Information Sciences Letters

Volume 12
Issue 1 *Jan. 2023*

Article 35

2023

Multidirectional Relationships Between Stock Markets and Non-macroeconomic Variables

Ali Matar
College of Administrative Sciences, Applied Science University, East Al-Ekir. P.O. Box 5055, Kingdom of Bahrain\\ Department of Financial Science & Banking, School of Business, Jadara University, P.O. Box733, Irbid, Jordan, ali.matar@asu.edu.bh

Information Sciences Letters
An International Journal

http://dx.doi.org/10.18576/isl/120135

Multidirectional Relationships Between Stock Markets and Non-macroeconomic Variables

Ali Matar[1,2]

[1]College of Administrative Sciences, Applied Science University, East Al-Ekir. P.O. Box 5055, Kingdom of Bahrain
[2]Department of Financial Science & Banking, School of Business, Jadara University, P.O. Box733, Irbid, Jordan

Received: 22 Jul. 2022, Revised: 12 Aug. 2022, Accepted: 14 Sep. 2022.
Published online: 1 Jan. 2023.

Abstract: This study investigates the multidirectional relationship between the stock market and macroeconomic variables in relation to non-economic variables. During the period 1988-2019, annual time series data from the World Bank and ASE was used. To test the integration of the tested variables, the VAR and VECM techniques are used. The finding shows that the stock market index and the macroeconomic variables under study have a long-term equilibrium relationship. The non-economic variables show that the GFC had a negative impact on the stock market index, as well as a major impact of the Gulf War in 1991, September 11, 2001, Iraqi invasion in 2003, Amman bombing in 2005, and the Syrian civil war. The results also show that ECT is negative and significant in the main model, supporting the speed with which disequilibrium adjusts from short-run to long-run equilibrium. The results also show that ECT is negative and significant in the main model, supporting the speed with which disequilibrium adjusts from short-run to long-run equilibrium. Investors may benefit from the different effects of macroeconomic variables on stock market returns in terms of portfolio diversification and risk-return strategies in terms of portfolio diversification and risk-return strategies. The study's findings have important implications for a variety of stakeholders, including investors, governments, and policymakers. By using macroeconomic data to make investment decisions, investors and portfolio managers can benefit from their portfolios.

Keywords: Financial Market, Non-macroeconomic Variables, VAR-VECM, Amman Stock Exchange, Jordan.

JEL Classification Code: D53, G01, C32, G1, R1

1 Introduction

Financial markets reflect the economy, and stock prices are influenced by a variety of factors, which in turn affect financial markets around the world. Furthermore, when analyzing stock market patterns, several elements must be taken into account. As these markets grow, a lot of focus has shifted to the subject of what are the most important factors that influence stock prices on the Amman Stock Exchange (ASE). A thorough evaluation of all measurable variables will provide an answer. These variables should be remembered before one invests in the stock market, as many people understand that economic variables are the most important factors that influence stock prices. This is partly true because one should not dismiss the equal importance of the psychological variables, such as the global financial crisis (GFC) that began as credit issues in the *US* in 2007 and affected the financial sector in other countries. A lot of investors; both individuals and companies, have been very much intimidated by the economic turmoil.

The goal of this research is to determine the factors that may influence the stock price index in the growing ASE stock market. Throughout the world, the ASE is a well-known, tiny, and open market. According to [1], stock returns in emerging economies have a higher level of volatility than returns in more developed markets. As a result, the important topic that requires further proof is whether non-macroeconomic elements are to blame for the stock market's volatility or structural cracks in emerging markets. The analysis is carried out on non-macroeconomic variables. This study employs a time series analysis technique for evaluation purposes. Many previous studies have been done, seeking to investigate the effect of macroeconomic variables on the stock market [2-5]. The fundamental idea is that most of these studies leaned on economic and financial theories such as the money supply and the market efficiency theory. Besides, there are other related theories including the capital asset pricing model (CAPM) and the arbitrage pricing theory (APT).

