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Stock and exchange rate movements in the MENA countries: A Markov Switching –VAR Model

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Abstract

Purpose — This article explores the causal link between stock and currency returns in The Middle Eastern and North African (MENA) countries from January 2011 through February 2020.

Methods — This study uses the Vector autoregressive (VAR) and the Markov switching vector autoregressive (MS-VAR) models to investigate the dynamic causality between equity and exchange rate markets.

Findings — Results indicate that this relation depends on the state of the markets. Furthermore, generally, equity returns have a significant impact on the currency markets, whatever the market state.

Implication — Regime shifts in the relationship between stock and exchange rate markets are significant for portfolio allocation because they help investors improve their investment decisions through knowledge of the dynamic link between these markets.

Originality — This study adds to the literature on the relationship between exchange rates and stock prices in the MENA countries, which have become attractive destinations for international investors due to their higher returns.

Keywords — Exchange rate, Stock market, VAR, Markov Switching VAR.

Introduction

The exchange rate controls the price of one money against another and has a major role in international finance and politics (S. Vogler, Schneider, & Zimmermann, 2019). Its crucial role in trade repeatedly puts it at the center of policy discussions. Simultaneously, stocks are the principal negotiated instruments because they are the easiest to trade and offer high returns (Syahri & Robiyanto, 2020). Thus, we can expect that excessive investment in the equity markets will lead to a rise in the demand and supply of currencies and, consequently, an interrelation between the exchange rate and stock price (Hung, 2022). Thus, it is interesting for researchers, practitioners, and policymakers to explore the dynamic connection between the equity and currency markets.

This linkage could allow policymakers to formulate appropriate policies before the crisis spreads. A link between those two markets would significantly affect economic policy and international capital planning decisions. The negative innovations that affect one market can be quickly transmitted to another through contagion effects (Chkili & Nguyen, 2014). As well as the above, the necessity of a better understanding of the financial system should be noted, especially during periods of high volatility, which can destabilize the financial system (Blau, 2018).

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Referring to the theory on the link between these two macro variables, we distinguish between two approaches. The first is the flow-oriented model implemented by Dornbusch and Fischer (1980). They consider that the exchange rate acts on the stock market prices. The second is the stock-oriented approach, defined by Branson (1981) and Frankel (1983). It states that changes in equity market prices affect exchange rates. According to the flow-oriented model, causality runs from the currency to the equity market. From this perspective, the fluctuations in the exchange rate affect international competitiveness and the trade balance. Indeed, an exchange rate appreciation implies an enhancement of the foreign currency against the domestic currency. Due to the devaluation of the national currency, the increase in exports leads to greater competitiveness. This leads to an appreciation of stock prices, which are the present value of a firm's future cash flows. For example, Aggarwal (1981) was the first to determine the interrelation between both markets in the post-Bretton Woods era, with monthly data on U.S. stock prices and effective exchange rates from 1974 to 1978. Using simple regressions, he found that equities and the value of the U.S. dollar are positively related.

Dahir, Mahat, Ab Razak, and Bany-Ariffin (2018) use the wavelet approach to examine the same relation in BRICS countries. Their findings concluded that stock markets and foreign exchange markets are strongly interconnected. Mroua and Trabelsi (2020) examine the dynamic and causal link between the U.S. dollar and the major stock indices of the BRICS nations (Brazil, Russia, India, China, and South Africa). Their findings show that exchange rate variations affect short- and long-run equity returns in every country. Salisu, Cuñado, Isah, and Gupta (2021) developed a model to study whether the differences in equity returns are predictable for BRICS exchange rates. They discovered a positive link for three of the BRICS nations: Brazil, India, and South Africa. Their findings confirm the persistence of the traditional approach of Dornbusch and Fischer (1980).

The portfolio balance and the monetary models are two sub-models of the stock-oriented approach. The portfolio balance approach (e.g., Branson (1981); Frankel (1983)) assumes that changes in the equity market affect the foreign exchange rates. A rising domestic stock price leads to a higher domestic currency with a higher interest rate, which in turn, conducts a lower exchange rate. For example, using the MS-VAR method, Korley and Giouvris (2021) explore the dynamic relationships between currency and stock price returns in sub-Saharan African (SSA) countries during higher and lower volatility periods.

Xie, Chen, and Wu (2020) examine the link between the two markets for twenty advanced and six emerging economies from January 1, 1998, to May 20, 2019, using symmetric and asymmetric bootstrap panels for Granger non-causality tests. In both periods, their outcomes show a significant causal connection between the stock and exchange rate markets. Their conclusions point to the interdependence of the equity and currency markets. This implies the transmission of a shock from one country to another.

As per the monetary approach, there is no relationship between the exchange rate and equity markets (when common factors affect the two variables). The foreign exchange rate is viewed as a relative asset price determined by expected future exchange rates (Gavin, 1989). Franck and Young (1972) are the pioneers to discover no link between the FX rate and the US stock market.

