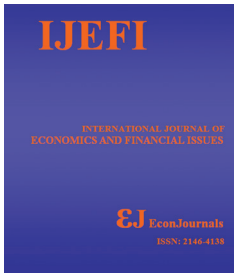

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Relationship between Exchange Rates and Stock Prices – GCC Perspectives

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ABSTRACT

The main objective of this paper is to investigate the relation between the exchange rates and stock prices of the six GCC countries. The empirical results indicate that there is cointegration between stock prices and exchange rates in Kuwait, Bahrain and Oman. The Granger causality test reveals that exchange rates (in terms of the GBP) cause stock prices in all GCC countries, while stock prices cause exchange rates in Oman and Kuwait. Conversely, the empirical evidence indicates that exchange rates (in terms of the JPY) cause stock prices in Kuwait, while there is only one case of bidirectional causality between stock prices and exchange rates (the case of Oman).

Keywords: Exchange Rate, Stock Price, Basket Currency, Peg Currency, Cointegration, Granger Causality
JEL Classifications: A10, A12, C13

1. INTRODUCTION

The relationship between exchange rates and stock prices has attracted the attention of policy makers, economists and investors, as these financial prices play a crucial role in the macro economy (Nieh and Lee 2001). Although the available evidence largely indicates the absence of a long-term relationship between stock prices and exchange rates (Sohrabiab and Bahmani, 1992; Nieh and Lee 2001; Ramasamy and Yeung, 2005), this relationship continues to be a source of contention and investigation.

The empirical work conducted this study is based on time series for exchange rates and stock prices. Although these financial prices behave in a similar fashion, as they are driven by news and other factors, there is a notable difference in their behaviour. Stock prices tend to move along a secular upwards trend arising from the growth and development of the economy, but this secular trend is interrupted by cycles of bear and bull markets. In contrast, exchange rate movements are dominated by cycles and do not exhibit long-run trends. Unless a country is experiencing hyperinflation, its exchange rate cannot fall or rise without bounds over a long period. This is particularly the case for the GCC currencies, which are pegged to the US dollar, except for the Kuwaiti currency, which is pegged to a basket of currencies. Therefore, it is of interest to determine whether changes in stock prices cause changes in exchange rates, or vice versa.

2. LITERATURE REVIEW

Theoretical considerations lead to the proposition that exchange rates and stock prices are related (Dornbusch and Fischer, 1980; Aggarwal, 2003; Yau and Nieh, 2006). The portfolio balance approach indicates that the exchange rate is influenced by the mechanism of the stock market. That is, portfolio theories focus on the significant role of capital account transactions in determining exchange rate dynamics (Ajayi et al., 1998; Hatemi and Irandoust, 2002; Phylaktis and Ravazzolo, 2005; Hatemi and Roca, 2004; Thoma, 2008). However, there is neither a theoretical nor an empirical consensus on the relationship between stock prices and exchange rates, and it is not clear whether this relationship is causal in one direction or both directions.

According to Johnston and Sun (1997), who examined exchange rate risk pricing in the US stock market, US companies exhibit significant cross-sectional differences in their exposure to foreign exchange risk. Abdalla and Murinde (1997) evaluated the interaction between stock prices and exchange rates in some emerging markets, including the Philippines, Pakistan, India

and Korea. Their results showed the presence of unidirectional causality from stock prices to exchange rates in the Philippines, India and Pakistan, as well as causality from exchange rates to stock prices in Korea. Hatemi and Roca (2005) criticised previous empirical research for using sample periods characterised by normal conditions instead of good and bad times. They pointed out that stock prices and exchange rates were strongly related during the period before the Asian financial crisis. The direction of causality was from stock prices to exchange rates in the case of Thailand and Indonesia, and from exchange rates to stock prices in the case of the Philippines. No causality was found in the case of Malaysia or for the period encompassing the financial crisis.

Ajay et al. (1998) examined the causal relation between exchange rates and stock prices using the Granger causality test. They found unidirectional causality from changes in the exchange rate to stock return differential in all industrial markets, whereas a consistent causal linkage was observed in emerging stock markets, with the exception of the Philippines and Indonesia, where the direction of causality was from exchange rates to stock prices. Hatemi and Irandoust (2002) employed the Granger test to study the relation between stock prices and exchange rates in Sweden. They found that causality is unidirectional, running from the currency market to the stock market. In fact, they found that an increase in Swedish stock prices leads to currency depreciation. Another study that supports the portfolio balance approach is that of Phylaktis and Ravazzolo (2005), who examined the underlying propositions for Thailand, Indonesia, Hong Kong, Malaysia and Indonesia. Their found no long-term relationship between stock prices and real exchange rates in all countries. Further, they found that stock prices are positively related to exchange rates. Bodnar and Bartov (1994), Nieh and Lee (2001), Muhammad and Rasheed (2002), Phylaktis and Ravazzolo (2005) and Uddin and Rahman (2009) indicated that exchange rates are not influenced by changes in stock prices, and vice versa. In contrast, others have found bidirectional causality between exchange rates and stock prices (Sohrabiab and Bahmani, 1992; Ajayi and Mougoue, 1996; Aydemir and Demirhan 2009).

Research on this issue is predominantly based on two-variable regressions to study the relationship between exchange rates and stock prices; thus, the problem of missing variables has been neglected. Nonetheless, previous studies have established that the exclusion of relevant variables from a system might invalidate the causality inference between the variables of an incomplete system. The underlying argument—that any change in one of the variables causes changes in another variable drawn from a bivariate causality test—may be invalid because of the omission of significant variables (Caporale et al. 2004).

3. METHODOLOGY

This section presents the methodology used, starting with the unit root test, followed by cointegration analysis and then causality.

3.1. Unit Root Test

Specifying a regression equation in levels rather than first differences may be problematical. Granger and Newbold (1974) presented some results indicating that when time series variables are non-stationary, using levels may result in a non-constant mean over time and a residual that is highly auto-correlated, with a low Durbin-Watson statistic. For this reason, Granger and Newbold recommended the use of the first difference of each variable before running the regression. Plosser and William (1978) noted that in an undifferenced regression, the disturbance term is non-stationary and is not well behaved. They concluded that it is better to work with differenced economic data rather than data in levels for most economic time series. Therefore, one must exercise care when using data in levels rather than differences. Griffiths et al. (1993) argued that "the usual statistical properties of least squares hold only when the time series variables involved are stationary." Accordingly, non-stationary time series have to be differenced before performing econometric analysis.

In this paper, we use the augmented Dickey-Fuller (ADF) unit root test. According to Schwert (1989), the ADF test with long lags outperforms the corresponding model without lags. Therefore, the model used in this study is specified as follows:

$$\Delta y_t = \alpha + \varphi y_{t-1} + \sum_{i=1}^{n} \beta_i \ \Delta y_{t-i} + \varepsilon_t \quad (1)$$

Where Δ is the first difference operator. The test is applied to stock prices SP_t and exchange rates ER_t. The corresponding equations are:

$$\Delta SP_t = \beta_0 + \varphi_1 SP_{t-1} + \sum_{i=1}^{n} \beta_i \ \Delta SP_{t-i} + \varepsilon_{1t} \quad (2)$$

And:

$$\Delta ER_t = \alpha_0 + \varphi_2 ER_{t-1} + \sum_{i=1}^{n} \alpha_i \ \Delta ER_{t-i} + \varepsilon_{2t} \quad (3)$$

Where,

$\Delta SP_t = SP_t - SP_{t-1}$ and $\Delta ER_t = ER_t - ER_{t-1}$. The null of non-stationarity (unit root) is H_0: $\varphi=0$, whereas the alternative of stationarity (absence of unit root) is H_1: $\varphi<0$.