However, several studies have reported an equilibrium relationship between pertinent economic variables and stock

*Corresponding author e-mail: ali.matar@asu.edu.bh; amatar@jadara.edu.jo

prices e.g. [6-19]. To look into the relationships between the stock market and non-macroeconomic variables, this study follows [20] question: why does the stock market volatility change over time? To elucidate the time-varying stock volatility, it is thought to be relevant to explore the different time-varying volatility levels of the macroeconomic and non-macroeconomic factors with a variation of effects on the stock market. However, the main objective of this study is to demonstrate if there are any short-term impacts of the selected non-economic variables on SPI.

Numerous studies have investigated the impact of a GFC on financial markets. For example, [21] examined the impact of the financial crash on the stock markets. They used a VECM model in six international markets with monthly closing price indices of Germany, France, UK, Canada, Japan, and the US over the 1979-1994 period. The results showed that after the crash, the UK and Dutch markets have become more dependent.

[22] also applied the VAR model to find out the significance of domestic and international shocks to volatile and small markets like New Zealand. They used quarterly data from 1983 to 2004. Their results showed that the international and climate stock price shock is more essential in business cycles fluctuations than domestic and international financial shocks. By using historical day-by-day price fluctuation transmission, [23] prove that the crash that have been originated in the US market help in the recovery of the US market. They used a VAR model with impulse response functions based on a causal approach around the October 19, 1987, crash. [24] investigated the stock return behavior during the 1992-2009 financial crisis period in Jordan by using the GARCH model. The results suggested that the GFC had a negative impact on stock returns for all sectors, with the banking sector being the most affected. In addition, there was evidence of a high incidence of volatility and a strong reverse relationship between stock returns and the volatility both pre and post-crisis.

[25] concluded that the Asian crisis adversely affected the efficiency of most Asian stock markets, with Hong Kong being the hardest hit, followed by the Philippines, Malaysia, Singapore, Thailand, and Korea. [26] employed monthly returns for 50 developed and emerging markets selected from January 1995 to December 2002. Their results displayed a positive relationship between the quality of the institutional environment and financial market performance measures. The results also indicated that the quality of governance is negatively associated with stock market risk.

Using the GARGH (1, 1) model, [27] investigated the effect of the September 11 attacks on 53 global financial markets return and volatility. The empirical results signaled the impact of the attacks resulted in significant increases in volatility over the study period which covered the 2001-2002 period. Also, the results suggested a significant negative return in the short-run but recovered quickly afterward. Besides, [28] explored whether terrorism exerts a significant negative impact on daily stock market returns for a sample of 22 terrorist activity countries. The data was collected about the exact calendar date (year, month, and day) during the 1994–2004 period by utilizing the CAPM and ARCH models. The results suggested that terrorist acts lead to significantly lower returns on the day a terrorist attack occurs. Furthermore, the negative effect of terrorists is substantially amplified when terrorist incidents cause a higher psychosocial impact.

[29] employed the GARCH model to study the relationship between the stock returns and cloud cover in Taiwan for the 1986- 2007 period. Their results suggested a negative impact of cloud cover on Taiwan's financial market. [30] identified the factors, such as the size of the company and the different strategies adopted that control the financial performance of firms. They employed questionnaires distributed for business managers in Hong Kong during the 2009-2010 period. Their result showed that different factors can significantly impact medium and small businesses such as ROE.

[31] examined whether the holy month of Ramadan reflected positive effects in Islamic Middle Eastern stock markets during the period 1992–2007. They used the methodology of a Wald-Wolfowitz (1940) Runs Test to show whether stock prices on the ASE follow a random walk during Ramadan. The daily close price and volume data used is derived from original stock exchange sources of some countries (e.g., Jordan, Saudi Arabia, Bahrain, UAE, Qatar, Kuwait, Egypt, and Turkey). They found strong evidence of positive and significant calendar effects about the whole period of Ramadan in most countries. Furthermore, market returns in the first days of Ramadan show a high level of significant year-on-year variation which can be attributed to related herding effects enlarging the impact of the mood swings associated with the period. [32] examined the causal relationship between real estate risk and stock market volatility. They employed the granger causality test and impulse response functions on yearly data from the UK for the 1990-2010 period. They found that the real estate sector is a key source of this unidirectional causal relationship by driving finance industry volatility.

