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# Assessing the Association between the Global Carbon Futures Index and the Stock Markets' Return and Volatility in Selected Arab Countries

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**Abstract**

Trading carbon allowances is an effective method for reducing carbon emissions and achieving net zero and carbon neutrality. Climate-change-related efforts have led many countries to develop carbon markets and carbon pricing systems in order to achieve their climate goals. Using the GARCH (1,1) model, this research paper examines the impact of the Global Carbon Futures Index (GCFI) on daily returns and volatility of selected Arab stock markets' namely: Bahrain, Saudi Arabia, UAE, and Qatar, over the period of "01/02/2017 to 30/10/2022". The results of the study show that GCFI has a positive and significant impact on the selected stock markets' return. In addition, it has an inverse and significant effect on the stock markets' volatility. These findings imply that trading carbon allowances would boost stock markets' returns, while lowering overall stock markets' volatility and risks. Using these findings, policymakers, regulators, and companies in Arab countries can reduce carbon emissions, mitigate climate change risks, and stabilize markets.

**Keywords**: carbon emission, climate risks, carbon trading, carbon futures, Arab stock markets.

## 1. Introduction

The impact of climate change on financial markets is being closely watched by financial institutions, central banks, and regulators. Currently, it is crucial to quantify and assess the extent to which these entities are exposed to climate change risks (Battistone et al., 2021). Risks related to climate change can be divided into two categories namely transition risks and physical risks. Transition risks are associated with investor behavior, technological developments, and emission-reduction policies (BFS, 2017). While physical risks from climate change can impact an economy in a variety of ways, including destroying physical assets, reducing agricultural productivity, causing heat-related illnesses and deaths, and destroying biodiversity. The goal of Emissions Trading Schemes (ETS) is to reduce emissions in the most economical and socially responsible manner possible by using market mechanisms (Bernardini et al., 2021). A framework for international trading in greenhouse gas emission reductions is established in Article 6.2 of the Paris Agreement. The trade of carbon allowances in carbon markets is an effective tool to achieve short- and medium-term climate goals. With their help, countries and businesses can transit more quickly to low-carbon energy and achieve net zero emissions. By letting people trade carbon credits, carbon markets encourage them to act on climate change. Carbon credits are earned when greenhouse gases are taken out of the atmosphere or reduced, such as when people switch from fossil fuels to renewable energy or when carbon stocks in ecosystems like forests are increased or maintained (World Bank, 2022).

In recent years, many nations have established emissions trading programs and a carbon trading market on a global scale. Corporations are granted permission to emit carbon dioxide under this market. Among the examples of Emission Trading Schemes (ETSs) is the European Union's Emission Trading Scheme, which includes 28 Member States and more than 11,500 plants in the sectors of electricity, refineries, coke, iron, cement, lime, glass, ceramics, and paper. Approximately 40 percent of the EU's greenhouse gas emissions are from sectors participating in the ETS (Venmans, 2015). A carbon trading initiative is currently underway in the Arab region, one announced by the United Arab Emirates in 2021[1], and another announced by the Egyptian stock exchange in 2022. They plan to open a carbon certificate trading market, as well as allow asset managers to launch new products based on this new stock market index. The Egyptian imitative, which was introduced during COP27 in Egypt, aims to "finance African climate projects to attain net zero" (Reuters)[2].

Prices for carbon certificates fluctuate significantly around the world. In particular, companies that require carbon provisions to cover carbon risks may experience a reduction in profits because of uncertain future allocation prices, which also impacts cash flows and stock prices (Gronwald et al., 2011, Chapple *et al*., 2013, Aswani *et al*, 2022, Oestreich & Tsiakas, 2015). In addition, it is common for carbon certificates to fluctuate substantially because carbon prices are linked to various sectors, including oil, electricity, and energy. Stock prices and carbon emissions trading have been examined in many research papers such as (Gronwald *et al*, 2011,

[1] www.adgm.com

[2] https://www.reuters.com/business/cop/egyptian-stock-exchange-launches-voluntary-carbon-market-tweet-2022-11-09/

Oberndorfer, 2009, Chava 2014, Venmans 2015, Oestreich and Tsiakas, 2015, Andersson, Bolton, and Samama 2016, Bernstein, Gustafson, and Lewis 2019, Giglio, Hong, Li, and Xu 2019, Krueger *et al*. 2020, Baldauf et al. 2020, Bakkensen and Barrage 2021, Maggiori 2021, Raghunandan & Rajgopal, 2022, Sun 2022, Aslan & Posch, 2022). Their studies found that carbon prices impact stock prices in two main ways, namely expected cash flows and uncertainty about expected returns. Carbon allowances prices have an impact on the future performance of the companies that own these credits. This is since their activities are sustainable, which results in higher returns, so owning these allowances reduces their losses and raises their expected returns.