3.2. Cointegration Testing

Cointegration is used to detect the existence of an equilibrium relationship between any two or more variables. Engle and Granger (1987) proposed a two-step approach to cointegration when the variables (stock prices and exchange rates) are I(1). The first step involves estimating the long-run equation by ordinary least squares (OLS) and then applying the ADF test to the residuals. Engle and Granger (1987) provided the critical values of the test statistics. Therefore, the test involves two equations:

$$y_t = \delta_0 + \delta_1 x_t + u_t \quad (4)$$

And:

$$\Delta u_t = \Delta u_{t-1} + \sum_{i=1}^{n} \varnothing_i \Delta u_{t-i} + v_t \quad (5)$$

The OLS estimates of the coefficients of the cointegrating regression are super consistent in the presence of cointegration,

even though the usual standard error is not reliable. If the residual is found to be non-stationary, then the two variables (exchange rate and stock price) are not cointegrated and the findings are possibly spurious. However, if the residual is stationary, then there is a meaningful long-run relationship between exchange rates and stock prices.

3.3. Causality Testing and the Vector Auto-regression (VAR) Model

To examine the relationship between stock prices and exchange rates, we must determine whether the exchange rate causes the stock price to change, or vice versa. In this paper, we use the VAR model to examine linear causality between these two variables. The use of VAR models can be justified in terms of the meaning of causality in economics, where it is not really causality in the same sense as it is in natural sciences. In economics (and finance) something causes something else because it occurs before the something else. A variable causes another if its lagged values can explain variation in the dependent variable over and above what can be explained by lagged dependent variables. For this reason a model with lagged dependent and explanatory variables is needed to conduct causality testing.

For this purpose, the following two equations are used if there is no integration between the two variables;

$$\Delta SP_t = \beta_0 + \sum_{i=1}^{n}\beta_{1i}\,\Delta SP_{t-i} + \sum_{i=1}^{n}\beta_{2i}\,\Delta ER_{t-i} + \varepsilon_{1t} \quad (6)$$

And:

$$\Delta ER_t = \beta_0 + \sum_{i=1}^{n}\beta_{1i}\,\Delta ER_{t-i} + \sum_{i=1}^{n}\beta_{2i}\,\Delta SP_{t-i} + \varepsilon_{2t} \quad (7)$$

The possibilities are as follows: (i) causality from stock prices to exchange rates ($SP_t \rightarrow ER_t$), (ii) causality from exchange rates to stock prices ($ER_t \rightarrow SP_t$), (iii) independence between exchange rates and stock prices, and (iv) and feedback causality between stock prices and exchange rates. If exchange rates and stock prices are cointegrated, the VAR model must include an error correction term (ECT), in which case the equations become:

$$\Delta SP_t = \beta_0 + \vartheta_1\left(SP_{t-1} - \delta ER_{t-1}\right) + \sum_{i=1}^{n}\beta_{1i}\,\Delta SP_{t-i} + \sum_{i=1}^{n}\beta_{2i}\,\Delta ER_{t-i} + \varepsilon_{st} \quad (8)$$

And:

$$\Delta ER_t = \alpha_0 + J_2\left(SP_{t-1} - \delta ER_{t-1}\right) + \sum_{i=1}^{n}\alpha_{1i}\,\Delta ER_{t-i} + \sum_{i=1}^{n}\alpha_{2i}\Delta SP_{t-i} + \varepsilon_{st} \quad (9)$$

Where ϑ_1 and ϑ_1 are the coefficients on the ECTs.

4. DATA

This empirical work is based on monthly time series data on exchange rates and stock prices over the period 1 January 2000-31 December 2013. The data were collected from data stream, with the exception of the share prices of Bahrain, Oman and the UAE, which were obtained from each country's stock exchange website. Table 1 lists the countries, exchange rates and stock market indices.

5. EMPIRICAL RESULTS

5.1. Unit Root Test—Results

The results obtained using the ADF test for the unit root are displayed in Table 2. H_0 is that ER_t and SP_t contain a unit root against H_a (alternative hypothesis) that both variables are stationary under consideration. Table 3 shows that the null hypothesis—that SP_t and ER_t have a unit root—cannot be rejected. Nevertheless, the H_0 of unit roots is rejected after the exchange rate and stock price variables have been put in first difference. This suggests that the variables are I(1).

Figures 1-18 show the exchange rates series and stock price series of the GCC countries. As shown in these figures, the exchange rates have similar cycles, which is due to the pegging of the exchange rates to the USD. That is, when the USD depreciates (appreciates)

Table 1: Countries, currencies and stock market indices

Country	Index	Currency
Kuwait	KSE	KWD
Saudi Arabia	SSE	SAR
Bahrain	BBE	BHD
Oman	MSE	OMR
Qatar	QSE	QAR
UAE	ADX	AED

Table 2: Results of testing for unit root

Variables	Level	First difference	Order of integration
Kuwait perspective			
SP_t	−1.559321	8.662193***	(1)
$ER_{t,KWD/GBP}$	−2.374937	−9.449167***	(1)
$ER_{t,KWD/JPY}$	−1.381478	−16.52882***	(1)
Saudi perspective			
SP_t	−1.972518	−9.549047***	(1)
$ER_{t,SAR/GBP}$	−1.622082	−3.8452258***	(1)
$ER_{t,SAR/JPY}$	−0.543151	−10.49670***	(1)
Bahrain perspective			
SP_t	−1.559321	−8.662193***	(1)
$ER_{t,BHD/GBP}$	−2.374937	−16.52882***	(1)
$ER_{t,BHD/JPY}$	−0.584228	−10.85234***	(1)
Oman perspective			
SP_t	−1.407224	−5.556350***	(1)
$ER_{t,OMR/GBP}$	−1.475810	−3.566934***	(1)
$ER_{t,OMR/JPY}$	−0.522623	−10.60504***	(1)
Qatar perspective			
SP_t	−1.760733	−10.96800***	(1)
$ER_{t,QAR/GBP}$	−3.566924	−12.29055***	(1)
$ER_{t,QAR/JPY}$	−0.532293	−11.38497***	(1)
UAE perspective			
SP_t	−1.728599	−9.980290***	(1)
$ER_{t,AED/GBP}$	−1.376321	−3.198712***	(1)
$ER_{t,AED/JPY}$	−0.550604	−10.56989***	(1)

The number of lags is provided in parentheses. ADF—critical values are at 1% = −4.04, 5% = −3.43 and 10% = −3.14. *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Figure 1: (a and b) Kuwait stock market index in level and first difference

