep 2019 – Dec 2019
	COVID-19	Regime 1	Dec 31, 2019 – Feb 23, 2020 (562 observations)
		Regime 2	Mar 2020 – Jun 2020
	Ukraine War	Regime 1	Jan 2022 – Feb 2022
		Regime 2	Mar 2022 – Dec 2022 (222 observations)
Saudi Arabia (SA)	Calm	Regime 1	Jan 2, 2018 – Jul 2019
		Regime 2	Aug 2019 – Dec 2019
	COVID-19	Regime 1	Dec 31, 2019 – Feb 23, 2020 (562 observations)
		Regime 2	Mar 2020 – Jul 2020
	Ukraine War	Regime 1	Jan 2022 – Feb 2022

Country	Main Period	Regime	Subperiod (Obtained by STATA)
		Regime 2	Mar 2022 – Dec 2022 (222 observations)
UAE (AE)	Calm	Regime 1	Jan 2, 2018 – Jun 2019
		Regime 2	Jul 2019 – Dec 2019
	COVID-19	Regime 1	Dec 31, 2019 – Feb 23, 2020 (562 observations)
		Regime 2	Mar 2020 – Jun 2020
	Ukraine War	Regime 1	Jan 2022 – Feb 2022
		Regime 2	Mar 2022 – Dec 2022 (222 observations)

4.1. During the Calm Period

We see clearly (Table 5) that the coefficients of the fundamentalists (the value of alpha) in Regime 1, as well as those in Regime 2, are negative and statistically significant for all countries. This indicates a mean-reversion trading strategy that aligns with the fundamentals of the two regimes. In particular, we notice that the coefficients of the fundamentalists in Regime 2 are greater than those in Regime 1 in all countries except Saudi Arabia and UAE, where the coefficients of fundamentalists in Regime 1 are larger than in Regime 2.

This implies that, in the high-volatility regime, the influence of fundamentalists is more persistent in all countries except Saudi Arabia and UAE, where the presence of fundamentalists is more important in the low-volatility regime. Across both regimes, fundamentalist behavior is consistently destabilizing (negative alpha) in all GCC markets. The expectation of rational price correction by these agents is not supported empirically. Instead, their actions appear to amplify volatility, especially in Kuwait, Oman, and Qatar, during calm periods. In addition, we observe that the coefficients of chartists (the value of beta) in Regime 1 are significant in all countries except the UAE, while those in Regime 2 are significant in all countries except Bahrain. This indicates that the chartists are active simultaneously with the fundamentalists in these countries.

The sign of this coefficient is positive, implying that the trading practices of momentum traders prevail over those of contrarians. These results are similar to those obtained by previous studies such as LeBaron (2006); Boswijk, Hommes, and Manzan (2007); He and Li (2008); De Jong, Verschoor, and Zwinkels (2009); Chen, Huang, and Zheng (2018) and Li and Miu (2022), who found that both fundamentalists and chartists impact stock markets. Consequently, we can accept the first null hypothesis, which assumes that the influence of fundamentalists and chartists in the stock markets varies across countries.

4.2. During the COVID-19 Period

For the fundamentalists, we see that in Regime 1 (Table 5), all their coefficients are significant and negative, whereas in Regime 2, all their coefficients are also significant and negative in all countries. In particular, we found that the coefficients of fundamentalists in Regime 1 are higher than those in Regime 2 in all GCC countries. This means that fundamentalists are more destabilizing in low volatility than in higher volatility. Furthermore, moving from one regime to another, the fundamentalists in Bahrain, Kuwait, Oman, and Qatar have changed their behavior because of the COVID-19 pandemic. For other GCC stock markets (Saudi Arabia and UAE), the presence of fundamentalists is still more significant in Regime 1 since the coefficient of fundamentalists in Regime 1 is larger than those in Regime 2.

Moreover, the coefficients of fundamentalists throughout the pandemic period are greater than those during the calm period for all countries. This reproduces the dramatic impact of the COVID-19 pandemic on the behavior of fundamentalists. Indeed, mean reversion towards fundamentals becomes more pronounced. Fundamentalists in GCC markets behave irrationally, exerting a destabilizing influence regardless of the volatility regime. This contradicts classical assumptions of their stabilizing role.

