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# THE IMPACT OF EXCHANGE RATE VOLATILITY ON STOCK PRICES: A CASE STUDY OF MIDDLE EAST COUNTRIES

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## ABSTRACT

The exchange rate is not only a determinant of economic activity but also a factor affecting the performance of stock market. In other words, the exchange rate volatility makes an impact on the stock market of any economy. This study has attempted to determine the relationship between exchange rate and stock prices of Middle East countries, using the GARCH model for the period Jan-2004 to Apr-2018, to make an econometric analysis. In this context, various time series analysis and Granger causality test were applied. Results of analyses show a strong evidence of causation running from exchange rate to stock prices; implying several variations such as Dubai stock prices experienced exchange rate volatility while the Saudi stock market witnessed a unidirectional relationship running from stock prices to exchange rate implying that variations the Saudi exchange rate determines the stock prices volatility. Finally, in the Egyptian stock market, no relationship between the exchange rate and stock prices was witnessed which means that changes in Egyptian stock prices cannot be explained by the volatility in the exchange rate.

**Contribution/ Originality:** This study contributes to the existing literature by enriching the evidence on the domestic value creation in the involvement in global value chains in Middle East countries economy, through using the using the GARCH model for the period Jan-2004 until Apr-2018.

## 1. INTRODUCTION

Financial markets play an important role in the economy of both developed and developing countries. These markets mobilize savings and channel them towards investments to support the national economy. Consequently, these countries have witnessed a steady growth in international trade over the last few decades and resulted in intertwining economic and trade relations between them. In spite of regional and international blocs, economic openness has lifted barriers allowing free movement of foreign goods and services. The liberalization of the financial services industry in the context of financial globalization has also led to increased cross-border capital flows. Owing to these changes at the global level, exchange rate volatility has become one of the important subjects for academics, investors and decision-makers (Amano and Van, 1998; Taylor, 2001). Moreover, exchange rate is also important for any economy due to its direct relationship with exports and imports and the movement of capital, i.e. owing to the relationship between external trade and financial transactions of any country with the outside world (see Aimer, 2016; 2017). It is therefore now believed that if the exchange rate of any national currency increases (or

decreases) compared to foreign currencies, it is directly reflected in the cost of imported and exported goods and services and their the price level, which potentially affects the competitiveness of the economy as a whole (see Goldberg and Knetter, 1996). The exchange market has become one of the largest markets in the world for currency trading and due to the large number of goods and services moving around the world throughout the year. A large number of currencies of different nations are at stake, whose conversion of into a specific currency or a limited group of major currencies defines the real purpose of acquisition. Exchange markets also play the role of monitoring this currency conversion and of intervening whenever necessary (see Pilbeam, 2001). For instance, there are countries that are represented by their central banks that constantly intervene in the exchange markets by selling or buying significant amounts of their own currency or use their foreign exchange reserves to maintain their value against other currencies and to reduce their volatility.

The period of the study is characterized by large fluctuations in the economic and monetary variables at the global level due to several instances. For instance, there was a subprime crisis (Dilek and Çolakoğlu, 2011) earthquake and tsunami, in addition to the sovereign debt crisis suffered by a group of EU countries; economic growth fell below 2.3% in 2008 compared to 2.5 per cent in 2007, not to mention record rise in inflation as well as unemployment rates, affecting the volume of world trade (see Ulusoy 2011). When countries are concerned about exchange rates in order to restore equilibrium of the balance of payments, its supports the competitiveness of their economy, it develops foreign trade and other objectives. Companies involved particularly in exports and importing of goods and services, of even basic necessities, in such as state of crisis, are also concerned with the development and impact of exchange rates, i.e., they are always exposed to exchange rate risks. Moreover, individuals such as investors, travellers for tourism businessmen are also affected by currency fluctuations. Tourists often wonder whether or not to travel and prefer to spend a holiday in their own country and are discouraged to travel because of the devaluation of foreign currencies during the travel season. Hence exchange rate has affected many indicators, institutions and economic bodies, including financial markets at both macro and micro levels.

Researchers have tried to understand the relationship between exchange rates and stock prices for a long time. There have been many experimental and theoretical studies to determine the direction of the causal relationship between these two financial variables. However, the direction of causation has remained unresolved in both theory and practice. While a few experimental studies have found some relationships and causality, but other studies show no causal relationship between these two variables. Moreover, the direction of causality is also witnessed shifting from one economy to another. Zubair (2013), for instance, attempted to study the causal relationship between the financial and monetary policy indicators (exchange rate and M2) in Nigeria during the global crisis. The study found that there was a lack of clarity in the relationship between these variables, particularly between the financial market index and the exchange rate. In another study, Kennedy and Nourzad (2016) dealt with the volatility of the US dollar against the Euro in the US financial market, focusing on the return of shares traded there. The study found that high exchange rate volatility was positively correlated with the fluctuation of those returns, implying that exchange rates affect the financial market. The results of Kocaarslan *et al.* (2017) study have also shown similar effects of volatility expectations in the U.S. equity markets where correlations are asymmetric based on the correlation level. The market interdependence is also driven by risk perceptions in both financial and non-financial markets. Such findings have important implications for identifying international investment strategies.