While carbon trading is just recently started in a few of the Arab countries, or not yet available in such stock market in the Arab region, however the potential positive impact of such a trading system on the Arab stock markets could be attributed to various factors. These include global market dynamics, as companies listed in Arab stock exchanges may have business dealings with countries that have carbon trading systems and can be affected by carbon pricing indirectly. Investor interest in environmental, social, and governance performance, including carbon emissions, also plays a role, with companies demonstrating a commitment to sustainability attracting higher share prices. Regulatory pressure to reduce carbon emissions, even in the absence of domestic carbon trading, can provide a competitive advantage to companies holding carbon credits.

As stated above, carbon trading improves company performance and reduces risks. Thus, the purpose of this study is to examine whether global carbon future price indices correlate with selected Arab stock market indices. The rest of the paper is structured as follows: the second section examines the literature on the relationship between carbon emissions trade pricing and stock markets' prices, returns, and volatility. Section three describes the data and the econometric model that was employed. Section four discusses the study's findings. Section five concludes.

## 2. Literature review

Worldwide, carbon emissions trading has been examined in many studies for its impact on stock market prices, returns, and volatility. For example, by using the GARCH model, Oberndorfer (2009) analyzed the effects of the EU Emission Trading Scheme (EU ETS) on the stock market for electricity companies. In the study, the researcher found that EU Emission Allowance (EUA) price changes affect the stock returns of European electricity companies. In particular, the price of EUAs and stock returns have a positive correlation. In other words, stock markets behave similarly when EUAs appreciate in comparison to depreciating, so the effect is not asymmetrical. In addition, a variety of multivariate GARCH, GLS panel, and aggregated models are used by Venmans (2015) to determine the impact of EUA prices on the stock prices of companies that participate in the EU Emission Trading Scheme (EUETS). Prices of allowances have a firm-specific effect on stock prices. In most cases, EUA prices have a positive correlation with the stock prices of regulated companies in all sectors.

In an empirical study by Oestreich and Tsiakas (2015), the Emission Trading Scheme's impact on German stock returns is examined. Based on the findings of the study, firms receiving free carbon emission allowances performed better than those receiving no allowances. Thus, the free availability of carbon emission allowances appears to result in a large and statistically significant "carbon premium." As well, there is some evidence that carbon risk contributes to cross-sectional variations in stock returns with high carbon emission firms more exposed to carbon risk and expected to earn higher profits. Moreover, the nonlinear auto-regression distributed lag (NARDL) model was used by Wen et al. (2020) to examine the asymmetric relationship between carbon emissions trading and stock market prices in China. Based on an analysis of both the overall and sector levels of the Chinese stock market, the study found asymmetric relationships between the carbon emission trading market and the entire market in both the long-run and the short-run. In particular, rising carbon emission trading prices have a greater impact on stock prices than declining carbon emission trading prices. Moreover, at the sector level, carbon emission trading prices have a significant relationship with certain energy-intensive sectors and financial sector indices. In addition, the study found that neither the overall level nor the sector level of the Chinese stock market has a significant effect on carbon emission trading price.