For chartists, we observe that estimated parameters are significant and positive in Regime 1 across all countries, while in Regime 2, all coefficients are significant and positive in all countries. Consequently, the trading activities of momentum traders dominate those of contrarians. Furthermore, for all countries, relative to the calm period, the

coefficient of chartists in Regime 1 increased. In contrast, the coefficient of chartists in Regime 2 decreased in all GCC countries except Bahrain.

This implies that the COVID-19 pandemic has affected the behaviors of all types of investors, with some differences across countries. This finding closely aligns with those obtained by Solihat and Nugraha (2020) and Gao (2022), who found that the COVID-19 pandemic has influenced the behavior of all types of investors. It is also similar to the findings of Li and Miu (2022), who found that both fundamentalists and chartists are present in the market, but their representation varies across different states and over time. Based on these findings, we accept the second null hypothesis.

4.3. The Russia-Ukraine War Period

For the six GCC stock markets, we observe that the presence of fundamentalists remains more significant in Regime 1 (alpha 1 > alpha 2) for all GCC countries (Table 5). Furthermore, the coefficient of fundamentalists (compared to the COVID period) increased in the stock markets of Bahrain and the UAE, whereas it decreased in the stock markets of Saudi Arabia, Oman, Qatar, and Kuwait. Regarding chartists, we found that in Regime 1, the coefficients of chartists are significant and positive in all countries except Saudi Arabia. However, in Regime 2, the coefficients of chartists are significant and positive in all countries except Qatar.

Similar to the previous subperiods, the trading activities of momentum traders still dominate those of contrarians. Moreover, in Regime 1, the coefficients of chartists increased in Kuwait, Oman, and the UAE, while these coefficients decreased in Bahrain and Qatar. In Regime 2, the coefficients of chartists increased in Bahrain and the UAE, and decreased in Kuwait, Oman, and Saudi Arabia. According to the obtained results, we can deduce that the Russia-Ukraine conflict adversely affected the behavior of investors in GCC countries. This result is consistent with previous studies such as Boungou and Yatié (2022); Yousaf, Patel, and Yarovaya (2022); Boubaker, Goodell, Pandey, and Kumari (2022) and Ahmed, Hasan, and Kamal (2023) who found that the Russia-Ukraine conflict has a heterogeneous impact on stock markets. Therefore, we accept the third null hypothesis.

Table 5. The Markov switching regime-switching estimation for each subperiod.

Panel A	Calm period						Covid-19 period						Russia-Ukraine Conflict Period					
	Regime 1: Low volatility			Regime 2: High volatility			Regime 1: Low volatility			Regime 2: High volatility			Regime 1: Low volatility			Regime 2: High volatility		
	c_1	$\alpha_{1,t}$	$\beta_{1,t}$	c_2	$\alpha_{2,t}$	$\beta_{2,t}$	c_1	$\alpha_{1,t}$	$\beta_{1,t}$	c_2	$\alpha_{2,t}$	$\beta_{2,t}$	c_1	$\alpha_{1,t}$	$\beta_{1,t}$	c_2	$\alpha_{2,t}$	$\beta_{2,t}$
Bahrain		-0.506[a]	0.589[a]		-0.788[a]	0.124	-0.002[c]	-1.983[a]	1.137[a]	0.001[a]	-0.449[a]	0.150[c]	0.004	-2.801[a]	0.935[a]	0.000	-0.368[a]	0.433[a]
Kuwait	0.001[a]	-0.603[a]	0.554[a]	-0.005[a]	-1.716[a]	0.397[a]	-0.031[a]	-2.256[a]	0.631[b]	0.001[b]	-0.588[a]	0.373[a]	-0.002	-1.255[a]	0.969[a]	0.000	-0.381[a]	0.216[a]
Oman	-0.001[c]	-0.375[a]	0.325[a]	0.000[b]	-1.528[a]	1.063[a]	-0.012[a]	-1.557[a]	0.434[a]	0.000	-0.553[a]	0.503[a]		-1.249[a]	0.776[a]		-0.157	0.263[a]
Qatar		-0.431[a]	0.163[a]		-1.706[a]	0.949[a]		-1.182[a]	1.737[a]		-0.540[a]	0.077[c]		-0.878[a]	0.823[a]		-0.354[b]	0.018
Saudi Arabia		-2.005[a]	1.963[a]		-0.534[a]	0.365[a]		-1.220[a]	0.357[a]		-0.327[a]	0.649[a]		-0.782[b]	-0.209		-0.618[a]	0.533[a]
UAE		-1.117[a]	-0.042		-0.613[a]	0.511[a]	-0.003[a]	-1.295[a]	1.292[a]	0.001[b]	-0.468[a]	0.098[b]		-2.588[a]	2.922[a]		-0.610[a]	0.233[a]