Research on the linkage between foreign currency and equity markets is limited in the MENA region. For example, Moussa and Delhoumi (2021) look at how equities, interest rates, and currency values interact in five MENA nations (Tunisia, Morocco, Egypt, Turkey, and Jordan) from June 1998 to June 2018. The Nonlinear Autoregressive Distributed Lag (NARDL) model shows that the stock index returns in the MENA region are associated with the currency and the real interest rate. Ahmed (2018) describes the link between exchange rates and equity markets in the MENA area from 2004 to 2015. Using the VECH (generalized autoregressive conditional heteroskedasticity)-GARCH model, he shows that the asymmetric relationship between these markets is more relevant in the post-2008 financial crises than in the pre-2008 financial crises. Mechri, de Peretti, and Hamad (2022) used GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model and multiple linear regression to study the interaction between equity prices and foreign exchange rates in two MENA countries. They also compare the outcomes of the multiple regressions to those of an artificial neural network (ANN). Their results show that currency fluctuation greatly impacted equity market movements in Tunisia and Turkey. Ahmed (2019) analyzes the relationship between EGP/USD and the EGX100 index using a nonlinear distributed lag autoregressive model. He found that the currency exchange rate seems to impact equity returns in the short and long term.

Political shocks majorly impact the linkages between economic variables and can cause nonlinearities in their evolution (Arouri, Estay, Rault, & Roubaud, 2016). Referring to Salisu and Ndako (2018) and Tiryaki, Ceylan, and Erdoğan (2019), the connection between the currency exchange rates and the equity market returns requires a nonlinear framework to capture financial market volatility and structural shifts. Our study contributes to knowledge in this field and employs a dynamic strategy to explore these marketplaces, especially in the MENA region.

In previous decades, MENA economies have become attractive destinations for international investors and offer better returns[1].Referring to El-Masry and Badr (2020), foreign exchange and stock markets represent the most sensitive segments of the financial system. They are considered a barometer of a country's economic health. Thus, knowledge about the dynamic interconnectedness between foreign exchange rates and equity markets is particularly important for MENA portfolio managers. For this reason, our focus in this paper is to determine the causal relationship between foreign exchange rates and stock returns in twelve MENA countries, namely Bahrain, Kuwait, Lebanon, Qatar, Oman, Morocco, Jordan, Tunisia, Turkey, Saudi Arabia, the United Arab Emirates (U.A.E.), and Egypt in the presence of regime shift. We follow earlier studies and consider a two-state MS model; calm and crisis regimes (Chkili & Nguyen, 2014; Hung, 2022; Kanas, 2005; Korley & Giouvris, 2021; Sosa, Ortiz, & Cabello, 2018).

This study differs from earlier research in several respects. First, the Arab Spring justifies the choice of the Markov switching model. "The largest refugee catastrophe since World War II," following the World Bank. Due to its economic and social ramifications, a major political event such as this has the potential to hugely influence equity market volatility (Chau, Deesomsak, & Wang, 2014). After the Arab uprising, the MENA region's equity and currency markets have become the focus of investors' attention in the coverage of risks. In this context, the causal linkage between these markets is explained from January 2011 to February 2020. Second, this study contributes to investigating the stock price-exchange rates literature by using the Markov switching vector autoregressive (MS-VAR) model to study the interactions between the two markets across different regimes. Indeed, the coefficients of this model are market-state-dependent. Third, we use oil price as a control variable. It is considered an important factor in determining the terms of trade (Raji, Abdulkadir, & Badru, 2018). According to World Atlas[2], the MENA region contains approximately 60% of the world's oil reserves and 45 % of the world's natural gas reserves. According to Lütkepohl (1982), omitting variables leads to biased and inappropriate results about this linkage. Indeed, oil prices affect the MENA economy's stock and exchange rate markets differently. For example, the Arab Spring led to oil price shocks, while the dynamic change in oil prices led to a decline in equity and currency markets (Bildirici & Turkmen, 2015).

Methods

We first consider the linear VAR model. The relationship between foreign exchange and equity returns can be captured using this model as they change through time. Before estimation, we test the stationary of the different variables under study using the Augmented Dickey-Fuller (ADF) Unit Root Test. We also use the minimum Schwarz criterion to identify the optimal delay length for the model VAR. Results of the linear model estimation are provided in Table 2. Second, we review the nonlinear interactions between stock markets, currency exchange rates, and crude oil to report on possible structural breaks and regime changes. Table 4 shows the evaluation of the parameters of the MS-VAR model.

[1]https://www.oecd.org/mena/competitiveness/36086643.pdf
[2]https://www.worldatlas.com/

The linear Vector Autoregressive (VAR) model

We apply a VAR model to understand each country's linear interdependencies between exchange and equity returns. Given the objectives of our study, the VAR model helps us chart the interrelationships between variables in the system. The VAR model used in this survey is expressed as follows:

$$SP_t = \text{Int}_1 + \sum_{i=1}^{n} \alpha_{1i}\, SP_{t-i} + \sum_{i=1}^{n} \alpha_{2i}\, ER_{t-i} + \sum_{i=1}^{n} \alpha_{3i}\, CO_{t-i} + \varepsilon_{1t} \tag{1}$$

$$ER_t = \text{Int}_2 + \sum_{i=1}^{n} \alpha_{4i}\, ER_{t-i} + \sum_{i=1}^{n} \alpha_{5i}\, SP_{t-i} + \sum_{i=1}^{n} \alpha_{6i}\, CO_{t-i} + \varepsilon_{2t} \tag{2}$$

SP and ER denote each MENA country's equity and exchange rate returns, respectively. CO is the crude oil return.$\varepsilon_{1t}$and$\varepsilon_{2t}$are the vectors of error terms.