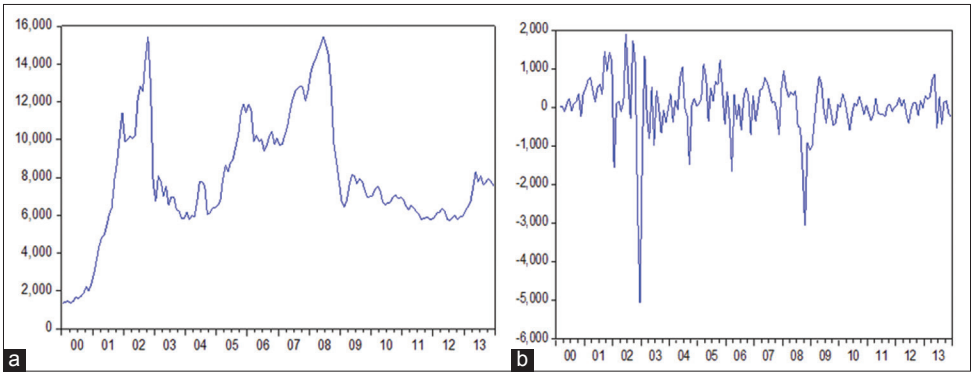


Figure 2: (a and b) KWD/GBP exchange rate in level and first difference

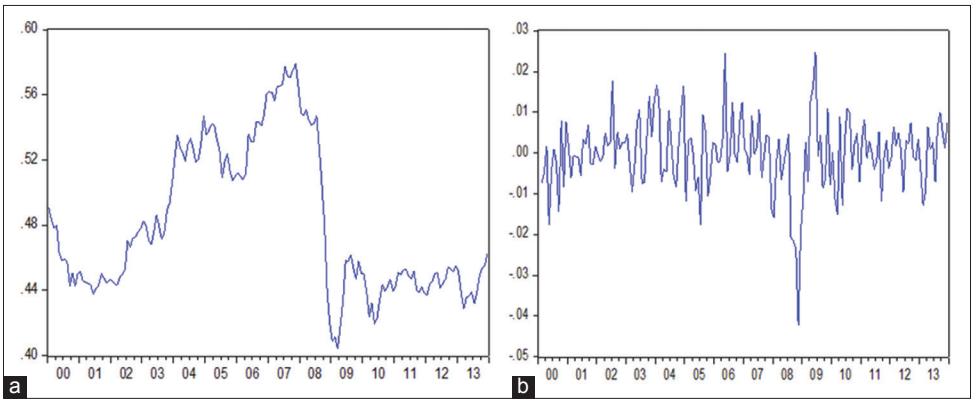


Figure 3: (a and b) KWD/JPY exchange rate in level and first difference

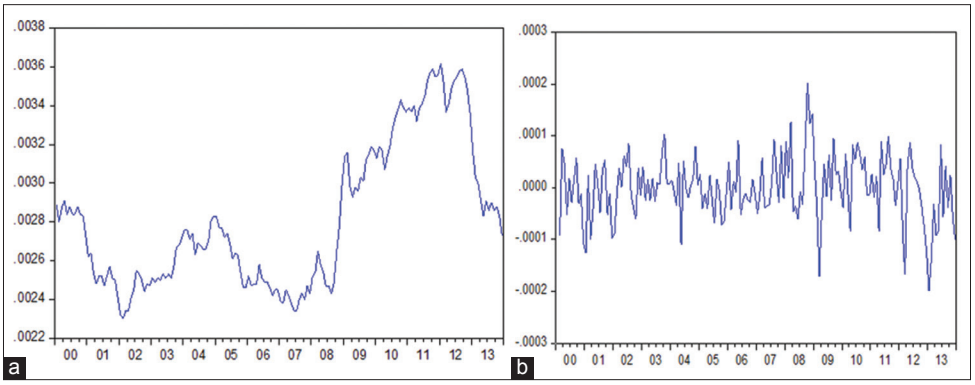


Table 3: Results of testing bivariate C-integration: Residual-based method

Variables	KWD/GBP	KWD/JPY
Kuwait stock market	−3.3157**	−3.1442**
Saudi stock market	SAR/GBP	SAR/JPY
	−1.7951	−1.8703
Bahrain stock market	BHD/GBP	BHD/JPY
	−3.7268*	−2.4755
Oman stock market	BHD/GBP	BHD/JPY
	−0.3461	−3.1623**
Qatar stock market	QAR/GBP	QAR/JPY
	−0.7334	−2.4170
UAE stock market	AED/GBP	AED/JPY
	−1.4742	−2.1454

* and **indicate statistical significance at 1 and 5% respectively. The critical values for cointegrating relations (with a constant in the cointegrating vector) are estimated using the Engle–Granger methodology. Critical values are interpolated using the response surface in Engle and Granger (1987)

against the GBP and JPY, GCC currencies depreciate (appreciate) against the same currencies. Kuwait is the only exception, as the currency is pegged to a basket of currencies.

GCC stock prices increased gradually during the sample—for example, from 2000 to 2008, stock prices increased by more than 120%. However, after the global financial crisis, most GCC stock markets declined gradually until the end of 2012. Although GCC stock prices and exchange rates have been moving in the same direction, there is no indication of stock indices being responsive to exchange rates, and vice versa. In addition, the figures show how stock prices and exchange rates in first differences behave.

5.2. Cointegration Analysis—Results

After testing for stationarity of stock prices series and exchange rates series, we moved to cointegration analysis. Two methods