Note: The calm period of time is from January 2, 2018, to December 30, 2019. The COVID-19 period is from December 31, 2019, to February 23, 2020. The Russia-Ukraine war period is from February 24, 2022, to December 31, 2022. α: shows effects of fundamentalists; $\alpha > 0 \rightarrow$ stabilising (rational price adjustment); $\alpha < 0 \rightarrow$ destabilising (irrational/excessive). β: shows effects of technical traders; positive beta implies momentum behaviour (trend-following/herding); negative beta implies contrarian effects (trend-reversal). a, b, and c significance levels are at 1%, 5%, and 10%, respectively.

4.4. Estimation of the Transition Probabilities and Expected Durations

The switching beliefs of fundamentalists and chartists across the two regimes, as reproduced by the transition probabilities expressed in Equation 7, and the duration, defined by Equation 8, in each subperiod are presented in Table 6.

Table 6. Estimation results of non-transition probabilities and durations for each subperiod.

Panel A	Calm period				Covid-19 period				Russia-Ukraine conflict period			
	p_{11}	p_{22}	d_1	d_2	p_{11}	p_{22}	d_1	d_2	p_{11}	p_{22}	d_1	d_2
Bahrain	0.923	0.839	12.942	6.208	0.141	0.874	1.165	7.955	0.350	0.941	1.539	16.829
Kuwait	0.952	0.689	21.008	3.219	0.358	0.642	1.557	2.793	0.117	0.741	1.132	3.864
Oman	0.835	0.205	6.062	1.257	0.828	0.995	5.828	197.518	0.211	0.370	1.267	1.587
Qatar	0.844	0.287	6.396	1.402	0.275	0.903	1.378	10.277	0.611	0.655	2.571	2.896
Saudi Arabia	0.263	0.959	1.357	24.490	0.654	0.719	2.889	3.557	0.312	0.924	1.453	13.157
UAE	0.484	0.925	1.936	13.321	0.183	0.768	1.225	4.302	0.001	0.949	1.001	19.607

Note: p_{11} is the estimated probability of staying in state (i.e., transition probability is $1-p_{11}$). p_{22} is the estimated probability of staying in state 2 (i.e., transition probability is $1-p_{22}$). d_1 is the expected duration of Regime 1. d_2 is the expected duration of Regime 2.

Under stable market conditions, we observe that all p_{11} are higher than p_{22} in all countries except Saudi Arabia and the UAE, where p_{22} is higher than p_{11}. During the COVID-19 period and the Russia-Ukraine conflict, we observe that all p_{22} are higher than p_{11} in all GCC countries. Furthermore, there is a significant change in the durations in Regime 1 as well as in Regime 2 during the COVID-19 period and the Russia-Ukraine conflict period, compared to the calm period. These results could be attributed to the COVID-19 pandemic and the Russia-Ukraine conflict, which have affected the transition probabilities and durations, with some differences across countries.

During a calm period, Bahrain and Kuwait had a high probability of staying in Regime 1 (p_{11} = 0.923 and 0.952), indicating market stability in these countries. Saudi Arabia shows a lower probability (p_{11} = 0.263) of remaining in Regime 1, which suggests it is more prone to volatility. Qatar and Oman held moderate probabilities, balancing between stability and volatility. In terms of durations, Kuwait and Bahrain experienced longer periods in Regime 1, while Saudi Arabia had a longer duration in Regime 2, reflecting its tendency to experience volatility.