The nonlinear Markov-Switching Vector Autoregressive (MS-VAR) model

The MS-VAR model can predict the connection between the equity price and foreign exchange over time, given a specific transition probability. This model was created in its original form by Krolzig (1997) and can be stated as follows:

$$SP_t = \text{Int}_1(S_t) + \sum_{j=1}^{p} a_{1j}(S_t)\, SP_{t-j} + \sum_{j=1}^{p} a_{2j}(S_t)\, ER_{t-j} + \sum_{j=1}^{p} a_{3j}(S_t)\, CO_{t-j} + \varepsilon_{1t} \tag{3}$$

$$ER_t = \text{Int}_2(S_t) + \sum_{j=1}^{p} a_{4j}(S_t)\, ER_{t-j} + \sum_{j=1}^{p} a_{5j}(S_t)\, SP_{t-j} + \sum_{j=1}^{p} a_{6j}(S_t)\, CO_{t-j} + \varepsilon_{2t} \tag{4}$$

S_t is an unobservable variable tested by a second-order Markov process. It is considered to be a two-state first-order Markov process with a transition probability matrix displayed as follows:

$P_{ij} = P[S_t = j\, / S_{t-1} = i]$ With $\sum_{j=1}^{2} p_{ij} = 1$ for all i, j$\epsilon\{1,2\}$

$$P=\begin{bmatrix} P_{11} & P_{21} \\ P_{12} & P_{22} \end{bmatrix} \text{ where } \begin{cases} P_{11} = P[S_t = 1/S_{t-1} = 1] \\ P_{12} = 1 - P_{11} = P[S_t = 2/S_{t-1} = 1] \\ P_{21} = 1 - P_{22} = [S_t = 1/S_{t-1} = 2] \\ P_{22} = P[S_t = 2/S_{t-1} = 2] \end{cases} \tag{5}$$

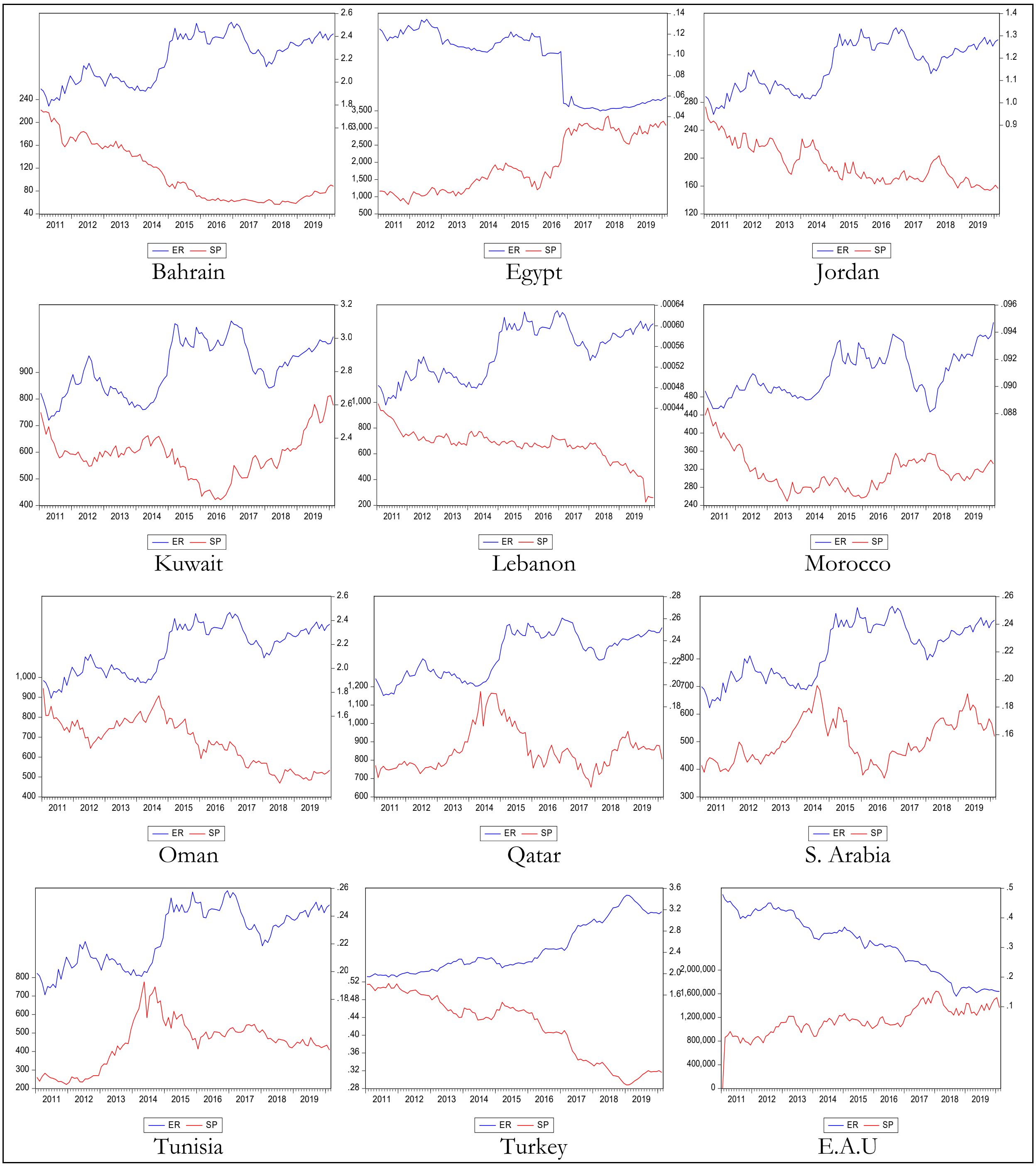
Furthermore, the transition probabilities give us information about the expected duration, which is the time required for the system to remain in a specific regime. Therefore, the expected duration is specified as follows:

$$E(d)=\frac{1}{1-P_{ij}} \text{, where i =1,2 ; j=1,2} \tag{6}$$

Data description

This paper utilizes monthly data for twelve MENA countries, namely, Bahrain, Jordan, Kuwait, Lebanon, Saudi Arabia, Qatar, Oman, Morocco, Tunisia, Turkey, U.A.E., and Egypt, from January 2011 to February 2020. Stock price indices expressed in local currencies are obtained from the MSCI (Morgan Stanley Capital International) database. The crude oil price in the U.S. dollar per barrel and the nominal exchange rates in local currency against the euro are from the DataStream. Monthly returns are calculated using the difference in the logarithm of two successive prices. They are then multiplied by 100.

Descriptive statistics for all data sets are summarized in Table 1. Panel A of Table 1 shows that Egypt has the highest mean stock market return with a value of (0.801). Lebanon has the lowest (-1.147). Concerning volatility, the Moroccan stock return has the lowest standard deviation (3.340), while the UAE equity market has the highest volatility (7.057). Currency exchange rate volatility varies from (0.423) for Morocco to (2.626) for Egypt. Panel B of table 1 shows that Tunisia seems to have suffered the largest currency losses, while Turkey experienced the most volatile currency changes during the sample period.



Notes: The figure displays the historical time series of the stock price index and exchange rate of the twelve MENA markets.

Figure 1. Time series of the data

Table 1. Descriptive statistics

	Mean	Std. Dev.	Skewness	Kurtosis	J.B.	Prob.	ADF (t-stat.)	Prob.	LB²	Prob.
Panel A: Stock market index returns										
Bahrain	-0.860	4.971	-0.202	4.249	7.898	0.019	-11.012	0.000	6.1223	0.634
Egypt	0.801	5.923	0.185	2.348	2.573	0.276	-10.340	0.000	19.044	0.015
Jordan	-0.834	3.940	0.255	2.763	1.451	0.484	-11.228	0.000	7.1820	0.517
Kuwait	-0.042	4.125	0.206	2.797	0.964	0.617	-8.944	0.000	12.230	0.141
Lebanon	-1.147	3.416	0.057	2.569	0.911	0.634	-11.500	0.000	6.9107	0.546
Morocco	-0.204	3.340	0.090	2.649	0.713	0.700	-10.024	0.000	7.2121	0.514
Oman	-0.364	3.991	-0.224	3.126	0.989	0.610	-12.084	0.000	14.478	0.070
Qatar	0.394	4.279	0.048	2.837	0.164	0.921	-9.266	0.000	18.631	0.017

	Mean	Std. Dev.	Skewness	Kurtosis	J.B.	Prob.	ADF (t-stat.)	Prob.	LB²	Prob.
Panel A: Stock market index returns										
S. Arabia	0.082	4.947	-0.143	3.245	0.652	0.722	-8.761	0.000	12.564	0.128
Tunisia	0.206	3.453	-0.303	3.605	3.358	0.187	-9.196	0.000	11.294	0.186
Turkey	0.479	6.375	-0.087	2.268	2.592	0.274	-11.178	0.000	5.6477	0.687
U.A.E	0.335	7.057	-0.269	5.011	19.869	0.000	-12.569	0.000	27.971	0.000
Panel B: Exchange rate returns										
Bahrain	0.179	2.294	0.498	3.429	5.390	0.068	-11.390	0.000	12.013	0.151
Egypt	-0.206	2.626	-0.577	4.829	21.436	0.000	-9.084	0.000	13.794	0.087
Jordan	0.017	2.083	0.134	2.594	1.088	0.580	-10.633	0.000	16.700	0.033
Kuwait	0.069	1.361	0.146	3.359	0.978	0.613	-7.688	0.000	11.881	0.157
Lebanon	0.179	2.295	0.501	3.435	5.474	0.065	-11.397	0.000	12.076	0.148
Morocco	0.031	0.423	0.077	2.703	0.511	0.775	-8.036	0.000	15.389	0.052
Oman	0.179	2.294	0.501	3.438	5.474	0.065	-11.395	0.000	12.124	0.146
Qatar	0.175	1.768	0.415	3.588	4.735	0.094	-7.687	0.000	10.953	0.204
S. Arabia	0.129	2.200	0.349	3.172	2.365	0.307	-11.869	0.000	24.411	0.002
Tunisia	0.453	1.613	-0.075	3.815	3.149	0.207	-8.372	0.000	21.691	0.006
Turkey	-0.874	2.325	0.081	2.265	2.601	0.272	-7.678	0.000	24.353	0.002
U.A.E	0.179	2.295	0.501	3.435	5.472	0.065	-11.398	0.000	12.086	0.147
Panel C: Crude Oil price changes										
	-0.429	9.469	-0.022	3.408	0.771	0.680	-9.963	0.000	13.538	0.095

Notes: Jarque-Bera (JB) is a normality test statistic. In the squares of the returns up to the eight orders, LB is the Ljung–Box Q-statistic. The Augmented Dickey-Fuller unit root tests (ADF) are a type of unit root test.