Figure 4: (a and b) Saudi stock market index in level and first difference

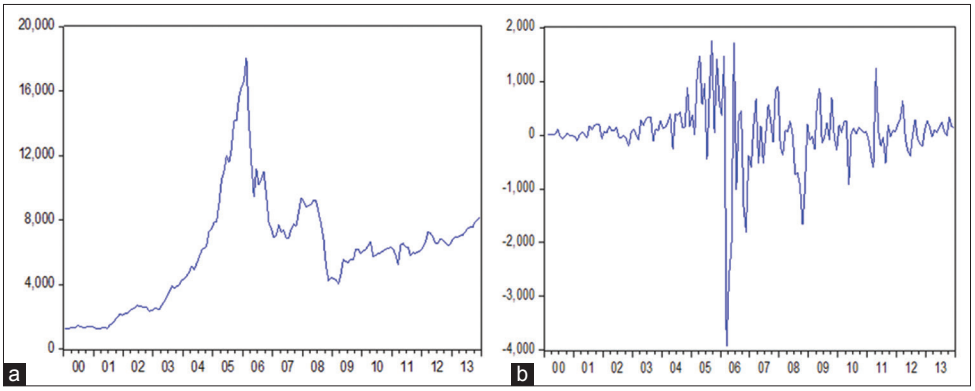


Figure 5: (a and b) SAR/GBP exchange rate in level and first difference

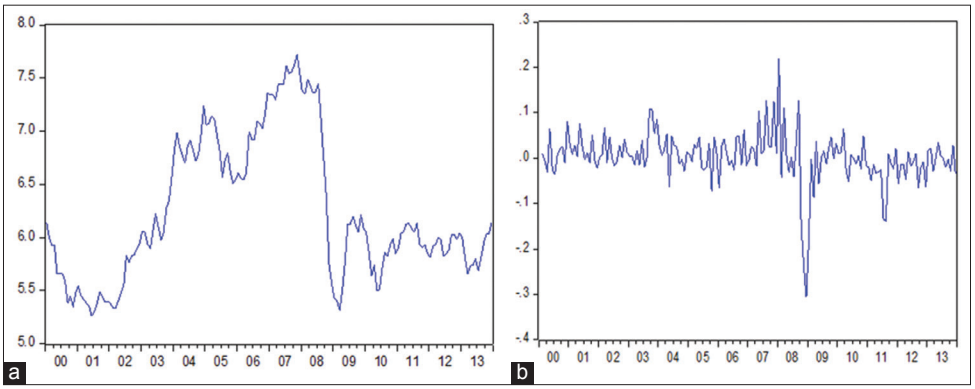


Figure 6: (a and b) SAR/JPY exchange rate in level and first difference

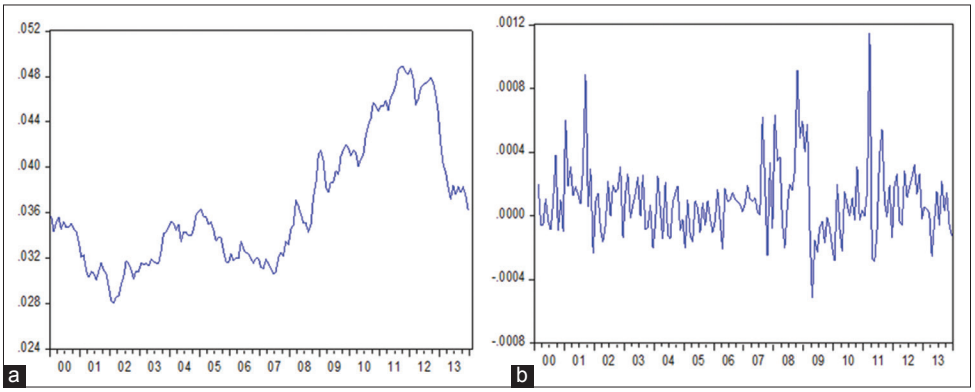


Figure 7: (a and b) Bahrain stock market index in level and first difference

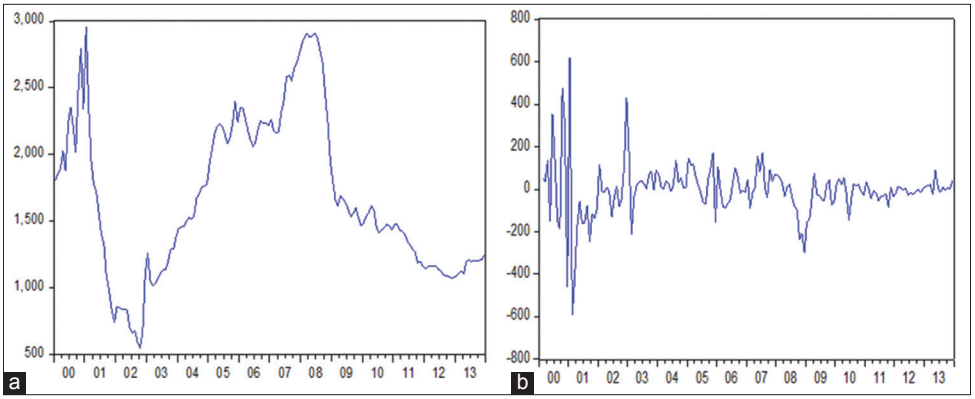


Figure 8: (a and b) BHD/GBP exchange rate in level and first difference

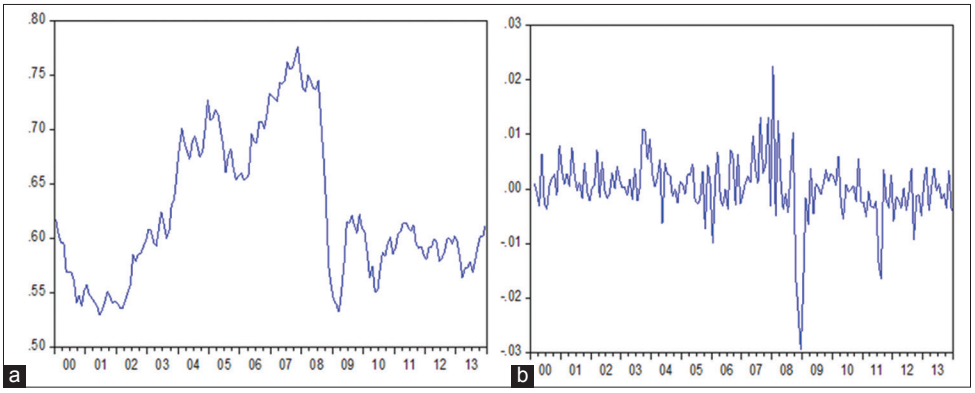


Figure 9: (a and b) BHD/JPY exchange rate in level and first difference

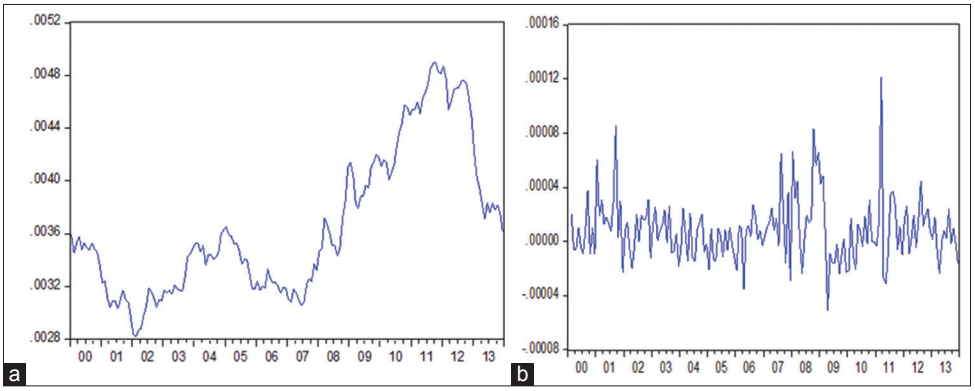


Figure 10: (a and b) Oman stock market index in level and first difference

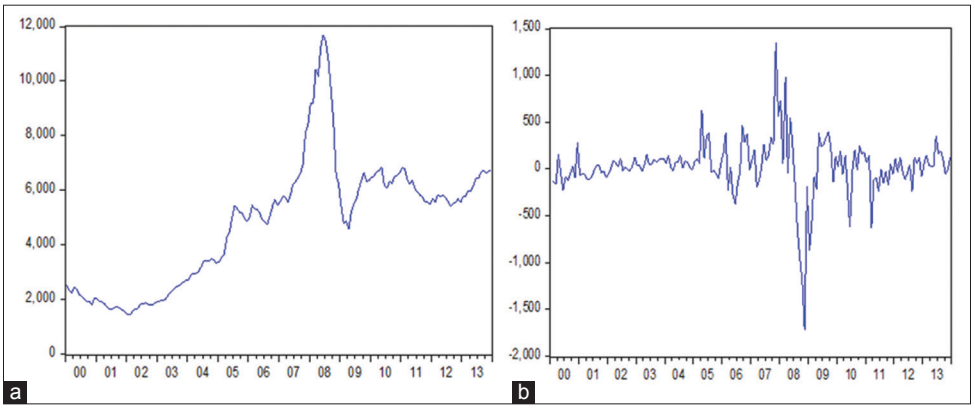