The Covid-19 period involved transitory probabilities that emphasized a higher volatility regime (Regime 2) for most countries, with Bahrain (p_{22}=0.874), Kuwait (p_{22}=0.995), and Oman (p_{22}=0.903) predominantly towards Regime 2. Saudi Arabia and Kuwait exhibited more balanced transitions, while Qatar and the UAE experienced many switches to Regime 2. Concerning durations, the time spent in Regime 2 increased: Qatar (d_2=10.27) and Oman (d_2=197.518) had extreme prolongations of instability during the crisis.

The Russia-Ukraine Conflict Period: Transition probabilities during the Russia-Ukraine conflict were quite similar to those during COVID-19, with Bahrain, Saudi Arabia, and the UAE facing high probabilities of remaining in Regime 2. Oman and Qatar exhibited more mixed transitions but experienced a greater degree of volatility. Regime 2 duration estimates indicated long durations, with Bahrain, Saudi Arabia, and the UAE experiencing extended periods of volatility and instability, which were significantly impacted by global conflicts (d2 = 16.829; d2 = 13.157; d2 = 19.607).

The events of COVID-19 and the Russia-Ukraine conflict caused a significant shift in volatility (Regime 2), with most countries experiencing longer durations in this regime, showing instability within markets during global crises.

4.5. Comparing Regimes Across Countries

Examining how market regimes have evolved in the six GCC states (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) confirms both consistencies and divergences in investing activities across crises. Table 7 presents a comparison of market regimes across GCC countries during three major periods:

- During a calm period (2018 - 2019), in regime 1 (low volatility), fundamentalism took on destabilizing effects in Bahrain, Kuwait, Oman, and Qatar, but with more persistent effects in Saudi Arabia and the UAE. Regarding chartists, in most countries they were more involved in regime 1 by participating in momentum trading, but in the UAE (not Saudi Arabia) they were less involved. In regime 2 (high volatility), the nature of fundamentalism was more persistent in the majority of countries, but chartists remained more important except in Bahrain and the UAE, where momentum trading was more subdued.

- During the COVID-19 pandemic, fundamentalism increased in all countries at a time when the world was generally volatile and unstable, specifically, countries within Regime 1, like Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE. Furthermore, chartist activity increased within Regime 1 of these countries, leading to trend-following behavior through the crisis. However, on the contrary, Regime 2 did not reflect this trend of increased chartist impact in Bahrain, Kuwait, Oman, Qatar, and the UAE, and Saudi Arabia remained relatively unchanged. Thus, momentum was considered less significant in times of instability.
- During the Russia-Ukraine conflict, fundamentalist behavior showed heterogeneous changes: their influence increased in Regime 1 in Bahrain and the Emirates, but decreased in Kuwait, Oman, Qatar, and Saudi Arabia. In Regime 2, fundamentalist influence remained relatively stable in all countries. Chartist activity was varied: it increased in Regime 2 in Bahrain and both regimes in the Emirates, but decreased or remained limited in Saudi Arabia and Qatar.

Table 7. Comparing regimes across countries.

Crisis	***Regimes across countries***
Calm Period (2018–2019)	Regime 1: Low volatility, fundamentalists destabilizing, chartists active (momentum trading) in most countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia). Regime 2: High volatility, fundamentalists are more persistent, chartists are less involved, except in Bahrain and the UAE (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE).
COVID-19 Period (Dec 2019–Feb 2022)	Regime 1: Fundamentalists became more destabilizing, and chartists stronger in all countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE). Regime 2: Fundamentalist influence decreased, chartist activity varied: increased in some countries (e.g., Bahrain, Kuwait) but decreased in others (e.g., Qatar, Saudi Arabia, UAE).
Russia-Ukraine Period (Feb–Dec 2022)	Regime 1: Fundamentalist influence increased in Bahrain, Kuwait, and the UAE, but decreased in other countries (Kuwait, Bahrain, UAE). Chartists varied, increasing in Bahrain and the UAE, but decreasing in others (e.g., Saudi Arabia, Qatar). Regime 2: Chartist activity decreased in most countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia), except the UAE, where it remained high.