Aydemir and Demirhan (2009) dealt with the relationship between share prices and exchange rates in the Turkish economy using data covering the period from 23 February 2001 to 11 January 2008. The reason of selecting this period was the floating exchange rate regime during this period. Indicators of 100 services, financing, industrial and national technology indicators were collected as a determinant of stock prices. This study concluded that there was a two-way link between stock prices and exchange rates due to the negative correlation between 100 sampled companies. While there was a positive causal relationship between technology indicators and exchange rates, there was also a negative reason for linking exchange rates to stock market indices.

In summary, these studies are theoretical explanation and evidence of the fact that exchange rate affects the performance of stock market and is an important determinant of economic activity, and that any exchange rate volatility will impact the stock market. However, results of experimental studies have found mixed results without a decisive conclusion on the issue of causation. A big factor also suggested in these studies is that the price of the currency in industrialized countries is subject to price fluctuations in financial markets. If currency price in a particular industrial country increases, the sale of exporting companies will decrease leading to a decline in their stock prices, and vice versa.

Similarly, the impact of exchange rates on stock markets also varies from one country to another. It is because of the difference in the evolution of exchange rate regimes and the degree of economic and financial development between two countries, or between two sectors, or two companies within the same sector and within the same country. Hence, there is no absolute rule to measure the positive or negative relationship between exchange rate and stock market. In addition, studies focused on Middle East countries; do not take into account large samples, which could better explain the effect of exchange rate volatility on stock market returns. In the current study, therefore, a large-sized sample of 14 years was taken into account in order to better reflect the stock market index determinants. Those determinants incorporated in the pilot test, were not used in this study.

The main objective of this study is to measure the relationship between changes in exchange rates and fluctuations in stock market returns in three Middle East countries (Saudi, Egypt and Dubai). The GARCH model is appropriate when the financial data series of face serial link problems in using other normal methods specifically to estimate the leftover. The study relied on monthly data for indicators of stock prices and exchange rates for the period from January 2004 to April 2018. The study has attempted to answer the following question in order to achieve the objectives of the study:

What is the effect of exchange rate fluctuations on stock prices? The remainder of this paper is presented as follows: Section 2 provides details about the adopted methodology; it illustrates empirical models used for this study. Section 3 discusses the empirical results. Finally, Section 4 summarizes the main conclusions of this paper.

## 2. METHODOLOGICAL ISSUES

### 2.1. Generalized Autoregressive Conditional Heteroskedasticity GARCH

This study focuses on a few characteristics of economic or financial chains, where the volatility or variation changes over time. To address this problem in terms of financial econometrics, relatively recent models of homogeneity of the Generalized Autoregressive Conditional Heteroskedasticity.

Autoregressive Conditional Heteroskedasticity (ARCH) models are used as a mechanism for predicting oscillations for variance modeling, to match with modern investors' preference to study and forecast not only financial asset returns, but also look at risk and uncertainty due to uncertain reasons. Hence, special models should be used to deal with volatility of financial asset values as a function of time.

In fact, the role of "uncertainty" in determining the dynamics of behavior of various modern economic variables, particularly in financial matters, has given importance to standard economic theories, starting with the use of conditional variable rather than non-conditional average in ARMA models. In improving the predictions resulting from these hybrid models, and to differentiate between these two concepts, we consider the process as in Equation 1:

$$AR\ (1){:}Y_t = \emptyset Y_{t-1} + \varepsilon_t. \tag{1}$$

Where $\varepsilon_t$ is the average (expected) conditional obtained from the following relationship Equation 2:

$$E(Y_t|Y_{t-1}, Y_{t-2}, \ldots.) = \emptyset Y_{t-1}. \tag{2}$$

This idea was evolved in Engle (1982) who explained the importance of using the concept of conditional variation instead of non-conditional variation in predictive values, because while the latter is constant with time change, the former can translate the relationship between current observation $Y_t$ and previous observations $Y_{t-1}$, In the previous example, the conditional variation of the process AR(1) is shown in Equation 3:

$$Var(Y_t|Y_{t-1}, Y_{t-2}, \dots \dots) = E\left([Y_t - E(Y_t|Y_{t-1}, Y_{t-2}, \dots.)]^2|Y_{t-1}, Y_{t-2}\right) \qquad (3)$$

The unconditional variation is shown in Equation 4:

$$Var(Y_t) = \alpha^2{}_t|(1 - \phi^2{}_t). \qquad (4)$$

All these principles were used to simplify the drafting of previous ARCH models. Engle (1982) recommended it to bridge the shortfall experienced by previous ARMA models, especially in time series characterized by rapid volatility.