Based on a nonlinear symbolic dynamic perspective, Sun (2022) examines the relationships between China's carbon prices "Guangdong carbon allowance prices" and four energy-intensive stock indexes, including the petrochemical index, the power index, the steel index, and the coal index. The study found that there was weak bidirectional causality between the markets, since 1 percent fluctuations in one market caused 0.15 to 0.3 percent fluctuations in the other. Further, the study evaluated the effects of policies on causality between markets at several stages during the entire timescale. Since China's carbon trading system was announced, stocks have become a dominant market for their causality. As of April 2018, carbon markets had started influencing stock markets in the opposite direction of what they had done before December 2017. Covid-19 has further weakened the role of carbon finance. Furthermore, the causality type reveals the delayed effects of the carbon market on the power industry's stock market. Also, Aslan & Posch (2022) investigate how the volatility of EUA prices influences European stock markets. The study performed a connectedness network analysis using EUA futures prices and FTSE sector indices to examine whether and how volatility in EUA futures spreads across different European markets. In the study, it was found that the EUA receives significant volatility across most sectors and is a net recipient of volatility connectedness.

A study by Xu et al. (2022) investigated the relationship between carbon emissions and Chinese stock market indexes. Nonlinear correlations depend on the method of allowance allocation applied. Study results show that carbon allowance prices and stock returns for carbon-intensive industries are positively correlated in Shenzhen and Shanghai. On the other hand, cross-correlations in Beijing, Guangdong, and Hubei were negative. In a similar study, Tian et al (2016) examined how the EUA market affects the stock returns of EU-ETS participants. The study found that carbon-intensive companies have negative stock returns affected by EUA returns, while producers with low carbon emissions have positive returns. In addition, the study found that the volatility of EUA markets and a company's stock returns are directly related.

Although a wide range of research has already examined the relationship between carbon emissions trading and stock market returns and volatility globally, yet this research field still lacks research in the Arab region. To fill the gap, this study investigates the association between the Global Carbon Future Index (GCFI) and stock market indices of selected Arab countries, including the UAE (Abu Dhabi), Bahrain, Qatar, and Saudi Arabia.

## 3. Data and methodology

### *3.1. Data*

This study investigates the relationship between selected Arab stock market indices such as Abu Dhabi, Bahrain, Qatar, and Saudi Arabia as well as the Global Carbon Future Index (GCFI). The original data for all variables under study were obtained from the Refinitiv Eikon database, which contains daily frequency data over the period of " 01/02/2017 to 30/10/2022". This study focus on the general stock markets indices in selected countries, this is due to the fact that studying the relationship between the trading of carbon certificates and stock prices at the sector level in Arab countries may be limiting in several ways. Focusing on sectors may not fully capture the broader impacts of carbon trading on the overall economy and may be more complex to analyse. Studying the relationship at the level of the general index of the stock market can provide a more comprehensive view of the overall impacts on the economy and inform policy decisions that benefit the economy as a whole.

### 3.2. Measurement of study variables

#### 3.2.1. Stock return

We calculated the daily stock return ($r_t$) by taking the logarithm of the first difference ($p_t - p_{t-1}$) in the closing prices of the stock indices by country every day. This is shown mathematically as follows:

$$r_t = \log\left(\frac{p_t}{p_{t-1}}\right)$$

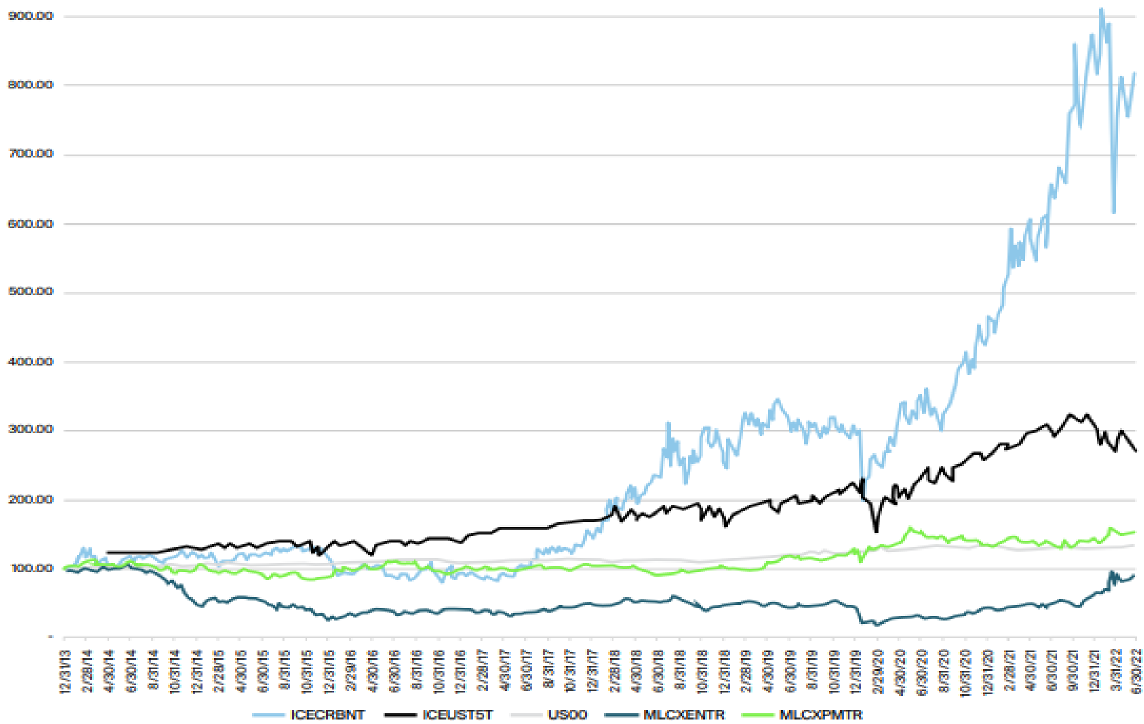
Where $r_t$ is the return (volatility) at time *t*, and $P_t$ is the daily closing prices at time *t, while* $p_{t-1}$ is the closing prices at previous day.