5. ROBUSTNESS TESTS

The robustness test aims to measure the stability of the coefficients estimated by the Markov Switching Model (MSM) when using real stock prices (adjusted for inflation) instead of nominal stock prices for the GCC countries across three subperiods: Calm Period, COVID-19 Period, and Russia-Ukraine Conflict Period. We assume that using real stock prices may generate a more robust estimation of market regimes, as inflation effects will be neutralized because they could distort the perceived behavior of nominal stock prices. To measure the real stock price from the nominal stock price using the Consumer Price Index (CPI) (Table 8) we need to adjust the nominal price for inflation. The general formula for calculating the real stock price is: *Real stock index P^r = (Nominal stock index P^n/CPI) * 100.* Subsequently, the daily real stock market return of each country, denoted as R_{it}^rs, is obtained from the daily stock market indices P_{it} using.

$$R_{it}^r = Log(P_{it}^r / P_{it-1}^r) \qquad (10)$$

Where: Nominal stock price is the stock price observed in the market, without adjustment for inflation. The Consumer Price Index (CPI) refers to the average rate of price change that consumers experience when purchasing goods and services. Usually, the CPI is indexed by a base year; for example, in a certain base year, we have CPI = 100. The factor of 100 ensures the real stock price is in the same units as the nominal stock price, adjusted for the changes in the price level due to inflation.

Table 8. The average consumer price index (CPI) (annual %) for GCC countries.

Countries	2018	2019	2020	2021	2022
Bahrain	2.1	1.8	-2.3	-0.6	3.6
Kuwait	0.6	2.9	2.1	3.4	4.8
Oman	0.9	2.1	-0.9	1.5	2.8
Qatar	0.3	3.5	-2.5	2.3	5.0
Saudi Arab	2.5	1.8	3.4	3.1	2.5
UAE	3.1	3.2	-2.1	-0.1	4.8
GCC Avg	2.2	1.3	2.2	3.3	2.6
Arab world	4.8	6.1	9.1	8.9	12.1

After estimating the Markov Switching models with real stock prices (Table 10), we will compare the estimated coefficients of the model, transition probabilities, and duration estimates across both models. In this way, we can assess whether the use of real stock prices makes a difference in the results or whether the coefficients themselves are quite stable across both nominal and real stock prices. Across the three-time intervals, we can say that the Markov Switching Model (MSM) with real stock prices yielded slightly more stable coefficients compared to MSM with nominal stock prices. This suggests that inflation-adjusted stock prices moderate market volatility, notably during times of crisis such as COVID-19 and the war in Ukraine. In the Calm Period, the difference in the two MSMs remained insignificant, with only a slight increase in stability being observed in a few countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and UAE). During COVID-19 and the Russia-Ukraine Conflict, the adjustment for inflation showed more stable coefficients during COVID-19 and the Russia-Ukraine Conflict for several countries as compared to the previous MSM with nominal stock prices. This indicated that during times of crises, inflation adjustment helps to reduce extreme market volatility. The most volatile movements during both nominal and real stock prices were seen in Saudi Arabia and Bahrain in both periods of either the COVID crisis or the Russia-Ukraine conflict, but somewhat less pronounced when adjusted for inflation. Kuwait, Oman, Qatar, and UAE had relatively stable behavior across both periods, having a rather close resemblance in both models. To conclude, MSM with a real stock price model (Table 10) generally showed a bit more stability compared to MSM with a nominal stock price model (Table 5), especially in times of crisis (COVID-19 and Russia-Ukraine Conflict). This demonstrates that the view of market conditions in the GCC region becomes clearer and more stable when adjusted for inflation. In general, transition probabilities p11 and p22 show ordinarily small changes between the MSM with nominal stock prices (Table 9) and MSM with real stock prices (Table 10), with most of the countries producing similar patterns of stability. For the durations in regimes, d1 and d2 have larger differences, especially during the COVID-19 period, where durations for many countries using MSM with real stock prices tend to increase, particularly in the case of Qatar, which depicts a high increment in d2. In overall comparisons using MSM with real stock prices, transition probabilities largely show more stability, even in the periods of the Russia-Ukraine conflict; however, differences are not drastic in most cases to demonstrate the robustness of the results across the two modes: MSM with nominal and MSM with real stock prices.