### 2.2. Heteroscedastici Problem

Most classical models are based on the principle that an average error is non-existent and its variation is constant with the change of time and that it is independent of each other:

$$E(\varepsilon_t) = 0, \qquad \forall t = 1 \dots \dots, T$$

$$Var(\varepsilon_t) = E(\varepsilon^2{}_1) = \alpha^2 \quad , \quad \forall t = 1 \dots \dots, T$$

$$Cov(\varepsilon_t, \varepsilon_{t'}) = E(\varepsilon_t, \varepsilon_{t'}) = 0 \quad , \quad \forall t \neq t', t, t' = 1 \dots \dots, T$$

The projection of these hypotheses in the estimation of variance and variation matrix is however difficult, because errors have heterogeneity and correlation feature, which reduces the efficiency of estimated models. In this context, many proposed actions and suggested solutions to new variance matrix have led to a number of questions, including: How can we build a mathematical model that allows us to study the proposed format? How do we estimate the parameters of this model? How do we discover a particular shape?

### 2.3. Formulation of ARCH (p) Model and its Characteristics

The process is known as ARCH as white noise subject to normal distribution $\eta_t$ multiplied for each period with a random variable $h_t^{1/2}$ which is linearly linked to past values of the process as shown in Equation 5 and 6.

$$\varepsilon_t = \eta_t \times h_t^{1/2}. \qquad (5)$$

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_t \varepsilon_{t-1}^2. \qquad (6)$$

$\eta_t \longrightarrow N(0,1)$, can be expressed as $\varepsilon_t$ from where $I_t$ is the amount of information available in the period t and conditional distribution of $\varepsilon_t$ with contrast $h_t$ as shown in Equation 7 and 8:

$$E(\varepsilon_t | I_{T-1}) = 0. \tag{7}$$

$$Var(\varepsilon_t | I_{T-1}) = h_t . \tag{8}$$

In addition, it can be drafted as $\varepsilon_t^2$ in the form of a process AR (p) as shown in Equations 9, 10 and 11:

$$v_t = \varepsilon_t^2 - h_t. \tag{9}$$

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_t \varepsilon_{t-1}^2. \tag{10}$$

$$\varepsilon_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_t \varepsilon_{t-1}^2 + v_t. \tag{11}$$

Where $v_t$ is the average and a common variation absent for each non-constant variation.

The regression model can be obtained ARCH by assuming average $\varepsilon_t$; as shown in Equation 12:

$$\varepsilon_t | I_{t-1} | \longrightarrow N(x_t, \beta, h_t) = \alpha_0 + \sum_{i=1}^{p} \alpha_t \varepsilon_{t-1}^2 + v_t. \tag{12}$$

$$h_t = h(\eta_{t-1}, \eta_{t-2}, \ldots, \eta_{t-p}, \alpha)$$

$$\eta_t = \varepsilon_t - x_t \beta$$

This expression has important properties in standard applications, as uncertainty about prediction varies with time periods, in both forecast horizon and random errors, where usually high errors are followed by weak errors. The mathematical formula of ARCH, where variation is related to time and past errors, allows for consideration of this phenomenon. If all the coefficients are positive and relatively large, there is a so-called continuity in the shock on the level of volatility. Thus we see strong volatility periods followed by periods of weak fluctuations; fluctuations are concentrated at certain periods where there is considerable variation. These periods are known to financial analysts as "wild" and resemble the image of a bull's horn, and if followed by less volatile periods, or periods of stagnation or hibernation (calm), they take the image of a bear. Therefore, we conclude that large changes in stock returns are followed by other changes against them, which is known in the financial markets as accumulation of volatility. This type of model allows dynamic (or dynamic) modeling of volatilities and reconciles potential mobility with structural representation of studied phenomenon and helps analyze the volatility of financial assets. For conditional variation to be positive and limited (less than ∞), the following conditions should be met:

$$\alpha_0 > 0, \alpha_1 \geqslant 0, \ldots \ldots, \alpha_p \geqslant 0$$

$$\sum_{i=1}^{p} \alpha_1 < 1$$

From Equation 13, the Kurtosis index is defined as the ratio of concentrated torque of class 4 on the center torque square of class 2, in the case of ARCH (1):

$$K = \frac{E(\varepsilon_t^4)}{[E(\varepsilon_t^4)]} = \frac{3(1-\alpha_1^2)}{(1-3\alpha_1^2)} \tag{13}$$

The estimate of K is much more than 2. This is what we observe in the financial chronological series as it contains a flat distribution form which is thicker than normal distribution. This is the case of the ARCH process, which has Leptokurtic distribution.

According to these models, the return on any financial asset shall be the place of contracting in the continuous time as in Equation 14:

$$R_t = \ln\left(\frac{S_t}{S_{t-1}}\right) \tag{14}$$

Where:

$R_t$: is the yield in period t, which is a random variable; Ln is Nubian logarithm based on ... (2.71); $S_t$ is the price of the original (contracted place) in period t.