Results and Discussion

Linear VAR model results

Table 2. Linear VAR estimation results

	Bahrain		Egypt		Jordan		Kuwait		Lebanon		Morocco	
	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER
Intercept	-0.877	0.266	0.808	-0.160	-0.540	0.203	-0.098	0.055	-1.293	0.151	-0.505	-0.036*
	(0.489)	(0.222)	(0.585)	(0.255)	(0.420)	(0.223)	(0.394)	(0.126)	(0.348)	(0.233)	(0.351)	(0.052)
SP_{t-1}	-0.014	0.069**	-0.006*	0.023**	-0.174*	-0.024**	0.175*	0.032**	-0.088*	-0.058*	0.172*	0.006**
	(0.104)	(0.047)	(0.099)	(0.043)	(0.096)	(0.051)	(0.098)	(0.032)	(0.097)	(0.065)	(0.096)	(0.014)
ER_{t-1}	0.196	-0.074*	0.024	0.153*	-0.234	-0.117*	0.028	0.266*	0.047	-0.114*	0.068	0.222*
	(0.218)	(0.099)	(0.224)	(0.097)	(0.187)	(0.099)	(0.293)	(0.094)	(0.147)	(0.098)	(0.656)	(0.098)
CO_{t-1}	0.039*	-0.023**	-0.010*	0.008**	0.046*	-0.021**	0.013**	-0.013**	-0.028**	-0.012**	-0.035**	0.005***
	(0.054)	(0.024)	(0.062)	(0.027)	(0.053)	(0.028)	(0.042)	(0.013)	(0.035)	(0.024)	(0.044)	(0.007)
Log-likelihood	-328.780		-348.543		-929.552		-883.808		-925.802		-753.229	

	Oman		Qatar		S. Arabia		Tunisia		Turkey		U.A.E	
	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER
Intercept	-0.609	0.245	0.301	0.131	0.122	0.173	0.278	0.346	0.400	-0.683	0.582	0.211
	(0.397)	(0.222)	(0.415)	(0.165)	(0.475)	(0.212)	(0.322)	(0.160)	(0.669)	(0.224)	(0.671)	(0.223)
SP_{t-1}	-0.210*	0.064**	0.117*	0.009**	0.148*	-0.015**	0.159*	0.010**	-0.067	0.061**	-0.226	0.009**
	(0.095)	(0.053)	(0.099)	(0.040)	(0.099)	(0.044)	(0.090)	(0.045)	(0.103)	(0.035)	(0.101)	(0.033)
ER_{t-1}	0.194	-0.108*	0.164	0.260*	-0.164	-0.136*	-0.059	0.214*	-0.058	0.251*	-0.396	-0.098
	(0.176)	(0.098)	(0.236)	(0.094)	(0.217)	(0.097)	(0.195)	(0.097)	(0.276)	(0.093)	(0.305)	(0.101)
CO_{t-1}	0.151*	-0.028**	-0.060**	-0.026**	-0.004*	0.002**	-0.068**	-0.007**	-0.107*	-0.058**	0.034*	-0.014**
	(0.051)	(0.029)	(0.045)	(0.018)	(0.052)	(0.023)	(0.033)	(0.017)	(0.066)	(0.022)	(0.073)	(0.024)
Log-likelihood	-922.574		-915.059		-955.752		-881.790		-982.563		-995.011	

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 2 shows the findings of the VAR model. This table shows the coefficient estimates relating a set of current returns to a period of lagged returns between currency exchange rates and equities prices, suggesting some predictability of these markets based on returns. There is unidirectional causality from equity to foreign exchange rates in all nations in the sample. Consequently, all countries adhere to the portfolio approaches. These findings can be interpreted as the outcome of the effect of equity on the foreign exchange due to the increase in inflation expectations induced by stock markets, which puts pressure on the domestic currency. The local currency appreciates as a finding of the demand pressure. These results support Xie et al. (2020); Andriansyah and Messinis (2019), which provided evidence for this approach. As presented in Table 3, the crude oil coefficient is significant for all exchange rate markets. This can be construed as the rise in oil prices trade has put pressure on the current account and led to exchange rate fluctuations (Bal & Rath, 2015).

Moreover, all stock prices are significantly impacted by crude oil. This implies that MENA stocks are sensitive to crude oil price movements. The results discussed below, however, are flawed in that they were derived from the estimation of a linear model, where the parameters are assumed to be constant, and they do not account for regime changes that could lead to fluctuating levels of uncertainty in a regime. We then allow nonlinear interactions between two financial markets.

Regime-shifting behavior of stock markets in MENA countries

Before applying the MS-VAR method, we check whether stock returns exhibit regime-switching behavior. For this purpose, we use the likelihood ratio test calculated as follows:

$$LR = 2\times \mid lnL_{MS\_AR} - lnL_{AR} \mid \quad (7)$$

Where lnL is the log-likelihood of the competing models (e.g., Hung, 2020; Korley & Giouvris, 2021), the critical values are based on Garcia (1998). Table 3 shows that the LR test statistics are significant at the 1% level in all stock returns. Thus, it is clear that there is solid proof of regime change in MENA stock returns. This outcome agrees with previous studies (see.g., Hung, 2020; Sosa et al., 2018). This behavior is not surprising and can be explained theoretically by the changing economic structure of these markets, especially after the Arab Spring. Al-Muharrami (2015), Chau et al. (2014), and Ghosh (2016) studies consistently show that the Arab Spring protests significantly affect stock market performance.