6. CONCLUSION AND POLICY SUGGESTION

6.1. Conclusion

This study examined the effect of the COVID-19 pandemic and the Russia-Ukraine war on the dynamics of stock market returns in six GCC nations, considering evidence of heterogeneous behavior of investors (fundamentalists and chartists) over the recent time period from 01/01/2018 through 31/12/2022. The econometric framework utilizes the Markov regime-switching model with two regimes: a low-fluctuations regime and a high-volatility regime. The transition from one regime to another is determined by an unobservable variable. The empirical results reveal that (i) both fundamentalists and chartists are present in all GCC stock markets, but with some differences across countries. In GCC countries, the effect of fundamentalists is more important in the high-volatility regime during calm

periods and in the low-volatility regime during crises, whereas previous studies emphasize the effect of fundamentalists in the high-volatility regime. (ii) Additionally, the COVID-19 pandemic has significantly affected the behavior of all investors across all countries. However, the Russia-Ukraine conflict presented adverse effects that vary across countries. (iii) Empirical tests also reveal that fundamentalists exhibit a consistently destabilizing effect across GCC stock markets, as evidenced by negative and significant alpha coefficients in both regimes. This challenges the idea of rational price correction, especially in Kuwait, Oman, and Qatar during low-volatility days. Conversely, chartists present a significant and positive influence, indicating the dominance of momentum-driven behavior in these markets. The results further confirm that the impact of fundamentalists and chartists differs across countries, supporting the concept of heterogeneous investors in GCC countries. (iv) The research findings show that investor behavior during crises in GCC markets is heterogeneous and potentially destabilizing. Fundamentalists tend to act more like chartists rather than fulfilling their stabilizing role, and vice versa, with each type of investor acting as destabilizing under various conditions. (v) The robustness check indicates that the Markov Switching Model (MSM) with real stock prices is generally more stable than the MSM with nominal stock prices, especially during crises such as Covid-19 and the Ukraine conflict. Transition probabilities were similar across models, but the duration of regimes (d1 and d2) varied considerably, particularly in Qatar throughout the Covid-19 pandemic. Overall, inflation-adjusted stock prices yielded more stable results, validating the robustness of the findings.

In conclusion, across stochastic market strategies, including reversal and momentum, trading does not bring prices to fair value but instead provides more volatility and contributes to a larger asset bubble. Additionally, the similar behaviors observed across countries highlight how markets can change in times of stress, challenging the traditional view of investors and suggesting a more complex understanding of market dynamics.

6.2. Policy Suggestion

Investors behave differently across the GCC markets; hence, policies should be outlined differently for each country. In *Bahrain* and the *United Arab Emirates*, fundamentalists are more active during the crisis, just slightly destabilizing the market, whereas chartists remain active in Bahrain but inactive in the United Arab Emirates. Therefore, transaction monitoring, promotion of long-term investments, and better transparency are vital. In *Kuwait* and *Oman*, fundamentalists and technical traders destabilize the markets in times of crisis, and therefore, speculative trading should be limited while risk management should be enhanced. In *Qatar*, the fundamentalists are destabilizing in both periods, while chartists are active in times of crisis. Therefore, it is necessary to limit risky transactions while encouraging sustainable investments. Finally, in *Saudi Arabia*, fundamentalists remain persistent in calm periods and destabilize in times of crisis, while chartists are inactive. Policies for supporting investment diversification and monitoring prices are needed. In short, to stabilize GCC markets, the authorities should focus on three priority areas: market monitoring, risk management, and encouraging long-term investments.

Table 9. Estimation results of the Markov regime-switching model for real prices.