#### 3.2.2. ICE Global Carbon Futures Index

The Intercontinental Exchange (ICE) Global Carbon Futures Index (GCFI) measures the performance of a basket consist by EUA Futures Contracts, UK Allowance Futures Contracts, California Carbon Allowance Futures Contracts, and Regional Greenhouse Gas Initiative Futures Contracts. Each EUA Contract is valued in euros and consists of one thousand Carbon

Emission Allowances (one metric ton of carbon dioxide equivalent emissions). Each UKA Contract is valued in pounds sterling and represents a quantity of one thousand Carbon Emission Allowances. Each UKA permits the holder to emit one metric ton of carbon dioxide equivalent gas. Each CCA Contract is denominated in dollars and represents a lot of 1000 California Carbon Allowances. Each CCA entitles the holder to emit one metric ton of $CO_2$ equivalent gas. Each Regional Greenhouse Gas Initiative contract is denominated in dollars and represents 1,000 Regional Greenhouse Gas Initiative (RGGI) permits, which are physically deliverable greenhouse gas emissions allowances provided by each state under the RGGI program. Each RGGI represents the right to release one metric ton of carbon dioxide (ICE, 2021).

Figure (1): The evolution of the ICE GCFI, US stocks, US bonds, energy futures, and precious metals futures.




**ICECRBNT**:ICE Global Carbon Futures Index, **ICEUST5T**: ICE U.S. 500 Index , **US00**: ICE BofA U.S. Broad Market Index , **MLCXENTR:** ICE BofA Commodity index eXtra (ENergy) , **MLCXPMTR**: ICE BofA Commodity index eXtra (Precious Metals).

Source: (ICE, 2022, p2).

### *3.3. Methodology*

Many studies employed the generalized autoregressive conditional heteroskedasticity (GARCH) models to analyse the proposed relationship between the carbon credit and stock precies (Oberndorfer. 2009, Aslan & Posch. 2022). In 1986, Engle and Bollerslev proposed that the GARCH model can detect the non-constant volatility, and the impact of variable on the volatility of another variable .

The ARCH(p) process is written as follows:

$$\varepsilon_t = \eta_t \times h_t^{1/2}$$

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_t \varepsilon_{t-1}^2 \qquad (01)$$

$$\eta_t \to N(0,1)$$

Where,

$\varepsilon_t$: the standard error,
$\alpha_i$: Model parameters.
$\eta_t$: normal distribution noise (IID),
$h_t$: Conditional variance characterized by heteroskedasticity,
The main innovation of ARCH-type models is that they not only consider the value of the variable at N-p periods, but also the change in the value of the variance at N-p periods, thereby vastly improving the volatility forecast.