According to the ARCH model the return $R_t$ is a random variable (dependent), as shown in Equation 15:

$$R_t = \sqrt{h_t} v_t \tag{15}$$

$$v_t \overset{iid}{\rightarrow} N(0,1)$$

In this case, the GARCH model changes as shown in Equation 16:

$$h_t = \alpha + \sum_{j=1}^{p} \beta_j h_{t-j} + \sum_{k=1}^{q} \gamma_k R_{t-k}^2 \tag{16}$$

Where α, β, $\gamma$ are Positive real numbers
The GARCH (1, 1) model can be taken as a special case as shown in Equation 17:

$$h_t = \alpha + \beta h_{t-1} + \gamma R_{t-1}^2 \tag{17}$$

Where the constant $\alpha$ represents the long-term variance value, if $\alpha + \beta < 1$ the series $R_t$ is stable

### 2.4. Autoregressive Models with Generalized Asymmetric Conditional Variation

This model was presented by Nelson (1991) where the researcher concluded that the conditional variance function is nonlinear but rather exponential. This is contrary to what (Bollerslev, 1990) sees in the GARCH model where the exponential asymmetric (or asymmetric) conditional variation model is written as shown in Equation 18:

$$\log(h_t) = \omega + \beta_j \sum_{j=1}^{p} \log(h_{t-j}) + \propto_k \sum_{k=1}^{q} \frac{|R_{t-k}|}{\sigma_{t-i}} + \gamma_k \sum_{k=1}^{q} \frac{R_{t-k}}{\sigma_{t-i}} \qquad (18)$$

$\gamma_k$ : Measures the parameters effect of the leverage in case it exists which is negative and statistically significant. In the case of the opposite situation, we say that there is no effect of the financial leverage.

## 3. EMPIRICAL RESULTS AND DISCUSSION

### 3.1. Description of Data

The monthly data was calculated according to the daily closing prices of each country's index of securities (daily index) during the period January 2004 to April 2018. The rate of return for the stock market index $(r_{i,t})$ and the rate of change in the exchange rate $(e_{i,t})$ were determined by the following relationships:

$$r_{i,t} = 100 \times \left(\frac{P_{i,t}}{P_{i,t-1}}\right)$$

$$e_{i,t} = 100 \times \left(\frac{E_{i,t}}{E_{i,t-1}}\right)$$

Where,

$P_{i,t}$ is the closing price of the index of the country's stock market (i) at time (t); $r_{i,t}$ is the closing price of the index of the country's stock market (i) at time (t).

$E_{i,t}$ is the currency exchange rate (i) at time (t), $e_{i,t}$ is currency exchange rate (i) at time (t).

### 3.2. Modeling the Volatility of Share Price Indices in the Stock Exchanges of the Countries Concerned During the Period from January 2004 to April 2018

Table 1 shows the descriptive statistics of the time series data for the stock market returns and the rate of exchange rate change in three markets of the Middle East, Dubai, Saudi Arabia and Egypt. With regard to the rate of return on the stock market, Table 1 shows that Egypt has the highest average return, followed by Dubai and Saudi Arabia, all being positive. On the other hand, the volatility of returns expressed by standard deviation was greater for Dubai, followed by Egypt and Saudi Arabia. The skewness shows that the distribution of stock returns was negatively and significantly skewed for the studied cases, accompanied by a positive kurtosis of all the time series of rate of stock returns. These results were confirmed by the Jarque–Berra test statistics, which rejects the null hypothesis (stock returns follows normal distribution) i.e., the distribution of return does not follow the normal distribution at a significant level of 1%, where the statistical values of this test is statistically significant. This is confirmed by the probabilistic value of test (P-value <1%). It should be noted that Egypt has a negative average of changes in the exchange rate against the dollar while the currencies of the countries (Dubai and Saudi Arabia) are characterized by a negative average of exchange rate changes against the dollar, i.e. an increase in the nominal value of the currency. Exchange rate fluctuations expressed in standard deviation were low and convergent compared to the volatility of stock returns. Figure 1 provides an illustration of the prices (returns) of the general market index, and for the exchange rate changes.

**Table-1.** Descriptive statistics on the rate of stock returns and rate of change in the exchange rate.

| Panel A: stock returns | R_ DUBAI | R_EGYPT | R_SAUDI ARABIA |
|---|---|---|---|
| Mean | 0.603242 | 1.521164 | 0.340694 |
| Std. Dev. | 10.00680 | 9.813301 | 7.790754 |
| Skewness | −0.093379 | −0.333925 | −0.774864 |
| Kurtosis | 5.435185 | 7.948353 | 4.596509 |
| Jarque-Bera | 42.50067 | 30.22499 | 35.27232 |
| Probability | 0.000000 | 0.000000 | 0.000000 |
| Observations | 171 | 171 | 171 |
| **Panel B: Exchange rate** | **USD/AED** | **USD/EGP** | **USD/SAR** |
| Mean | −1.599999 | 0.615281 | −1.56666 |
| Std. Dev. | 0.050209 | 5.749509 | 0.117074 |
| Skewness | −0.308500 | 10.27916 | 2.292529 |
| Kurtosis | 78.53932 | 125.5487 | 62.41785 |
| Jarque-Bera | 40659.31 | 110015.9 | 25304.46 |
| Probability | 0.000000 | 0.000000 | 0.000000 |
| Observations | 171 | 171 | 171 |