With respect to crude oil, several studies such as [33] and [34] have suggested that one of the most important international variables that can significantly impact the financial markets and economies is global oil. An increase in oil price is considered beneficial and positively influence the oil-exporting countries stock index, while negatively influencing the oil-importing countries' stock index due to an increase in the costs of production and finally decreasing the cash flow. [35] used the Vector Error Correction Model (VECM) to analyze the interaction between multiple

macroeconomic variables and stock prices in Kenya and found that interest rate positively influences the stock prices. [36] investigated the European Union stock market reaction to events correlated with the channel of instructive. They suggested that the European market is negatively reacted to the firm's pre-regulation environmental social government disclosure and performance. [37] explored that the increases in stock volatilities are attributed to the financial shock, however, the predestined changes in firms are significantly mitigated response of the economy to that shock.

[38] investigated the co-integration association between the Pakistan stock market index (KSE-100) and macroeconomic variables during the GFC. Their findings indicated that interest rate, exchange rate, and trade balance are significantly impacted stock prices. Using wavelet coherent analysis, [39] suggested time varying and nonlinear relationship between stock market and macroeconomic variables in India.

However, industrial production and consumer price index are positively impacted the stock price index. [40] tested the dynamic relationship between macroeconomic variables and stock markets in different countries. They found the existence of volatility spillover between stock markets and exchange rates. [41] checked the co-movement between aggregate stock indices and Swiss France, gold safe-haven assets (Gold, Swiss Franc) with macroeconomic set during financial crises. The significant impact of macroeconomic variables on stock returns was found for different tested indices. Using the GARCH model, [42] examined the impact of COVID-19 on financial market volatility in the UK, USA, Japan, and China. Their results suggested a positive significant impact of COVID-19 on the permanent volatility of tested financial markets.

What distinguish the current study from previous literature that most of the previous studies focus on the linkage between stock markets and macroeconomic variables without considering the non-economic events except few studies that did it, while the current study brings together most of variables that affecting stock market whether they are economic or non-economic events especially in an emerging market like ASE.

2 Methods

The study relied on time series data covering the 1988- 2018 period. ASE website was used to gather the data for the stock price index. The close price of every transaction day in every year determines the stock price. The data of macroeconomic factors were selected from the database of the Central Bank of Jordan (CBJ) and the World Bank (WB). The publication and database of both ASE and CBJ are the sources from which data for macroeconomic variables are selected. The study selected the most appropriate macroeconomic variables according to the data availability in Jordan. The consumer price index (the 2000 year as a base year) was gathered from World Bank and deflated the real GDP, FDI (foreign direct investment), and M2 (money supply) in constant price (2000=100). In the current study, the non-macroeconomic variables have been used as the second group of variables represented by the global financial crisis and other significant explanatory variables affecting the SPI. These variables are the 1991 Gulf war, the 2003 Iraqi invasion, and the 2005 terrorist hotel attack in Amman represented by D1.

The 2011 Syrian Civil War is presented by D2; the 2007 global financial crisis is represented by D3. Studies suggest that to measure the impact of all non-macroeconomic variables to be tested as dummy variables then the value of (1) should be taken during the corresponding year of event date and value of (0) otherwise (see [43]; [4]; [44-49]; [8]; and [9]).

$$LSPI_t = \gamma_0 + \gamma_1 LM2_t + \gamma_2 LGDP_t + \gamma_3 LFDI_t + \gamma_4 EX_t - \gamma_5 DR_t - \gamma_6 CPI_t + \gamma_7 D1_t + \gamma_8 D2_t - \gamma_9 D3_t + \varepsilon_t \quad (1)$$

Vector Autoregressive (VAR) is one of the most essential time series approaches that are used to test the short-term integration among the variables. According to [72], VAR is based on multi endogenous variables together. However, each endogenous variable is explained by its lagged values. Therefore, all variables in the model are endogenous without any exogenous variables included in the model which is the main feature of the VAR model ([9]).