The GARCH model proposed by Bollerslev in 1986, follows the same premise as the ARCH model, but add a second element, the moving average of order q, to the equation. The GARCH (p,q) models are formulated generally as follows:

$$\varepsilon_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha \varepsilon_{t-i}^2$$

$$\sigma_t^2 = \omega + \sum_{i=1}^{p} \alpha \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta \sigma_{t-j}^2 \quad (02)$$

Where $\alpha, \beta, \gamma$is Positive real numbers, and as a special case we write GARCH (1,1) as follows:

$$\varepsilon_t^2 = \alpha_0 + \varepsilon_{t-1}^2$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (03)$$

In our study we test the impact of carbon future prices on the stock return and volatility, we included the GCFI in mean and variance equations as follows:

$$R_t = \alpha_0 + \gamma GCFI_t$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \tau GCFI_t \quad (04)$$

Where,

GCFI: ICE Global Carbon Futures Index.

## 4. Findings and Analysis

In this section, the findings analysis includes descriptive analysis, unit root tests, volatility clustering analyses, ARCH-LM test, and the GARCH (1,1) model to examine the impact of the GCFI on the return and volatility of selected Arab stock markets.

### 4.1. Descriptive statistics

In Table (1), the logarithmic returns for the Global Carbon Futures Index (GCFI) and stock markets' indexes of selected countries are provided, including the UAE (Abu Dhabi), Bahrain, Qatar, and Saudi Arabia. The data set selected for analysis shows a wide range of returns, standard deviations, and levels of normality. A positive average return was experienced by all stock market indexes over the period of the study. Also, the GCFI experienced positive returns of 0.002519 over the study period. Additionally, the Skewness test indicates that the series of variables under study are not normally distributed, except for the GCFI with a value of -0.569867, which is less than the cut-off score of [-1 , +1] that shows normal distribution. Additionally, the Kurtosis and Jarque-Bera tests show that the time series of variables under study are not normally distributed, since all Kurtosis values are greater than the rule of thumb of "more than 3," and Jarque-Bera is l significant levels at 1 percent .

Table (1): Descriptive statistics for the index under study

| | ABD | BAH | GCFI | QAT | SAU |
|---|---|---|---|---|---|
| Mean | 0.000778 | 0.000344 | 0.002519 | 0.000138 | 0.000474 |
| Median | 0.000465 | 0.000366 | 0.003097 | 0.000437 | 0.000977 |
| Maximum | 0.080762 | 0.042664 | 0.166163 | 0.060819 | 0.068315 |
| Minimum | -0.17711 | -0.0947 | -0.23957 | -0.13175 | -0.16755 |
| Std. Dev. | 0.013433 | 0.007003 | 0.033205 | 0.011621 | 0.013002 |
| Skewness | -2.7543 | -3.03368 | -0.56987 | -1.59641 | -2.70435 |
| Kurtosis | 47.66881 | 43.96098 | 9.189685 | 22.25002 | 34.95332 |
| Jarque-Bera | 89128.49*** | 75443.05*** | 1742.893*** | 16753.32*** | 46211.83*** |
| Obs | 1056 | 1056 | 1056 | 1056 | 1056 |

Note: ***, denote significant levels at 1 significance.