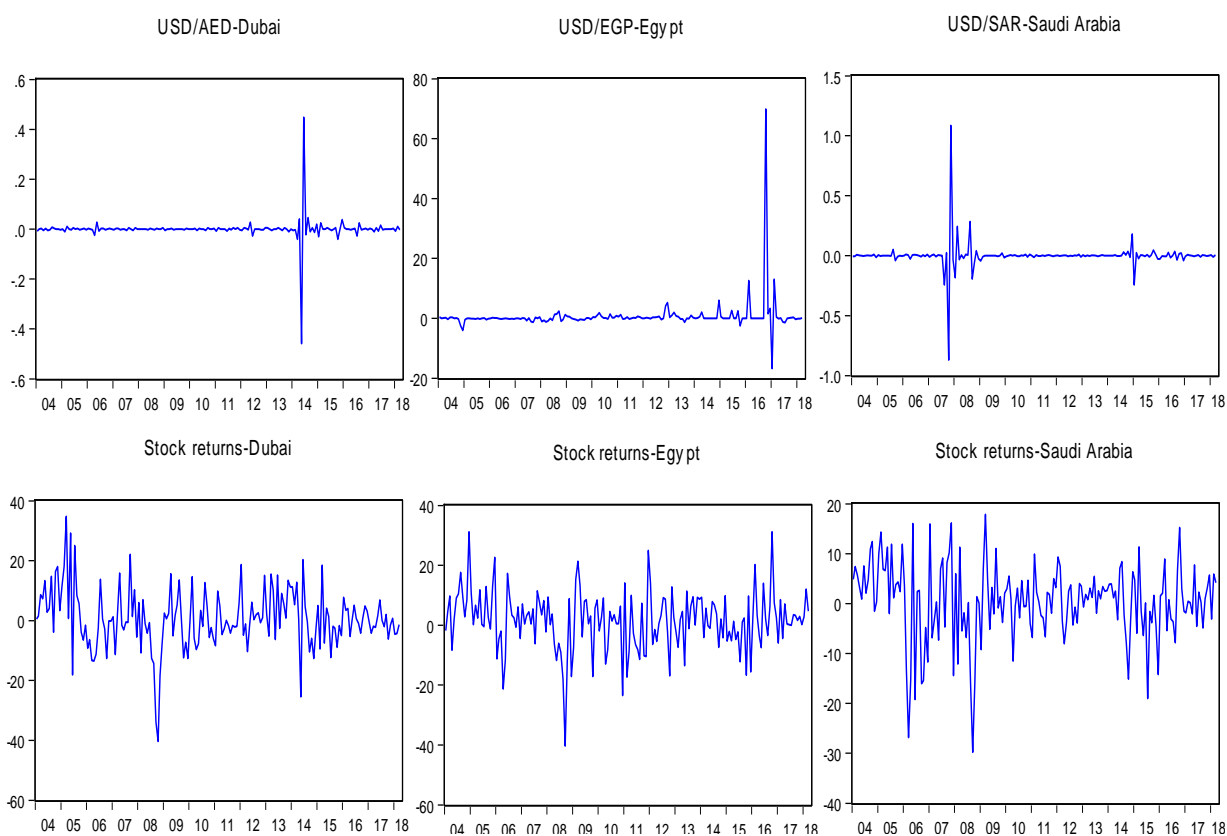**Source:** by author depending on EViews.



**Figure-1.** The performance of stock indexes and of exchange rates of the countries concerned.

**Source:** by author depending on EViews10.

### 3.3. Stationary Test for the Series Indicators of Country Exchanges

The unit root tests of Dickey and Fuller (1981) and Phillips and Perron (1988) can be used to measure the stationary of time series by testing the null-hypothesis (the series is nonstationary, i.e. has a unit root) against the alternative hypothesis (i.e., that a unit root does not exist), then we reject the null-hypothesis and accept the alternative hypothesis that has a unit root.