Figure 11: (a and b) OMR/GBP exchange rate in level and first difference

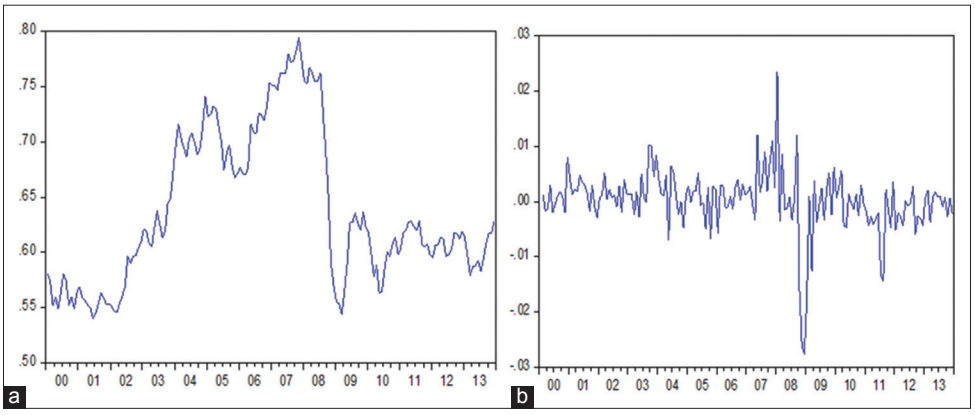


Figure 12: (a and b) OMR/JPY exchange rate in level and first difference

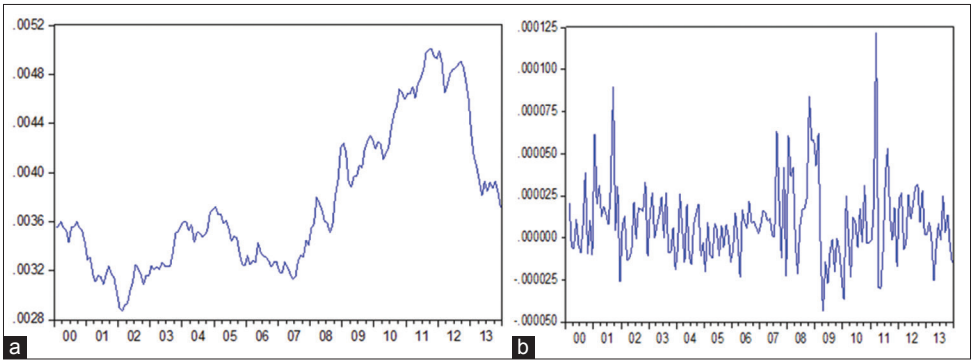


Figure 13: (a and b) Qatar stock market index in level and first difference

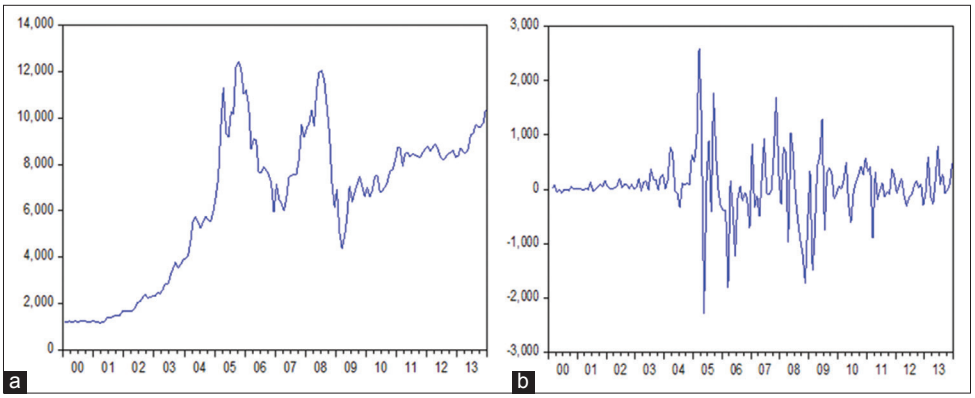


Figure 14: (a and b) QAR/GBP exchange rate in level and first difference

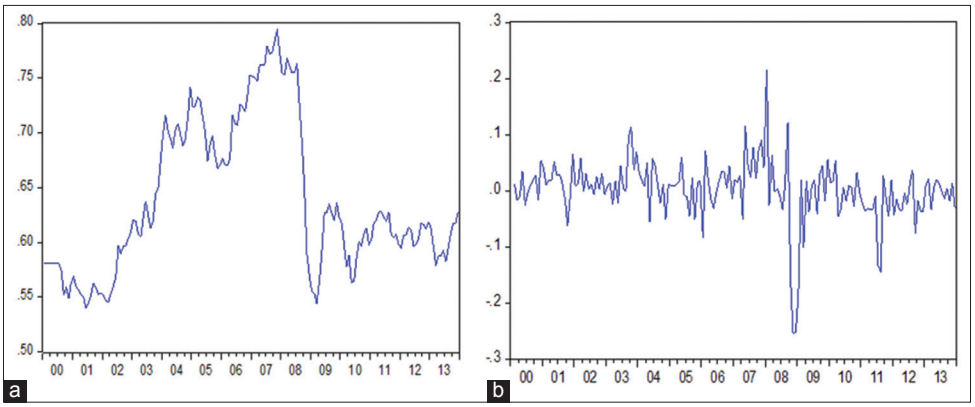


Figure 15: (a and b) QAR/JPY exchange rate in level and first difference

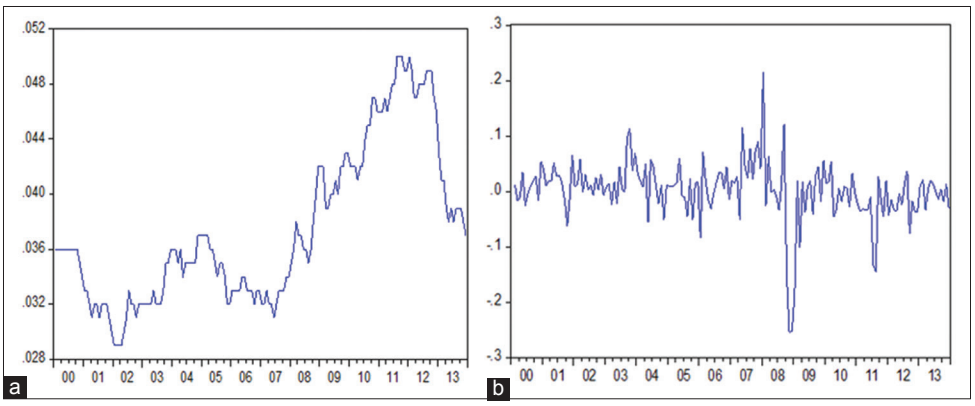


Figure 16: (a and b) UAE stock market index in level and first difference

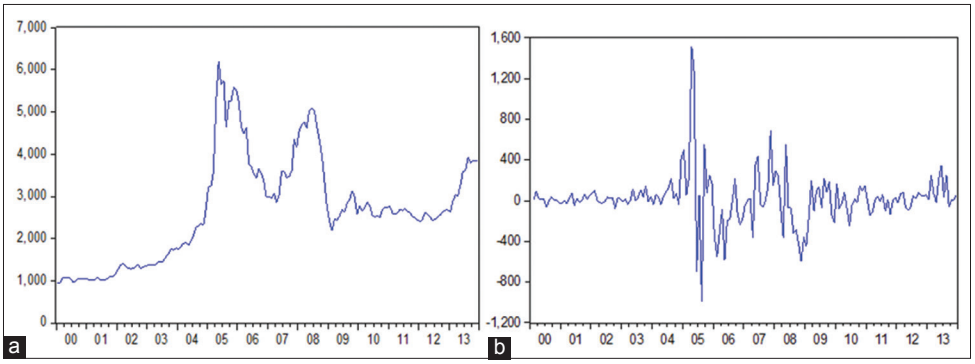


Figure 17: (a and b) AED/GBP exchange rate in level and first difference

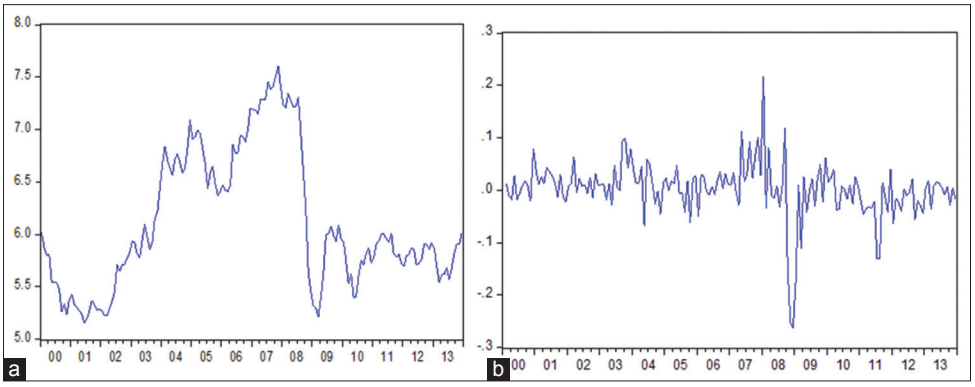
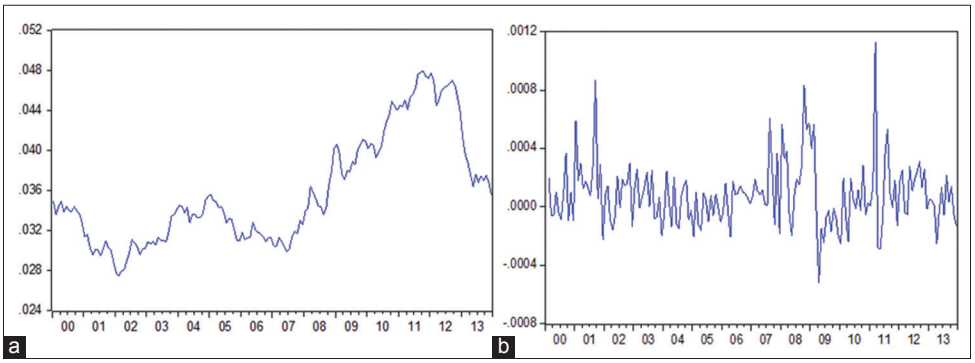