## 4.2. Unit Root and ARCH Test Results

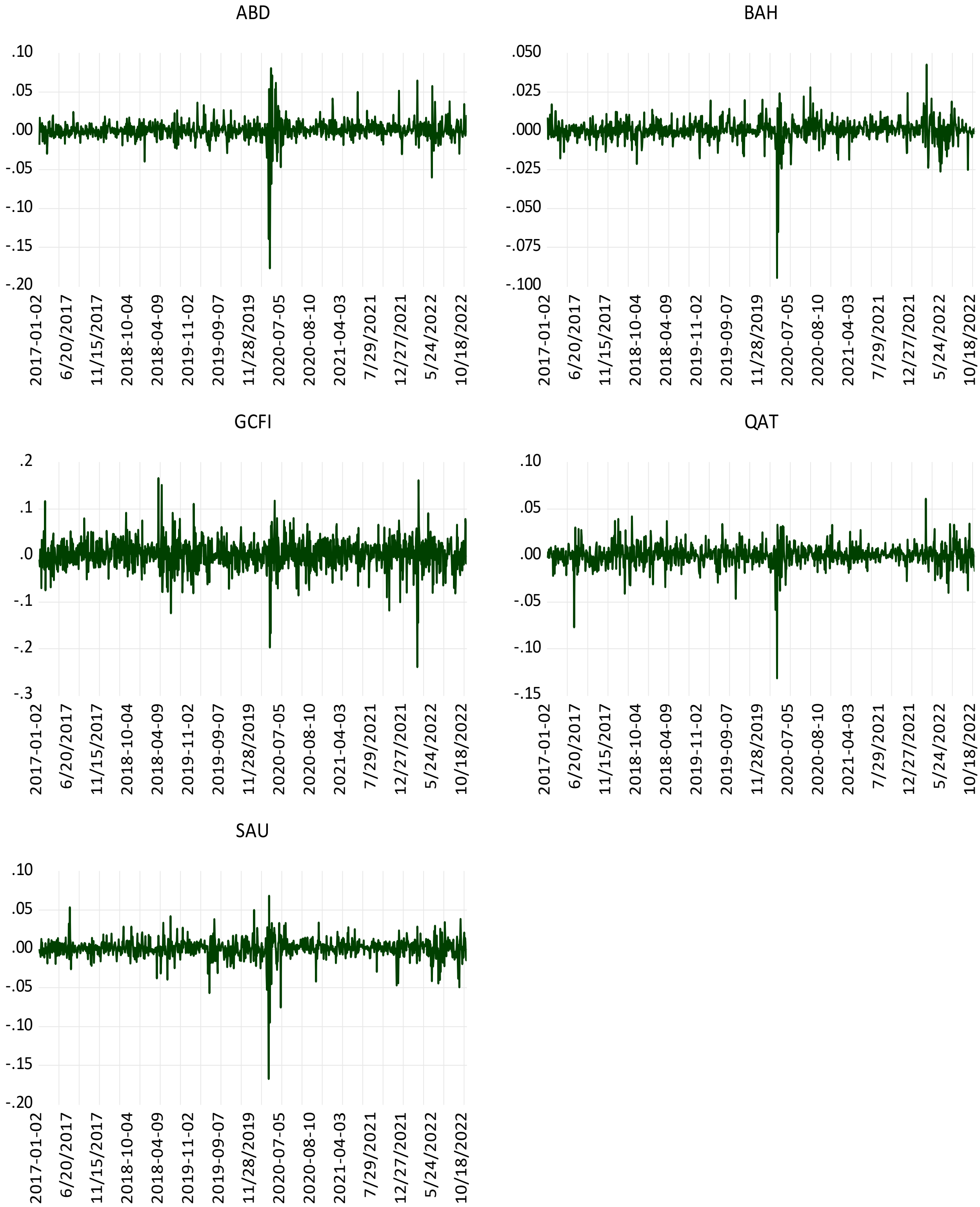
The results of the unit root test and ARCH-LM test are displayed in Table (2). Based on the ADF and PP tests in table (2), stationary conditions are confirmed for the log first difference of GCFI and selected stock market indices, since their P-values are statistically significant at the 1 percent level. Moreover, Figure (1) shows GCFI and corresponding stock market indices' Volatility Clustering Analysis. Over the study period, the GCFI and selected stock market indices displayed a pattern of volatility clustering. During this pattern, high volatility periods are followed by prolonged periods of high volatility. Contrary to this, low volatility intervals follow low volatility intervals. This means that the GCFI and selected stock market indices do not have constant returns over time, but instead vary over time. Based on the residuals of the return series, the ARCH-LM test was performed to check the existence of volatility clustering in GCFI and stock market returns. Based on the ARCH-LM test results shown in table (2), each residual model exhibits the ARCH effect. In light of the high statistical significance of the ARCH-LM test, we reject the null hypothesis that ARCH does not exist at 1 percent significance level. Following the confirmation of the ARCH effect in the preliminary tests, the study applied the GARCH model to estimate how GCFI affects capital market returns and volatility.