It is not always easy to interpret each coefficient if the lags are many in an equation, especially if the signs of the coefficients alternate. As a result, the impulse response function (IRF) is examined in VAR modeling to find out how the dependent variable responds to a shock administered to one or more equations in the system.

Substantially, the main assumptions of the VAR model can be clarified as ([25]): First, to run the VAR approach, all variables should be stationary in the same order without differencing. Second, the VAR model can be used to test only the short-term relationship among the variables. Third, to run VAR does not necessarily call for the examination of the co-integration among the regressors thus, it can be run with no co-integration among the variables. Finally, VAR needs a large observation for validity and a uniform number of lags. According to [50], the VAR model with one lag is commonly used to analyze the dynamic impact of random disturbances on the system of variables. This means every

endogenous variable in the system is a function of the lagged values of all the endogenous variables. The standard form of VAR for this study can be specified as in equations (2-8).

$$\Delta LSPI_t = \chi_{01} + \sum_{i=1}^{k} \alpha_{11} \Delta LSPI_{t-i} + \sum_{i=0}^{k} \alpha_{12} \Delta LM2_{t-i} + \sum_{i=0}^{k} \alpha_{13} \Delta LGDP_{t-i} + \sum_{i=0}^{k} \alpha_{14} \Delta LFDI_{t-i} + \sum_{i=0}^{k} \alpha_{15} EX\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{16} DR\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{17} \Delta CPI_{t-i} + \beta_{11} D1_t + \beta_{12} D2 - \beta_{13} D3_t + \varepsilon_{t1} \quad (2)$$

$$\Delta LM2_t = \chi_{02} + \sum_{i=1}^{k} \alpha_{21} \Delta LM2_{t-i} + \sum_{i=0}^{k} \alpha_{22} \Delta LSPI_{t-i} + \sum_{i=0}^{k} \alpha_{23} \Delta LGDP_{t-i} + \sum_{i=0}^{k} \alpha_{24} \Delta LFDI_{t-i} + \sum_{i=0}^{k} \alpha_{25} \Delta EX_{t-i} - \sum_{i=0}^{k} \alpha_{26} DR\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{27} \Delta CPI_{t-i} + \beta_{21} D1_t + \beta_{22} D2_t - \beta_{23} D3_t + \varepsilon_{t2} \quad (3)$$

$$\Delta LGDP_t = \chi_{03} + \sum_{i=1}^{k} \alpha_{31} \Delta LGDP_{t-i} + \sum_{i=0}^{k} \alpha_{32} \Delta LSPI_{t-i} + \sum_{i=0}^{k} \alpha_{33} \Delta LM2_{t-i} + \sum_{i=0}^{k} \alpha_{34} \Delta LFDI_{t-i} + \sum_{i=0}^{k} \alpha_{35} EX\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{36} DR\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{37} \Delta CPI_{t-i} + \beta_{31} D1_t + \beta_{32} D2_t - \beta_{33} D3_t + \varepsilon_{t3} \quad (4)$$

$$\Delta LFDI_t = \chi_{04} + \sum_{i=1}^{k} \alpha_{41} \Delta LFDI_{t-i} + \sum_{i=0}^{k} \alpha_{42} \Delta LSPI_{t-i} + \sum_{i=0}^{k} \alpha_{43} \Delta LM2_{t-i} + \sum_{i=0}^{k} \alpha_{44} \Delta LGDP_{t-i} + \sum_{i=0}^{k} \alpha_{45} EX\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{46} DR\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{47} \Delta CPI_{t-i} + \beta_{41} D1_t + \beta_{42} D2_t - \beta_{43} D3_t + \varepsilon_{t4} \quad (5)$$