Figure 18: (a and b) AED/JPY exchange rate in level and first difference



were used to test for cointegration: The residual-based method and the error correction method.

5.3. Bivariate Cointegration Test Analysis: Residual-based Method

For residual-based bivariate cointegration analysis, equation 8 is estimated, and the residual is extracted and tested for the unit root. Table 3 shows the ADF statistics corresponding to the maximum Akaike's Information Criterion for the ADF regressions of the residual ranging from order 0 to order 10.

The results reported in Table 3 show that, with the exception of that between the market index and exchange rate series in Kuwait, Bahrain and Oman, failed to reject the null hypothesis of no cointegration. Hence, cointegration appears between the Kuwait stock market index and exchange rate (KWD/JPY) series, between the Kuwait stock market index and exchange rate (KWD/GBP) series, between the Bahrain stock market index and exchange rate (BHD/JPY) series, and between the Oman stock market index and exchange rate (OMR/JPY) series.

5.4. Bivariate Cointegration Analysis: Error Correction Model

According to Granger's representation theorem, cointegration implies and is implied by the existence of a valid error correction representation. Hence, it is possible to test for cointegration by estimating the error correction model (ECM) and testing its validity. The test of cointegration depends on the significance of ϑ_1 and ϑ_2 in equations 8 and 9 respectively. It is worth noting that the coefficients must be significantly negative in the ECM. The maximum lag(n) length of the ECM is initially specified as four for stock prices and two for exchange rate variables.

For bivariate cointegration analysis, the estimation results for equations 11 and 12 are reported in Table 4, which shows evidence for cointegration between stock market indices and exchange rates (against JPY) for most GCC countries, except Bahrain and Oman. In addition, there are only two cases of cointegration (Kuwait and Bahrain) between stock prices and exchange rates (against GBP).

Table 4: Results of testing bivariate cointegration: Error correction model

Variables	KWD/GBP	KWD/JPY
Kuwait stock market	−0.0691*	−0.0617*
Saudi stock market	SAR/GBP	SAR/JPY
	−0.0275	−0.0316**
Bahrain stock market	BHD/GBP	BHD/JPY
	−0.0384***	−0.0228
Oman stock market	BHD/GBP	BHD/JPY
	−0.0183	−0.0200
Qatar stock market	QAR/GBP	QAR/JPY
	−0.0243	−0.0357***
UAE stock market	AED/GBP	AED/JPY
	−0.0338	−0.0330***

*,** and ***indicate statistical significance at 1, 5 and 10% respectively

5.5. Granger Causality Testing

Having tested for cointegration, we now test for causality between the exchange rates and stock prices. For this purpose, equations 9 and 10 are estimated. Prior to applying Granger causality tests, we need to select the appropriate lag length for exchange rates and stock prices using the Schwarz Bayesian information criterion. The optimum lag length for testing causality from exchange rates to stock prices (ER→SP) is three for exchange rates and two for stock prices. The optimum lag for testing causality from stock prices to exchange rates is four for stock prices and seven for exchange rates. The results are presented in Tables 5-10.

The findings presented in Tables 5-10 vary according to the market. For instance, it is noticeable that exchange rates cause stock prices

Table 5: Causality between KWD/GBP and Kuwait stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	0.347329	0.230372
Standard error	0.079947	0.080744
t-value	0.473951	0.2853126
ΔSP_{t-1}	−0.139799	−0.121446
Standard error	0.084169	0.083372
t-value	−1.660922*	−1.456672
ΔSP_{t-2}	0.071805	0.087164
Standard error	0.080201	0.078787
t-value	0.895311	1.106330
ΔSP_{t-3}	1.68E-06	25.70501
Standard error	9.62E-07	53.11878
t-value	1.741842	0.483916
ΔSP_{t-4}	0.227883	0.035301
Standard error	0.080108	0.082567
t-value	2.844703	0.427542
ΔER_{t-1}	0.033790	0.081472
Standard error	0.082246	0.082427
t-value	0.410837	0.988417
ΔER_{t-2}		0.186132
Standard error		0.081194
t-value		2.292422
ΔER_{t-3}		−0.070600
Standard error		0.082455
t-value		−0.856228***
ΔER_{t-4}		−0.066886
Standard error		0.082799
t-value		−0.807804
ΔER_{t-5}		−0.113052
Standard error		0.081037
t-value		−1.395068
ΔER_{t-6}		2.47E-05
Standard error		0.000638
t-value		0.038734
ΔER_{t-7}		0.73124
Standard error		0.052681
t-value		1.035428

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 6: Causality between SAR/GBP and Saudi stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	0.296516	0.267574
Standard error	0.079870	0.082910
t-value	3.712473	3.227302
ΔSP_{t-1}	0.044724	0.312538
Standard error	0.083248	0.083074
t-value	0.53724	3.762163***
ΔSP_{t-2}	−0.078794	0.046106
Standard error	0.080681	0.087034
t-value	−0.976613	0.529746
ΔSP_{t-3}	−0.010392	−0.138988
Standard error	0.0101341	0.087739
t-value	−0.1025416	−1.584096
ΔSP_{t-4}		0.138513
Standard error		0.087526
t-value		1.582543
ΔER_{t-1}	0.248715	0.213825
Standard error	0.080157	0.085953
t-value	3.102841	2.487697
ΔER_{t-2}	0.183316	0.050303
Standard error	0.080845	0.086190
t-value	2.26751	0.583629
ΔER_{t-3}		−0.125520
Standard error		0.085886
t-value		−1.461475
ΔER_{t-4}		0.160801
Standard error		0.086449
t-value		1.860056
ΔER_{t-5}		0.085247
Standard error		0.084911
t-value		1.003954
ΔER_{t-6}		−0.081818
Standard error		0.081379
t-value		−1.005387
ΔER_{t-7}		0.312538
Standard error		0.083074
t-value		3.762163

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 7: Causality between BHD/GBP and Bahrain stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	−3.700990	0.000154
Standard error	8.66880	0.00041
t-value	−0.42693	0.37211
ΔSP_{t-1}	0.129544	0.162189
Standard error	0.079047	0.080279
t-value	1.638815	2.020309**
ΔSP_{t-2}	0.061128	0.101389
Standard error	0.080306	0.0822
t-value	0.76119	1.233444
ΔSP_{t-3}	0.094131	−0.000533
Standard error	0.07975	0.078242
t-value	1.180327	−0.006806
ΔSP_{t-4}		0.104801
Standard error		0.076182
t-value		1.375665
ΔER_{t-1}	0.193082	0.206087
Standard Error	0.079704	0.083429
t-value	2.422503	2.470219
ΔER_{t-2}	0.161186	0.18201
Standard error	0.08019	0.084792
t-value	2.010048	2.146539
ΔER_{t-3}		0.064252
Standard error		0.085395
t-value		0.752413
ΔER_{t-4}		−0.094747
Standard error		0.085582
t-value		−1.107083
ΔER_{t-5}		0.129989
Standard error		0.085705
t-value		1.516781
ΔER_{t-6}		0.096573
Standard error		0.084509
t-value		1.142752
ΔER_{t-7}		−0.080484
Standard error		0.081552
t-value		−0.986936

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 8: Causality between OMR/GBP and Oman stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	9.747781	−7.28E-05
Standard error	19.5391	0.00037
t-value	0.49889	−0.19596
ΔSP_{t-1}	0.35667	0.287679
Standard error	0.080633	0.084583
t-value	1.423349***	3.40114***
ΔSP_{t-2}	0.355095	0.416093
Standard error	0.083239	0.089068
t-value	4.265972	4.671612
ΔSP_{t-3}	−0.109303	0.01577
Standard error	0.088955	0.096761
t-value	−1.228808	0.162983

(Contd...)