Table (2): Unit Root and ARCH Test Findings

| Variables | ADF-test | PP-test | ARCH -LM test |
|---|---|---|---|
| ABD | -11.64940 *** | -32.11477 *** | Prob. F (1,1053) = [0.0000] |
| BAH | -14.97701 *** | -29.37757 *** | Prob. F (3,1049) = [0. 0000] |
| GCFI | -33.50841*** | - 33.5859*** | Prob. F (1,1053) = [0.0000] |
| QAT | -30.98798 *** | -31.04704 *** | Prob. F (3,1047) = [0. 0000] |
| SAU | -14.49842 *** | -32.89167 *** | Prob. F (1,1053) = [0.0000] |

Note: ***, ** and * denote significant levels at 1, 5 and 10 significances, respectively.

Figure (2): Volatility Clustering Analysis Results for GCFI and the selected stock market indices



### 4.3. GARCH Model analysis

In the GARCH (1,1) models' analysis, both the mean equation and variance equation result are interpreted to understand the impact of the GCFI on selected stock markets' returns and volatility structure.

#### 4.3.1. Mean Equation Results

Table (3) shows that GCFI has significant impact on the stock market return for all selected countries at significant level of 1 percent. Carbon certificates trading can have a positive effect on stock market returns for several reasons. First, it can improve corporate social responsibility and attract socially responsible investors. Second, it creates opportunities for new revenue streams through selling unused carbon credits or investing in renewable energy projects. Third, it reduces regulatory risk by ensuring compliance with carbon emissions regulations. Fourth, it stimulates innovation by incentivizing companies to adopt innovative technologies and processes that can reduce carbon emissions. Finally, it can increase demand for low-carbon products and services, creating new market opportunities and leading to higher revenue and stock market returns. This is an indication that raising the carbon emission trading price has a potential positive impact on the stock return. This perhaps because the implementation of carbon trading programs in Arab countries could potentially create new economic opportunities, such as the development of renewable energy projects and the growth of carbon offset markets. These opportunities could, in turn, stimulate economic growth and provide benefits to Arab stock markets. Moreover, by reducing greenhouse gas emissions, carbon trading can help countries to meet their climate change goals and reduce the risks associated with climate change. This, in turn, can increase investor confidence and create a more stable investment environment for Arab stock markets.

Furthermore, the trading price of carbon emissions is strongly tied to the stock market return of selected countries. There are several channels through which carbon trading can impact stock prices, including expected cash flows and future returns. The price of carbon affects the future cash flows of companies that own carbon allowances, because these companies' possession of these provisions will reduce their losses and increase their expected profits, since they have sustainable activities, which result in a higher return on investment.

#### 4.3.2. Variance Equation Results

Based on the GARCH (1,1) model for symmetric effects, Table (3) shows the results of variance equation analysis. Specifically, table (3) indicates statistical significance at 1 percent and 5 percent for the coefficient's parameters of the GARCH (1,1) model for selected stock markets' returns. According to the results, stock market returns are persistently volatile in all selected countries. Based on Table (3), the estimated coefficients of the ($\beta$) parameters in Abu Dhabi, Bahrain, Qatar, and Saudi Arabia are larger than those of the ($\alpha$) parameters. Thus, the volatility of these stock markets has a long memory, and it is insensitive to new shocks in market values rather than to the prior values (lags). Additionally, in most countries, the sum of these two coefficients (α + β) was near 1. The values near unity indicate that stock markets' returns in these countries will remain volatile for quite some time.

Additionally, according to the results of the GARCH model in Table (3), the study finds that carbon emission trading has a negative significant impact on return volatility in the selected countries. Accordingly, increasing carbon emissions trading can decrease stock market risk and facilitate price stabilization.

### 4.4. Diagnostic Test Results

Our final step was to identify any ARCH effects in the residual of the Dynamic Conditional Correlation model by using diagnostic ARCH-LM tests. According to Table (3), at a significance level of 5 percent, the null hypothesis "there is no ARCH effect" has been accepted, all residuals contributed to the Dynamic Conditional Correlation Model are unaffected by ARCH effects. In the estimated GARCH (1,1) model, this means that the conditional variance equation for volatility specification has been successfully identified and estimated.