**Table-2.** Results of unit root test.

| Panel A: stock returns | | | | |
|---|---|---|---|---|
| **Unit root test table (ADF) At Level** | | | | |
| **At Level** | | | | |
| | | **R-DUBAI** | **R-EGYPT** | **R-SAUDI ARABIA** |
| Constant | t-Statistic | −4.152777*** | −4.431032*** | −7.886225*** |
| Constant & Trend | t-Statistic | −4.154023*** | −4.435554*** | −7.873261*** |
| Without Constant & Trend | t-Statistic | −4.167500*** | −4.233525*** | −7.899163*** |
| **At First Difference** | | | | |
| Constant | t-Statistic | −8.945133*** | −8.092552*** | −14.51075*** |
| Constant & Trend | t-Statistic | −8.918094*** | −8.070017*** | −14.47187*** |
| Without Constant & Trend | t-Statistic | −8.969620*** | −8.117745*** | −14.55458*** |
| **Unit root test table (PP)** | | | | |
| **At Level** | | | | |
| | | R-DUBAI | R-EGYPT | R-SAUDI ARABIA |
| Constant | t-Statistic | −10.77771*** | −11.51877*** | −10.89238*** |
| Constant & Trend | t-Statistic | −10.81256*** | −11.50569*** | −10.88357*** |
| Without Constant & Trend | t-Statistic | −10.77973*** | −11.42555*** | −10.90903*** |
| **At First Difference** | | | | |
| Constant | t-Statistic | −139.3261*** | −37.66230*** | −104.1818*** |
| Constant & Trend | t-Statistic | −138.4081*** | −37.59793*** | −134.4677*** |
| Without Constant & Trend | t-Statistic | −135.9456*** | −37.81943*** | −103.8024*** |
| **Panel B: exchange rates** | | | | |
| **Unit root test table (ADF)** | | | | |
| **At Level** | | | | |
| | | E-DUBAI | E-EGYPT | E-SAUDI ARABIA |
| Constant | t-Statistic | −14.45840*** | −5.584102*** | −8.411882*** |
| Constant & Trend | t-Statistic | −14.41525*** | −6.021129*** | −8.385552*** |
| Without Constant & Trend | t-Statistic | −14.50188*** | −5.387775*** | −8.438132*** |
| **At First Difference** | | | | |
| Constant | t-Statistic | −19.92233*** | −9.637751*** | −11.47593*** |
| Constant & Trend | t-Statistic | −19.86186*** | −9.608090*** | −11.43978*** |
| Without C& Trend | t-Statistic | −19.98260*** | −9.668008*** | −11.51196*** |
| **Unit root test table (PP)** | | | | |
| **At Level** | | | | |
| | | E-DUBAI | E-EGYPT | E-SAUDI |
| Constant | t-Statistic | −133.0928*** | −13.36520*** | −63.12840*** |
| Constant & Trend | t-Statistic | −134.7495*** | −13.73498*** | −62.87299*** |
| Without Constant & Trend | t-Statistic | −134.0355*** | −13.24697*** | −63.37393*** |
| **At First Difference** | | | | |
| Constant | t-Statistic | −185.2277*** | −177.3632*** | −177.2651*** |
| Constant & Trend | t-Statistic | −184.5861*** | −177.1717*** | −176.6817*** |
| Without Constant & Trend | t-Statistic | −185.8367*** | −178.3032*** | −177.8936*** |

**Notes:** (***) Significant at the 1%.
*MacKinnon (1996) one-sided p-values.

The results of Table 2 show that the time series for both stock returns and exchange rate indices were stationary at their levels. They are also stationary at the first differences with a significant level of 1% for all variables.

### 3.4. Co-integration Test

Statistics from Table 3 show the values of trace statistic less than the critical values. The results of the Johansen test indicate that there is a trend for co-integration according to the trace test, which rejects the null hypothesis that "there is no co-integration at a significant level (5%) and acceptance of the existence hypothesis 95%", which confirms a long-term equilibrium relationship between the general index of prices and the exchange rate. This means that there is no possibility of a false regression of variables.

**Table-3.** Shows the results of the test of the cointegration of the two exchange rate variables and the share price index.

| Countries | Hypothesized No. of CE(s) | Variables | Critical Value 0.05 | Trace Statistic |
|---|---|---|---|---|
| Dubai | None * | R | 15.49471 | 52.3045 |
| | At most 1 * | E | 3.841466 | 25.4184 |
| Egypt | None * | R | 15.49471 | 27.7747 |
| | At most 1 * | E | 3.841466 | 3.35567 |
| Saudi Arabia | None * | R | 15.49471 | 49.9232 |
| | At most 1 * | E | 3.841466 | 20.3111 |

**Source:** by author depending on EViews.

**Table-4.** Estimates of OLS regression.

| Countries | $\beta_0$ | $\beta_1$ | Adjusted $R^2$ | D.W | F-stat | ARCH(1) |
|---|---|---|---|---|---|---|
| Dubai | 0.60399 (0.4192) | 47.0000* (0.0019) | 0.050 | 1.452 | 9.95* (0.0019) | 0.6051* (0.000) |
| Egypt | 1.2747*** (0.0850) | 0.40053* (0.0020) | 0.049 | 1.71 | 9.8490* (0.00200) | 0.529* (0.0006) |
| Saudi Arabia | 0.3407 (0.5689) | 2.9026 (0.5711) | –0.015 | 1.62 | 0.3221 (0.5710) | 0.2736* (0.0000) |
| No of Significant cases | 1/3 | 2/3 | | | | 3/3 |

**Note:** Numbers in parentheses indicate the P-value. * Indicates the significance level at 1%.

Table 4 shows the results of the estimation of the relationship between the rate of return of the stock market and rate of change in the local currency exchange rate against dollar for the three studied cases, where the parameters of exchange rate variables are found statistically significant for Egypt and Dubai. The results indicate that the exchange rate accounts for a larger percentage of changes in the returns of the Dubai stock market compared to Egypt. While exchange rates have no impact on the Saudi stock markets.