Table 8: *(Continued)*

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
ΔSP_{t-4}		−0.16057
Standard error		0.09718
t-value		−1.652292*
ΔER_{t-1}	0.078991	0.104701
Standard error	0.080314	0.084358
t-value	0.983527	1.241147
ΔER_{t-2}	0.096479	0.103749
Standard error	0.076757	0.084122
t-value	1.256946	1.233309
ΔER_{t-3}		0.068678
Standard error		0.083857
t-value		0.818991
ΔER_{t-4}		−0.1506
Standard error		0.082193
t-value		−1.832288
ΔER_{t-5}		0.160768
Standard error		0.083339
t-value		1.929084
ΔER_{t-6}		0.115907
Standard error		0.079744
t-value		1.453502
ΔER_{t-7}		0.009253
Standard error		0.076876
t-value		0.120326

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 9: Causality between QAR/GBP and Qatar stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	39.53891	0.000158
Standard error	42.8499	0.00400
t-value	0.92273	0.03956
ΔSP_{t-1}	0.232856	0.304232
Standard error	0.079099	0.08316
t-value	2.943854***	3.658398***
ΔSP_{t-2}	−0.156276	−0.256917
Standard error	0.079807	0.086704
t-value	−1.958183	−2.963160
ΔSP_{t-3}	0.174966	0.276504
Standard error	0.08153	0.090047
t-value	2.146037	3.070668
ΔSP_{t-4}		
Standard error		
t-value		
ΔER_{t-1}	0.197125	0.197722
Standard error	0.080183	0.083538
t-value	2.458427	2.366864
ΔER_{t-2}	0.144719	0.150713
Standard error	0.079162	0.084855
t-value	1.828138	1.776131
ΔER_{t-3}		0.074347
Standard error		0.085483
t-value		0.869728
ΔER_{t-4}		−0.076821
Standard error		0.084970
t-value		−0.904104

(Contd...)

Table 9: *(Continued)*

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
ΔER_{t-5}		0.174406
Standard error		0.086536
t-value		2.015414
ΔER_{t-6}		0.012782
Standard error		0.085951
t-value		0.148713
ΔER_{t-7}		−0.000714
Standard error		0.081475
t-value		−0.008761

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 10: Causality between AED/GBP and UAE stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	0.000482	0.000519
Standard error	0.00380	0.00385
t-value	0.12673	0.13478
ΔSP_{t-1}	0.195864	0.250195
Standard error	0.08198	0.08662
t-value	2.391493	2.888402***
ΔSP_{t-2}	0.077819	0.026562
Standard error	0.083096	0.088833
t-value	0.936502	0.299007
ΔSP_{t-3}	−0.06684	−0.070113
Standard error	0.082778	0.087808
t-value	−0.806975	−0.79848
ΔSP_{t-4}		0.031228
Standard error		0.086812
t-value		0.359719
ΔER_{t-1}	0.255888	0.289352
Standard error	0.081874	0.08723
t-value	3.125385	3.317107
ΔER_{t-2}	0.16472	0.171526
Standard error	0.080946	0.089527
t-value	2.034936	1.915913
ΔER_{t-3}		0.04991
Standard error		0.088778
t-value		0.562192
ΔER_{t-4}		−0.122078
Standard error		0.087677
t-value		−1.392371
ΔER_{t-5}		0.178078
Standard error		0.089463
t-value		1.990517
ΔER_{t-6}		0.064405
Standard error		0.089683
t-value		0.718137
ΔER_{t-7}		−0.054068
Standard error		0.085741
t-value		−0.630602

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

for all GCC countries, while stock prices cause exchange rates only in Kuwait and Oman. That is, there is only unidirectional causality between stock prices and exchange rates. The empirical

Table 11: Causality between KWD/JPY and Kuwait stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	5.28E-05	4.767954
Standard error	(9.8E-05)	(1.18868)
t-value	[0.53992]	[4.01115]
ΔSP_{t-1}	−0.367425	−0.6414756
Standard error	(0.16136)	(0.196203)
t-value	[−2.27698]	[−0.32695]*
ΔSP_{t-2}	1.327657	−0.3283157
Standard error	(0.16066)	(1.953487)
t-value	[8.26365]	[−0.16807]
ΔSP_{t-3}		−0.457872
Standard error		(0.15652)
t-value		[−2.92539]
ΔSP_{t-4}		1.214697
Standard error		(0.15934)
t-value		[7.62346]
ΔER_{t-1}	−0.2013685	0.921561
Standard error	(0.028023)	(0.25236)
t-value	[−0.71858]	[3.65181]
ΔER_{t-2}	−0.3461329	0.019620
Standard error	(0.2814872)	(0.25349)
t-value	[−0.12297]	[0.07740]
ΔER_{t-3}	0.716843	−1.88E-09
Standard error	(0.22691)	(2.0E-08)
t-value	[3.15921]	[−0.09211]
ΔER_{t-4}	5.28E-05	2.58E-08
Standard error	(9.8E-05)	(2.0E-08)
t-value	[0.53992]	[1.28371]
ΔER_{t-5}		−2.29E-05
Standard error		(0.00015)
t-value		[−0.15048]
ΔER_{t-6}		−0.305622
Standard error		(0.22287)
t-value		[−1.37127]
ΔER_{t-7}		0.716843
Standard error		(0.22691)
t-value		[3.15921]

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

results of the Granger causality test between stock prices and exchange rates (in terms of JPY) are reported in Tables 11-16. The results show that bidirectional causality exists between stock prices and exchange rates in the case of Oman. In addition, exchange rates cause stock prices in the case of Kuwait—that is, only unidirectional causality is detected between exchange rates and stock prices.