$$\Delta EX_t = \chi_{05} + \sum_{i=1}^{k} \alpha_{51} \Delta EX_{t-i} + \sum_{i=0}^{k} \alpha_{52} \Delta LSPI_{t-i} + \sum_{i=0}^{k} \alpha_{53} \Delta LM2_{t-i} + \sum_{i=0}^{k} \alpha_{54} \Delta LGDP_{t-i} + \sum_{i=0}^{k} \alpha_{55} \Delta LFDI_{t-i} - \sum_{i=0}^{k} \alpha_{56} DR\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{57} \Delta CPI_{t-i} + \beta_{51} D1_t + \beta_{52} D2_t - \beta_{53} D3_t + \varepsilon_{t5} \quad (6)$$

$$\Delta DR_t = \chi_{06} + \sum_{i=1}^{k} \alpha_{61} DR\Delta_{t-i} - \sum_{i=0}^{k} \alpha_{62} \Delta LSPI_{t-i} - \sum_{i=0}^{k} \alpha_{63} \Delta LM2_{t-i} - \sum_{i=0}^{k} \alpha_{64} \Delta LGDP_{t-i} - \sum_{i=0}^{k} \alpha_{65} \Delta LFDI_{t-i} - \sum_{i=0}^{k} \alpha_{66} \Delta EX_{t-i} + \sum_{i=0}^{k} \alpha_{67} \Delta CPI_{t-i} + \beta_{61} D1_t + \beta_{62} D2_t - \beta_{63} D3_t + \varepsilon_{t7} \quad (7)$$

$$\Delta CPI_t = \chi_{07} + \sum_{i=1}^{k} \alpha_{71} \Delta CPI_{t-i} - \sum_{i=0}^{k} \alpha_{72} \Delta LSPI_{t-i} - \sum_{i=0}^{k} \alpha_{73} \Delta LM2_{t-i} - \sum_{i=0}^{k} \alpha_{74} \Delta LGDP_{t-i} - \sum_{i=0}^{k} \alpha_{75} \Delta LFDI_{t-i} - \sum_{i=0}^{k} \alpha_{76} \Delta EX_{t-i} + \sum_{i=0}^{k} \alpha_{77} DR\Delta_{t-i} + \beta_{71} D1_t + \beta_{72} D2_t - \beta_{73} D3_t + \varepsilon_{t7} \quad (8)$$

Where Δ is the first difference operator; χ_{01},…., χ_{07}: are the intercepts; α_{11},…., α_{77}: are the short-term coefficients of the macroeconomic variables (SPI, M2, GDP, FDI, EX, DR, CPI); β_{11},…., β_{73}: are the coefficients of the dummy variables D1, D2, D3 (as defined early in section 2); k is the lag; and ε_{t1},…. , ε_{t7}: are white noise error terms. We need to test the existence of short-term relationship among the variables in equations (9-15) by computing the t-test for the short-run to test the null and alternative hypothesis is the following (Table 1):

Table 1: VAR hypotheses:

H_0 : No short–term relationship	**H_1: Short–term relationship**	**Equation**
$\alpha_{11} = \alpha_{12} = \alpha_{13} = \alpha_{14} = \alpha_{15} = \alpha_{16} = \alpha_{17} = 0$	$\alpha_{11} \neq \alpha_{12} \neq \alpha_{13} \neq \alpha_{14} \neq \alpha_{15} \neq \alpha_{16} \neq \alpha_{17} \neq 0$	(9)
$\alpha_{21} = \alpha_{22} = \alpha_{23} = \alpha_{24} = \alpha_{25} = \alpha_{26} = \alpha_{27} = 0$	$\alpha_{21} \neq \alpha_{22} \neq \alpha_{23} \neq \alpha_{24} \neq \alpha_{25} \neq \alpha_{26} \neq \alpha_{27} \neq 0$	(10)
$\alpha_{31} = \alpha_{32} = \alpha_{33} = \alpha_{34} = \alpha_{35} = \alpha_{36} = \alpha_{37} = 0$	$\alpha_{31} \neq \alpha_{32} \neq \alpha_{33} \neq \alpha_{34} \neq \alpha_{35} \neq \alpha_{36} \neq \alpha_{37} \neq 0$	(11)
$\alpha_{41} = \alpha_{42} = \alpha_{43} = \alpha_{44} = \alpha_{45} = \alpha_{46} = \alpha_{47} = 0$	$\alpha_{41} \neq \alpha_{42} \neq \alpha_{43} \neq \alpha_{44} \neq \alpha_{45} \neq \alpha_{46} \neq \alpha_{47} \neq 0$	(12)
$\alpha_{51} = \alpha_{52} = \alpha_{53} = \alpha_{54} = \alpha_{55} = \alpha_{56} = \alpha_{57} = 0$	$\alpha_{51} \neq \alpha_{52} \neq \alpha_{53} \neq \alpha_{54} \neq \alpha_{55} \neq \alpha_{56} \neq \alpha_{57} \neq 0$	(13)