Table 3. LR test statistic results.

	L(AR)	L(MSR)	LR
Bahrain	-329.402	-319.402	19.754*
Egypt	-348.564	-337.305	22.519*
Jordan	-303.801	-281.127	45.348*
Kuwait	-306.582	-294.648	23.868*
Lebanon	-287.659	-278.083	19.150*
Morocco	-285.532	-274.762	21.539*
Oman	-304.049	-294.695	18.707*
Qatar	-312.609	-300.244	24.730*
S. Arabia	-327.237	-316.372	21.729*
Tunisia	-282.538	-267.153	30.769*
Turkey	-355.943	-342.027	27.832*
U.A.E	-365.183	-354.490	21.386*

Notes: Critical value of Garcia (1998) is 17.52 for α=1%. "*" Denotes significance at 1% level.

Dynamic relationships between equity and currency markets

Table 4 shows the MS-VAR estimation results, which explicitly analyze the interactions between currency exchange rates and equity returns in MENA countries. Volatilities are higher in regime 2 compared to regime 1. These outcomes indicate that the first regime can be described as a "calm regime" and the second "crisis regime. The crisis regime (regime 2) is more enduring than the first one for most markets. Indeed, the average duration $E(d_2)$ of the crisis regime is higher than that of the calm regime (regime 1) in most countries (equation 6). Table 4 also shows that the coefficient estimates are more significant, especially under quiet conditions. In this earlier regime, the impact of equity returns on currency movements is significant for Egypt, the UAE, Tunisia, and Turkey.

Table 4. Estimation results of the MS-VAR model.

	Bahrain		Egypt		Jordan		Kuwait	
	SP	ER	SP	ER	SP	ER	SP	ER
	Calm regime							
$\boldsymbol{Intercept_1}$	-0.05	0.05	1.45	0.8***	-1.02*	-0.11	-0.34	0.02
	(0.89)	(0.83)	(0.19)	(0.00)	(0.09)	(0.82)	(0.38)	(0.85)
$\boldsymbol{SP_{t-1}}$	-0.01	0.03	-0.02	0.11**	0.58***	0.15	0.32***	0.03
	(0.98)	(0.59)	(0.92)	(0.02)	(0.00)	(0.21)	(0.00)	(0.36)
$\boldsymbol{ER_{t-1}}$	-0.12	-0.07	0.06	-0.27*	-0.29	-0.01	-0.06	0.34***
	(0.73)	(0.63)	(0.92)	(0.06)	(0.42)	(0.98)	(0.83)	(0.00)
$\boldsymbol{CO_{t-1}}$	-0.01	0.03	-0.04	0.02	-0.05	0.05	0.03	-0.02
	(0.99)	(0.17)	(0.66)	(0.37)	(0.69)	(0.47)	(0.49)	(0.13)
$\boldsymbol{\sigma_1^2}$	21.283***	3.096***	30.415***	1.472***	5.991***	3.420***	13.167***	1.460***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Crisis regime							
$\boldsymbol{Intercept_2}$	-1.51**	0.45	0.56	-0.24	-0.84*	-0.01	-0.05	0.09
	(0.04)	(0.19)	(0.46)	(0.51)	(0.09)	(0.99)	(0.99)	(0.89)
$\boldsymbol{SP_{t-1}}$	-0.03	0.16**	-0.03	0.03	-0.19	0.02	-0.28	0.06
	(0.86)	(0.03)	(0.81)	(0.6)	(0.12)	(0.7)	(0.23)	(0.49)
$\boldsymbol{ER_{t-1}}$	0.39	-0.08	0.02	0.17	-0.02	-0.01	0.11	-0.09
	(0.16)	(0.53)	(0.94)	(0.17)	(0.91)	(0.99)	(0.90)	(0.74)
$\boldsymbol{CO_{t-1}}$	0.07	-0.12**	-0.07	0.02	0.02	-0.02	-0.01	0.01
	(0.44)	(0.01)	(0.43)	(0.71)	(0.63)	(0.91)	(0.98)	(0.77)
$\boldsymbol{\sigma_2^2}$	23.877***	5.455***	37.297***	8.502***	17.138***	4.178***	24.754***	2.707***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)
$\boldsymbol{P_{11}}$	0.98***		0.96***		0.87***		0.98***	
	(0.00)		(0.00)		(0.00)		(0.00)	
$\boldsymbol{P_{22}}$	0.97***		0.97***		0.95***		0.93**	
	(0.01)		(0.00)		(0.00)		(0.01)	
E($\boldsymbol{d_1}$)	54.2		23.48		7.72		65.23	
E($\boldsymbol{d_2}$)	45.94		30.1		19.22		13.76	
Log(L)	-946.7604		-983.7932		-918.781		-874.3499	