**Table-5.** Results of AR(1) estimation of the monthly data on the returns of stock indices in the Middle East Countries stock exchanges.

| Countries | $\gamma_0$ | $\gamma_1$ | $\alpha_0$ (constant) | $\alpha_1$ (ARCH Effect) | $\beta$ (GARCH Effect) | Heteroskedasticity Test: ARCH (F-statistic) |
|---|---|---|---|---|---|---|
| Dubai | 0.6688 (0.3960) | 0.2028*** (0.0452) | 6.84435 (0.1837) | 0.21396* (0.0030) | 0.7276* (0.0000) | 0.2625 (0.6090) |
| Egypt | 1.386 (0.074) | 0.0488*** (0.5949) | 76.30* (0.000) | 0.3735* (0.005) | –0.1076 (0.446) | 0.54454 (0.4616) |
| Saudi Arabia | 1.199** (0.030) | 0.2079** (0.011) | 1.414 (0.3488) | 0.233* (0.0008) | 0.765* (0.000) | 1.138246 (0.2848) |
| No of Significant cases | 1/3 | 3/3 | 1/3 | 3/3 | 2/3 | |

**Note:** Numbers in parentheses indicate the P-value.
* Indicates the significance level at 1%, ** Indicates the significance level at 5%, and *** Indicates the significance level at 10%.

Table 5 Shows the results of the estimation of GARCH (1.1) parameters. The parameter $\gamma_1$, which measures the effect of exchange rate changes on the rate of return of the stock market is positive and statistically significant in Saudi Arabia, Egypt and Dubai, i.e., a positive relationship of statistical significance between variables. It is clear from the variance conditional equation (the intercept term) $\alpha_0$ that the effects of exchange rate change are statistically significant in Egypt. This means that there is an important part of the stability over time in the returns generation process, which is expressed as effect of the average long-term volatility. The parameters of both ARCH and GARCH ($\alpha_1$, $\beta$) achieve a non-negative condition, and the significance of the GARCH parameter is greater than the ARCH parameter except for Egypt, which means that the volatility of the return of each stock market is more sensitive to the values lagged (previous values) than the new surprises. In other words, the effects of the variance projections for the previous period are more persistent. The sum of these coefficients ($\alpha_1 + \beta$) are 0.99, 0.48 and 0.94

which are close to unity indicate that the shock will persist to many future periods for all three cases (Saudi Arabia, Egypt and Dubai) This suggests that the shocks of yield indicators had more lasting effects and that the volatility response was fading at a slower pace. We found that the sensitivity of stock market returns to exchange rates was strong, which means that exchange rate fluctuations play an important role in determining the dynamics of stock market returns. To increase confidence in the results, other tests were carried out to validate the model which was free from the problems defined by the ordinary least squares model estimate. These tests were used to test the existence of the problem of variance instability through the ARCH test: Heteroskedasticity Test.

The null hypothesis was also tested which states that there was no problem of contrast instability, homoscedasticity versus the alternative hypothesis; however, there was the problem of instability of variation (Heteroscedasticity). The null hypothesis can be accepted if the value of p is greater than the level of 5%. Besides, the exchange rate changes further explained a larger share of stock market returns. The logical explanation of such a negative relationship with the exchange rate is the devaluation of the local currency which may lead to deterioration in the stock market as well as a decline in stock market returns. The results of ARCH test for heteroskedasticity are presented in Table 5 (last column). All values of test statistic have p-value, above 5 percent, suggesting that null hypothesis cannot be rejected, and indicating that condition variance is correctly specified.