Table (3): The Impact of the GCFI on the Stock Markets' Return for Selected Countries

| | | *ABD* | *BAH* | *QAT* | *SAU* |
|---|---|---|---|---|---|
| Mean Equation | *constant* | 0.000484** | 7.35E-06 | 0.000482** | 0.000834*** |
| | *t-Statistic* | 2.352192 | 0.098091 | 2.246038 | 3.781171 |
| | *GCFI* | **0.024464****** | **0.013726****** | **0.02125****** | **0.024154****** |
| | *z-Statistic* | 3.644457 | 5.84801 | 3.101247 | 3.45749 |
| *Variance Equation* | *constant* | 1.38E-05*** | 3.90E-05* | 5.02E-06*** | 9.61E-06*** |
| | *z-Statistic* | 3.81299 | 1.690318 | 2.790467 | 3.497098 |
| | ARCH (α) | 0.145084*** | 0.041872 | 0.073767*** | 0.105204*** |
| | *z-Statistic* | 3.929268 | 0.744594 | 3.470218 | 3.997925 |
| | GARCH (β) | 0.732104*** | 0.576853** | 0.892007*** | 0.828221*** |
| | *z-Statistic* | 13.05614 | 2.341486 | 29.04694 | 21.79557 |
| | *GCFI* | **-0.00014*** | **-0.00052***** | **-0.00024***** | **-0.000284**** |
| | *z-Statistic* | -1.92014 | -4.82953 | -3.28207 | -2.419562 |
| *Sum squared resid* | | 0.187875 | 0.05151 | 0.142244 | 0.176422 |
| *Log likelihood* | | 3455.727 | 3964.686 | 3402.414 | 3371.256 |
| *Akaike info criterion* | | -6.53168 | -7.49562 | -6.43071 | -6.371698 |
| *Schwarz criterion* | | -6.49879 | -7.46272 | -6.39781 | -6.338804 |
| ARCH effect test F(1,1053) | Prob. | 0.877188 | 0.7056 | 0.6579 | 0.7893 |

*Note: *** , ** and * denote significant levels at 1 , 5 and 10 significance, respectively.*

## 5. Conclusion And Recommendation

Although climate change and carbon emissions management are challenging tasks, Arab countries have been and continue to make significant advances in the circular carbon economy, using capture technology and relying on the 4R strategy (reduce, reuse, recycle, and remove) in order to manage carbon emissions. In this context, several Arab countries have announced plans to trade carbon certificates. Given the critical importance of carbon trading in reducing carbon emissions and climate risks, the objective of the study was to investigate the relationship between the GCFI index and stock markets' returns and volatility in selected Arab countries. This study analyzes daily frequency data from Bahrain, Saudi Arabia, UAE, and Qatar between 2017 and 2022 using the GARCH (1,1) model. The findings of the study demonstrate that there is a significant positive relationship between carbon emissions as measured by GCFI and stock markets' returns. Although Arab countries lack a domestic carbon trading system yet, the global nature of financial markets, investor preferences, and regulatory pressure can all positively impact stock markets return. Conversely, the findings indicate that there is an inverse relationship between the GCFI and the volatility of stock returns on the Arab stock market. The results can be related to the fact that carbon trading reduces stock markets' risk and increases the expected return in the Arab world. These findings would encourage the Arab countries to establish and develop carbon trading markets as a mechanism for reducing carbon emissions and achieving carbon neutrality, thereby reducing climate change risks. In addition, To create a positive impact of carbon certificates trading on stock market returns in the Arab region, policy suggestions include developing a regional carbon market, encouraging the adoption of carbon certificates trading by offering incentives, promoting transparency and accuracy in carbon accounting, investing in renewable energy and emissions reduction projects, and collaborating with international partners to develop a more robust and effective carbon market in the region.

A future extension of this research could compare carbon trading index and stock returns with other international stock markets as well as volatility. This would enable diversification of investing methods across different countries. In addition, expanding the analysis of the study to focus on the sectors levels particularly the energy sector and the impact of carbon certificates trading on stock market prices of these companies could provide valuable insights into the relationship between carbon certificate trading and the financial performance and pricing of companies. One possible approach to this analysis could involve identifying a sample of energy companies that operate in Arab countries with carbon certificates trading's policies, and then examining their influence on stock market performance and prices over a defined period. The study could also explore the extent to which these companies have invested in low-carbon technologies and whether this has had an impact on their financial performance and pricing.

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