	Lebanon		Morocco		Oman		Qatar	
	SP	ER	SP	ER	SP	ER	SP	ER
	Calm regime							
$\mathrm{Intercept_1}$	0.8	-0.22	-0.46	0.02	1.26**	-0.16	0.31	0.14
	(0.18)	(0.73)	(0.2)	(0.68)	(0.02)	(0.62)	(0.32)	(0.63)
$\mathrm{SP_{t-1}}$	0.02	0.06	0.14	-0.01	-0.09	0.1	-0.21	-0.01
	(0.86)	(0.65)	(0.19)	(0.6)	(0.6)	(0.52)	(0.25)	(0.99)
$\mathrm{ER_{t-1}}$	0.06	0.08	-0.1	0.51***	0.02	0.01	-0.15	0.09
	(0.68)	(0.75)	(0.91)	(0.00)	(0.98)	(0.94)	(0.51)	(0.55)
$\mathrm{CO_{t-1}}$	-0.02	0.02	-0.06	-0.01*	-0.04	0.06	0.05	-0.07
	(0.64)	(0.76)	(0.11)	(0.06)	(0.65)	(0.61)	(0.27)	(0.15)
σ_1^2	2.982***	3.107***	9.637***	0.116***	6.307***	2.755*	4.439***	2.505***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.00)	(0.00)
	Crisis regime							
$\mathrm{Intercept_2}$	-1.74***	0.15	0.9	-0.01	-1.06**	0.45	0.4	0.18
	(0.00)	(0.54)	(0.35)	(0.92)	(0.02)	(0.12)	(0.49)	(0.39)
$\mathrm{SP_{t-1}}$	-0.05	-0.13*	-0.15	-0.07**	-0.25**	0.06	0.15	0.01
	(0.62)	(0.05)	(0.55)	(0.02)	(0.02)	(0.4)	(0.21)	(0.92)
$\mathrm{ER_{t-1}}$	0.06	-0.14	-0.01	-0.27	0.14	-0.12	0.15	0.37***
	(0.68)	(0.17)	(0.99)	(0.17)	(0.43)	(0.3)	(0.64)	(0.00)
$\mathrm{CO_{t-1}}$	-0.02	-0.02	0.08	0.01	0.15***	-0.02	-0.09	-0.01
	(0.64)	(0.53)	(0.24)	(0.32)	(0.00)	(0.48)	(0.13)	(0.9)
σ_2^2	12.330***	4.977***	13.024***	0.171**	14.607***	5.71***	23.667***	2.919***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
$\mathrm{P_{11}}$	0.91*		0.94***		0.93***		0.93***	
	(0.05)		(0.00)		(0.00)		(0.00)	
$\mathrm{P_{22}}$	0.97***		0.77*		0.98***		0.97***	
	(0.00)		(0.09)		(0.00)		(0.00)	
E($\mathrm{d_1}$)	1.03		17.9		14.47		14.79	
E($\mathrm{d_2}$)	10.65		4.32		57.92		32.79	
Log(L)	-903.3845		-725.4658		-916.2205		-900.7851	

	S. Arabia		Tunisia		Turkey		U.A.E	
	SP	ER	SP	ER	SP	ER	SP	ER
Calm regime								
$\boldsymbol{Intercept_1}$	-0.02 (0.98)	-0.18 (0.65)	-0.14 (0.73)	-0.33* (0.05)	0.05 (0.92)	-0.09 (0.48)	1.28* (0.05)	-0.06 (0.77)
$\boldsymbol{SP_{t-1}}$	-0.07 (0.7)	-0.05 (0.63)	-0.11 (0.49)	-0.12* (0.09)	-0.45*** (0.00)	0.03* (0.07)	0.04 (0.76)	0.08* (0.07)
$\boldsymbol{SP_{t-2}}$			-0.24 (0.15)	0.01 (0.9)				
$\boldsymbol{ER_{t-1}}$	0.24 (0.54)	-0.15 (0.52)	-0.08 (0.85)	0.46** (0.02)	0.1 (0.75)	-0.71*** (0.00)	-0.72* (0.05)	0.1 (0.42)
$\boldsymbol{ER_{t-2}}$			0.48 (0.22)	0.02 (0.89)				
$\boldsymbol{CO_{t-1}}$	0.04 (0.76)	-0.01 (0.94)	0.15** (0.01)	0.01 (0.69)	-0.49*** (0.00)	-0.06*** (0.00)	-0.11 (0.18)	-0.03 (0.32)
$\boldsymbol{CO_{t-2}}$			0.01 (0.94)	-0.03 (0.13)				
$\boldsymbol{\sigma_1^2}$	11.502*** (0.00)	3.456*** (0.00)	2.676*** (0.00)	0.387*** (0.01)	2.241** (0.03)	0.114* (0.05)	25.767*** (0.00)	2.794*** (0.00)
Crisis regime								
$\boldsymbol{Intercept_2}$	-0.04 (0.91)	0.49* (0.09)	0.26 (0.51)	0.5** (0.01)	0.01 (0.97)	-0.85*** (0.00)	-2.72* (0.07)	0.92* (0.07)
$\boldsymbol{SP_{t-1}}$	0.23* (0.07)	0.01 (0.98)	0.19* (0.07)	0.07 (0.18)	0.05 (0.68)	0.1** (0.01)	-0.38** (0.01)	-0.06 (0.31)
$\boldsymbol{SP_{t-2}}$			0.14 (0.18)	0.01 (0.95)				
$\boldsymbol{ER_{t-1}}$	-0.28 (0.33)	-0.21* (0.08)	-0.12 (0.59)	0.14 (0.21)	-0.01 (0.99)	0.29*** (0.00)	-0.17 (0.72)	-0.24 (0.16)
$\boldsymbol{ER_{t-2}}$			0.11 (0.62)	0.14 (0.21)				
$\boldsymbol{CO_{t-1}}$	0.03 (0.63)	0.01 (0.79)	-0.11*** (0.00)	-0.01 (0.72)	-0.03 (0.67)	-0.04* (0.06)	0.01 (0.94)	0.01 (0.93)
$\boldsymbol{CO_{t-2}}$			0.01 (0.95)	0.04* (0.07)				
$\boldsymbol{\sigma_2^2}$	29.611*** (0.00)	4.860*** (0.00)	9.946*** (0.00)	2.517*** (0.00)	39.020*** (0.00)	3.908*** (0.00)	68.115*** (0.00)	8.815*** (0.00)
$\boldsymbol{P_{11}}$	0.91*** (0.00)		0.81*** (0.00)		0.8* (0.08)		0.99*** (0.00)	
$\boldsymbol{P_{22}}$	0.96*** (0.00)		0.95** (0.04)		0.89*** (0.00)		0.95*** (0.00)	
E($\boldsymbol{d_1}$)	10.55		5.38		1.25		85.51	
E($\boldsymbol{d_2}$)	26.29		18.98		9.31		20.61	
Log(L)	-943.4875		-861.7698		-978.064		-986.693	