## 4. THE TODA–YAMAMOTO APPROACH TO GRANGER CAUSALITY TEST

To test the causality, a modified Wald test (MWALD) was used to ascertain the direction of causality between the share index and exchange rates of Egypt, Saudi Arabia and Dubai between Jan-2004 to Apr-2018. Such a modified Wald test (MWALD) is proposed by Toda and Yamamoto (1995) that is particularly useful to avoid the problems associated with ordinary Granger causality test.

$$\ln E_t = a_0 + \sum_{i=1}^{K} \alpha_{1i} \ln E_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} \ln E_{t-j} + \sum_{i=1}^{K} \phi_{1i} \ln R_{t-i} + \sum_{j=k+1}^{d_{max}} \phi_{2j} \ln R_{t-j} + \lambda_{1t} \tag{19}$$

$$\ln R_t = \beta_0 + \sum_{i=1}^{K} \beta_{1i} \ln R_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j} \ln R_{t-j} + \sum_{i=1}^{K} \delta_{1i} \ln E_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} \ln E_{t-j} + \lambda_{2t} \tag{20}$$

From Equation 19 Granger causality from $lnRt$ to $lnE_t$ implies $\phi_{1i} = 0$ ∀i; similarly in Equation 20 $lnEt$ Granger causes $lnRt$, if $\delta_{1i} = 0$ ∀i. The model thus estimates using seemingly unrelated regression (SUR) (see, Rambaldi and Doran (1996)).

**Table-6.** Granger Causality test.

| Countries | From LNE to LNR | | From LNR to LNE | | Direction of causality |
|---|---|---|---|---|---|
| | ρ-value | Sum of lagged coefficients | ρ-value | Sum f la ed coefficients | |
| Dubai | 0.0253** | 7.352395 | 0.3164 | 2.301510 | LNE ⇒ LNR |
| Egypt | 0.4999 | 0.455162 | 0.6201 | 0.245793 | no |
| Saudi Arabia | 0.7138 | 0.674404 | 0.0020*** | 12.41469 | LNR ⇒ LNE |

* Significant levels at 10%. ** Significant levels at 5%. *** Significant levels at 1%.

The Granger causality test rejects the null hypothesis which suggests that "LN(R-Saudi) does not Granger Cause LN (E-Saudi)". This implies the acceptance of the alternative hypothesis. However, the test fails to reject the second null hypothesis saying "LN (E-Saudi) does not Granger Cause LN(R-Saudi)". The test therefore clearly shows a unidirectional relationship running from stock market performance to exchange rate in Saudi Arabia. i.e. there is a strong evidence that the causation runs from exchange rate; implying that variations in the Saudi exchange rate is explained by stock market volatility. This finding is consistent with that of Granger, Parsva and Lean (2011); Parsva and Lean (2017). The Granger causality test also rejects the null hypothesis that says "LN (E-Dubai) does not Granger Cause LN(R-Dubai)". This implies the acceptance of the alternative hypothesis. However, the test fails to reject the second null hypothesis saying "LN(R-Dubai) does not Granger Cause LN (E-Dubai)". The

test therefore clearly shows a unidirectional relationship running from exchange rate to stock market performance in Dubai. i.e. there is a strong evidence that the causation runs from exchange rate stock market returns; implying that variations in the Dubai stock market is explained by exchange rate volatility.

Finally, the causal Granger test accepts a null hypothesis that says "LN (E-Egypt) does not Granger caused LN(R-Egypt)". This means rejecting the alternative hypothesis. However, the test accepts the rejection of the second zero hypothesis that says "LN(R-Egypt) does not cause Granger LN (E-Egypt)". Thus, the test clearly shows that there is no relationship between the exchange rate and the performance of stock market in Egypt, which means that changes in the Egyptian stock market are not explained by the volatility of the exchange rate. These results correlate with the results of Parsva and Lean (2011).

## 5. CONCLUSION

This research aimed to identify the relationship between changes in exchange rates and stock market returns for three Middle East countries (Egypt, Saudi Arabia and Dubai). The Generalised Autoregressive Conditional Heteroskedascity (GARCH) model was applied to measure the relationship between exchange rate volatility and stock market volatility. The study relied on monthly closing prices data for indicators of stock prices and exchange rates for the period from Jan-2004 until Apr-2018. Several standard tests were used and statistics suggested the appropriateness of the estimated models. Stock market returns sensitivities we found to be stronger for exchange rates, which means that exchange rate changes play an important role in determining the dynamics of the conditional return on equity market returns. The Granger causality test showed strong evidence that the causation runs from exchange rate to stock market performance; implying that variations in Dubai stock market can be explained by exchange rate volatility. The test therefore clearly showed a unidirectional relationship running from stock market performance to exchange rate in Saudi Arabia. i.e. there was a strong evidence that the causation runs from exchange rate; implying that variations in the Saudi exchange rate can be explained by stock market volatility. Finally, the test clearly shows that there was no relationship between the exchange rate and the performance of the stock market in Egypt, which means that changes in the Egyptian stock market cannot be explained by the volatility of the exchange rate. Previous findings have suggested taking into account the risk of financial risk management and valuation of financial assets, especially in emerging markets where exchange rate is highly volatile. The study suggests better financial investments at the local and international levels, and formulation of appropriate risk management strategies especially during financial crises and crises of the Currency. The study also recommends that investors should closely monitor the effects of the developments in monetary policy decisions on their investments. This will help them to take the appropriate decision in a timely manner as the exchange rate is an important channel for policymakers in transferring the effects of monetary policy to the financial and real side of the economy.

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