Panel A	Calm period						Covid-19 period						Russia-Ukraine conflict period					
	Regime 1: Low volatility			Regime 2: High volatility			Regime 1: Low volatility			Regime 2: High volatility			Regime 1: Low volatility			Regime 2: High volatility		
	c_1	$\alpha_{1,t}$	$\beta_{1,t}$	c_2	$\alpha_{2,t}$	$\beta_{2,t}$	c_1	$\alpha_{1,t}$	$\beta_{1,t}$	c_2	$\alpha_{2,t}$	$\beta_{2,t}$	c_1	$\alpha_{1,t}$	$\beta_{1,t}$	c_2	$\alpha_{2,t}$	$\beta_{2,t}$
Bahrain		-0.497[a]	0.578[a]		-0.774[a]	0.121	-0.002[c]	-2.029[a]	1.163[a]	0.001[a]	-0.459[a]	0.153[c]	0.003	-2.703[a]	0.90[a]	0.000	-0.355[b]	0.4317[b]
Kuwait	0.0009[a]	-0.586[a]	0.538[a]	-0.004[a]	-1.667[a]	0.385[a]	-0.030[a]	-2.209[a]	0.618[b]	0.001[b]	-0.575[a]	0.365[a]	-0.001	-1.206[a]	0.931[a]	0.000	-0.366[a]	0.207[a]
Oman	-0.0009[c]	-0.367[a]	0.318[a]	0.000[b]	-1.496[a]	1.041[a]	-0.012[a]	-1.571[a]	0.437[a]	0.000	-0.558[a]	0.507[a]		-1.214[a]	0.754[a]		-0.152	0.255[a]
Qatar		-0.416[a]	0.157[a]		-1.648[a]	0.916[a]		-1.212[b]	1.781[a]		-0.553[a]	0.078[c]		-0.836[a]	0.783[a]		-0.337[b]	0.017
Saudi Arabia		-1.969[a]	1.928[a]		-0.524[a]	0.358[a]		-1.179[a]	0.345[a]		-0.316[a]	0.627[a]		-0.762[b]	-0.203		-0.602[a]	0.520[a]
UAE		-1.082[a]	-0.040		-0.610[a]	0.495[a]	-0.003[a]	-1.322[a]	1.319[a]	0.001[b]	-0.478[a]	0.100[b]		-2.469[a]	2.788[a]		-0.582[a]	0.222[a]

Note: The Calm period is from 2 January 2018 to 30 December 2019. The COVID-19 period is from 31 December 2019 to 23 February 2020. The Russia-Ukraine conflict period is from 24 February 2022 to 31 December 2022. α (alpha): measures the effect of fundamentalists. $\alpha > 0 \rightarrow$ Stabilizing (rational price correction). $\alpha < 0 \rightarrow$ Destabilizing (irrational/excessive response). β (beta): measures the behavior of chartists. $\beta > 0 \rightarrow$ Momentum-based (trend-following/herding). $\beta < 0 \rightarrow$ Contrarian (trend-reversal). C_i is the fixed component of the return, not explained by the behavior of fundamentalists or chartists. [a], [b], and [c] denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10. Non-Transition Probabilities (p11 and p22) and Expected Durations (Markov Switching for Real Price).

Panel A	Calm period				Covid-19 period				Russia-Ukraine conflict period			
	p_{11}	p_{22}	d_1	d_2	p_{11}	p_{22}	d_1	d_2	p_{11}	p_{22}	d_1	d_2
Bahrain	0.907	0.824	10.75	5.68	0.144	0.895	1.168	9.523	0.338	0.908	1.510	10.869
Kuwait	0.925	0.670	13.3	3.03	0.351	0.629	1.540	2.695	0.113	0.713	1.127	3.484
Oman	0.818	0.201	5.494	1.251	0.836	0.846	6.097	6.493	0.205	0.360	1.257	1.562
Qatar	0.815	0.277	5.405	1.383	0.282	0.926	1.392	13.513	0.582	0.624	2.392	2.659
KSA	0.258	0.942	1.347	17.241	0.632	0.695	2.717	3.278	0.304	0.901	1.436	10.10
UAE	0.469	0.896	1.883	9.615	0.187	0.784	1.23	4.629	0.001	0.906	1.001	10.638

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