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

This evidence can be explained by a low level of growth as well as by high inflation experienced by Egypt, Tunisia, and Turkey, especially since 2016, which has led to a sharp depreciation of their national currencies against the reference currencies (Alpha MENA, 2021)[3]. As international investors have mostly ignored MENA stock markets due to trading restrictions, this circumstance may inspire foreign investors who are not risk-averse to convert their currencies and participate in MENA stock markets. As a result of this intervention, stock prices increase, increasing national investors' wealth. Consequently, the value of the currency has increased. This result supports the theoretical prediction of the stock-oriented models. Our result is in accordance with Roubaud and Arouri (2018) and Sosa et al. (2018). There is also interaction for the crisis regime that leads from equity markets to currency exchange rates in Bahrain, Lebanon, Morocco, and Turkey. We note that an unstable environment is favorable for stock market investment in these MENA countries. Indeed, investors are confident about the opportunities in MENA equities. This is similar to that of Ahmed (2019) and Hung (2020).

[3] https://www.tustex.com/bourse-divers/les-rendements-des-actifs-en-tunisie-turquie-et-egypte-compares-par-alphamena

Additionally, we examine how exchange rate returns affect stock market returns. We show that this impact is negligible in both regimes, except for the calm regime in the UAE. So, we notice that stock returns in this country are more susceptible to exchange rate fluctuations. This evidence shows that investors can better predict UAE stock price movements based on foreign exchange fluctuations. Indeed, this stock market will attract foreign portfolio investment, leading to a rise in the value of the national currency. This result supports the theoretical prediction of the flow-based models.

From table 4, we generally note that equity markets are less affected by currency exchange rate fluctuations. This is an indication that the fluctuation of EUR exchange rates does not have a strong influence on the stock return dynamics. Similarly, Hung (2020) confirms that equity returns have a stronger impact on currency returns. In general, our findings are affected by political instability. The Arab Spring in the MENA zone has caused delays in investment decisions. This causes the euro to appreciate against the national currency and a slowdown in export orders. These indicators suggest that asset values in these countries are contagious. This turbulent period has influenced investor behavior.

Table 4 shows the impact of oil on foreign exchange fluctuations and equity returns under calm and crisis states. In many countries, this impact is higher during a crisis state than during a calm one. This is because the economic conditions of these countries are affected by the "Arab Spring ." This finding, which confirms the result of previous studies (see, e.g., Al-Qaralleh, 2020; Nouira, Amor, & Rault, 2019), can be justified by the fact that investors' behavior is related to the evolution of oil prices because fluctuations in crude oil have a direct impact on corporate cash flows and equity market value (Mensi, Reboredo, & Ugolini, 2021). This linkage is sensitive to oil shocks.

Conclusion

In this work, we determine the interactions between equity and currency markets for twelve MENA countries in a stable and regime-change environment. Specifically, the paper addresses the direction of causality between the two markets in a linear framework and regime-switching behavior in MENA equity markets. In addition, the paper confirms whether the movements between currency exchange rates and equity markets are stronger in times of crisis than in calm ones. We have determined the direction of causality between the financial markets using a linear VAR. From the limits of the linear model, we consider the changes in a regime that can affect the causal relationships between the markets considered. We have calculated the LR test to detect regime-switching behavior in the equity returns of MENA markets and provide evidence of the presence of two distinct regimes for all equity markets, calm and crisis states. We also used the MS-VAR model to analyze the relationship between the currency exchange rate and equity markets. The persistence of two different regimes for all markets, namely low and high volatility regimes, has been detected. The high volatility regime has more persistence than the low volatility regime. The results show that equity market returns significantly impact currency exchange returns for some countries in both regimes. However, foreign exchange markets impact the stock market only for the UAE in the quiet regime. Finally, our findings are of interest to economic policymakers, hedgers who would be able to use appropriate hedging strategies to protect themselves against market risks in future crises, and portfolio managers who want to diversify their portfolios and invest in different asset classes in the currency and equity markets. Before investing in a portfolio, it is important to comprehend the time-varying relationships between equities and currencies when considering investments in MENA countries. Within the regime-switching framework, this study contributes to a deeper comprehension of the relationship between equities and currencies in MENA countries.

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