6. CONCLUSION

In this paper, we estimated the relationship between exchange rates and stock prices in GCC countries during the period 2000-2013. The empirical results show that there is cointegration between stock prices and exchange rates in Kuwait, Bahrain and Oman. The Granger causality test reveals that exchange rates (in terms of GBP) cause stock prices in all GCC countries, while stock prices cause exchange rates in Oman and Kuwait. In contrast,

Table 12: Causality between SAR/JPY and Saudi stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	36.77025	−4.89E-09
Standard error	(57.8174)	(5.5E-09)
t-value	[0.63597]	[−0.88474]
ΔSP_{t-1}	−0.024197	−3.69E-08
Standard error	(0.01568)	(2.9E-08)
t-value	[−1.54332]	[−1.25360]
ΔSP_{t-2}	0.016814	−2.69E-08
Standard error	(0.08341)	(3.0E-08)
t-value	[0.20158]	[−0.91058]
ΔSP_{t-3}		0.007456
Standard error		(0.08188)
t-value		[0.09106]
ΔSP_{t-4}		0.033673
Standard error		(0.08666)
t-value		[0.38857]
ΔER_{t-1}	−0.0853253	0.035290
Standard error	(0.0234120)	(0.08686)
t-value	[−0.03645]	[0.40631]
ΔER_{t-2}	0.2013063	0.012486
Standard error	(0.238157)	(0.08446)
t-value	[0.84527]	[0.14784]
ΔER_{t-3}	−302040.5	−0.000162
Standard error	(238300)	(0.00014)
t-value	[−1.26748]	[−1.16729]
ΔER_{t-4}		0.023265
Standard error		(0.08420)
t-value		[0.27631]
ΔER_{t-5}		−0.057090
Standard error		(0.08472)
t-value		[−0.67388]
ΔER_{t-6}		0.012486
Standard error		(0.08446)
t-value		[0.14784]
ΔER_{t-7}		−0.018250
Standard error		(0.08328)
t-value		[−0.21913]

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 13: Causality between BHD/JPY and Bahrain stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	0.130691	−0.031977
Standard error	(11.2594)	(0.01740)
t-value	[0.01161]	[−1.83785]
ΔSP_{t-1}	−0.514757	0.069744
Standard error	(0.455765)	(0.08117)
t-value	[−1.12944]	[0.85925]
ΔSP_{t-2}	5.503609	0.020995
Standard error	(1.448345)	(0.08251)
t-value	[0.12275]	[0.25444]
ΔSP_{t-3}		5.44E-09
Standard error		(3.1E-09)
t-value		[1.72586]

(Contd...)

Table 13: *(Continued)*

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
ΔSP_{t-4}		−1.43E-08
Standard error		(1.5E-08)
t-value		[−0.98460]
ΔER_{t-1}	0.125134	−0.000162
Standard error	(0.505398)	(9.8E-05)
t-value	[2.47595]	[−1.65344]
ΔER_{t-2}	0.910137	0.067713
Standard error	(0.435751)	(0.08436)
t-value	[0.20886]	[0.80265]
ΔER_{t-3}	−4.057886	0.009255
Standard error	(4.467720)	(0.08650)
t-value	[−0.90827]	[0.10700]
ΔER_{t-4}		−0.001235
Standard error		(0.08640)
t-value		[−0.01429]
ΔER_{t-5}		0.068466
Standard error		(0.08694)
t-value		[0.78753]
ΔER_{t-6}		−0.004730
Standard error		(0.08712)
t-value		[−0.05430]
ΔER_{t-7}		−0.013042
Standard error		(0.08635)
t-value		[−0.15104]

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 14: Causality between OMR/JPY and Oman stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	−0.037605	3.48E-09
Standard error	(0.01586)	(1.1E-09)
t-value	[−2.37140]	[3.04372]
ΔSP_{t-1}	0.313088	−1.49E-08
Standard error	(0.08924)	(6.4E-09)
t-value	[3.50840]	[−2.31720]
ΔSP_{t-2}	0.099244	−5.28E-09
Standard error	(0.08921)	(6.4E-09)
t-value	[1.11242]*	[−0.82166]
ΔSP_{t-3}		−0.004875
Standard error		(0.08133)
t-value		[−0.05995]
ΔSP_{t-4}		−0.021364
Standard error		(0.08285)
t-value		[−0.25786]
ΔER_{t-1}	0.550672	−0.034960
Standard error	(0.08701)	(0.09769)
t-value	[6.32914]	[−0.35787]
ΔER_{t-2}	0.246060	−0.154688
Standard error	(0.09041)	(0.09834)
t-value	[2.72170]	[−1.57300]
ΔER_{t-3}		−0.181476
Standard error		(0.09069)
t-value		[−2.00101]
ΔER_{t-4}		0.082297
Standard error		(0.08722)
t-value		[0.94360]

(Contd...)

Table 14: *(Continued)*

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
ΔER_{t-5}		−2.300071
Standard error		(31.0742)
t-value		[−0.07402]*
ΔER_{t-6}		0.055102
Standard error		(0.08547)
t-value		[0.64469]
ΔER_{t-7}		0.056374
Standard error		(0.08558)
t-value		[0.65870]

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

Table 15: Causality between QAR/JPY and Qatar stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags length	n_1=3 and n_2=2 dependent variable ΔSP	n_1=7 and n_2=4 dependent variable ΔER
C	92.97477	7.02E-05
Standard error	(56.0414)	(2.2E-05)
t-value	[1.65904]	[3.16410]
ΔSP_{t-1}	0.163994	0.082804
Standard error	(0.07894)	(0.08277)
t-value	[2.07750]	[1.00043]*
ΔSP_{t-2}	−0.062781	0.021193
Standard error	(0.08072)	(0.08292)
t-value	[−0.77775]	[0.25557]
ΔSP_{t-3}		0.093090
Standard error		(0.08100)
t-value		[1.14932]
ΔSP_{t-4}		−5.05E-08
Standard error		(3.1E-08)
t-value		[−1.61537]
ΔER_{t-1}	0.125032	−0.002375
Standard error	(0.08408)	(0.00410)
t-value	[1.48704]	[−0.57923]
ΔER_{t-2}	−0.071693	0.076772
Standard error	(0.08397)	(0.08503)
t-value	[−0.85382]	[0.90288]
ΔER_{t-3}		0.003278
Standard error		(0.08698)
t-value		[0.03768]
ΔER_{t-4}		0.069323
Standard error		(0.08590)
t-value		[0.80706]
ΔER_{t-5}		−0.015465
Standard error		(0.08604)
t-value		[−0.17974]
ΔER_{t-6}		0.123204
Standard error		(0.08533)
t-value		[1.44386]
ΔER_{t-7}		0.165460
Standard error		(0.08416)
t-value		[1.96613]

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

the empirical evidence indicates that exchange rates (in terms of JPY) cause stock prices in Kuwait, while there is only one case of bidirectional causality between stock prices and exchange rates (in the case of Oman).

Table 16: Causality between AED/JPY and UAE stock prices

Variables	Stock price cause exchange rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange rate cause stock price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal lags	n_1=3 and n_2=2	n_1=7 and n_2=4
length	dependent variable ΔSP	dependent variable ΔER
C	27.16355	7.00E-05
Standard error	(24.4232)	(2.1E-05)
t-value	[1.11220]	[3.37247]
ΔSP_{t-1}	−0.006813	−0.038392
Standard error	(0.08051)	(0.01787)
t-value	[−0.08463]	[−2.14852]
ΔSP_{t-2}	0.103161	0.175902
Standard error	(0.08126)	(0.07986)
t-value	[1.26955]	[2.20259]
ΔSP_{t-3}		0.103161
Standard error		(0.08126)
t-value		[1.26955]
ΔSP_{t-4}		0.148738
Standard error		(0.08078)
t-value		[1.84136]
ΔER_{t-1}	−0.015916	−0.000243
Standard error	(0.08370)	(0.00128)
t-value	[−0.19015]	[−0.19004]
ΔER_{t-2}	0.102833	0.154604
Standard error	(0.08369)	(0.08458)
t-value	[1.22870]	[1.82781]
ΔER_{t-3}		0.031311
Standard error		(0.08598)
t-value		[0.36416]
ΔER_{t-4}		0.009312
Standard error		(0.08502)
t-value		[0.10953]
ΔER_{t-5}		0.036459
Standard error		(0.08486)
t-value		[0.42963]
ΔER_{t-6}		−0.057951
Standard error		(0.08518)
t-value		[−0.68033]
ΔER_{t-7}		0.101481
Standard error		(0.08471)
t-value		[1.19803]

*, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively

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