$\alpha_{61} = \alpha_{62} = \alpha_{63} = \alpha_{64} = \alpha_{65} = \alpha_{66} = \alpha_{67} = 0$	$\alpha_{61} \neq \alpha_{62} \neq \alpha_{63} \neq \alpha_{64} \neq \alpha_{65} \neq \alpha_{66} \neq \alpha_{67} \neq 0$	(14)
$\alpha_{71} = \alpha_{72} = \alpha_{73} = \alpha_{74} = \alpha_{75} = \alpha_{76} = \alpha_{77} = 0$	$\alpha_{71} \neq \alpha_{72} \neq \alpha_{73} \neq \alpha_{74} \neq \alpha_{75} \neq \alpha_{76} \neq \alpha_{77} \neq 0$	(15)

Several investigations have confirmed the following issues with VAR modeling: For starters, there are a lot of parameters to estimate. Second, to analyze the statistical significance of the coefficients, all the components in the VAR must be stationary. Many supporters of the VAR technique, on the other hand, believe that differencing to produce stationery should be avoided. Third, VAR estimation is only used to look at short-term correlations between variables, whereas the error correction model (VECM) can fix this problem.

3 Results

Table 2 shows the descriptive statistics of macroeconomic variables, namely LSPI, LM2, LGDP, LFDI, DR, EX, and CPI. The results have shown that the EX has the lowest mean (0.57) according to the constant range of EX during a lengthy period of 1991 to 2012. By contrast, M2 has the highest mean of (85.98). Furthermore, results indicate that we can accept the H0 of normality whereby the distributions for all variables are normal due to the Jarque-Bera P-values.

Table 2: Descriptive statistics of the macroeconomic variables

	LSPI	**LM2**	**LGDP**	**LFDI**	**DR**	**EX**	**CPI**
Mean	7.45	22.55	22.38	18.80	6.52	0.57	85.98
Median	7.33	22.39	22.35	18.60	6.50	0.69	87.28
Maximum	9.01	23.57	23.15	21.50	9.00	0.71	162.98
Minimum	6.37	21.51	21.55	16.62	2.50	0.29	27.64
Std. Dev.	0.78	0.55	0.44	1.47	1.63	0.17	38.60
Skewness	0.61	0.27	0.20	0.27	0.32	0.63	0.237
Kurtosis	2.10	2.37	2.06	1.82	2.44	1.49	2.074
Jarque-Bera	3.38	1.00	1.51	2.45	1.08	5.64	1.577
Probability	0.18	0.60	0.46	0.29	0.58	0.05	0.45
Sum	261.0	789.3	783.5	658.0	228.5	20.11	3009.4
Sum Sq.Dev.	20.80	10.53	6.78	70.22	90.59	1.02	50663.
Observations	30	30	30	30	30	30	30

Data outliers will emerge from non-recurring shocks such as financial crises, terrorist attacks, wars, and oil price shocks rather than the usual transformation of economic data due to non-normality variables. However, if the degree of freedom is significant, it is advisable to employ dummy variables. Instead of coming up with a description of the structural breaks for each variable, the study used dummy variables that depend on the degree of freedom and the number of observations to discover any effect of non-macroeconomic variables. As a result, the number of dummy variables is weighted against the total number of observations, and the total number of observations must not exceed ([51]).

Many time series tend to be non-stationary but moving together over time can create some influences on the series, as in market forces, which imply that the two series are bounded by some relationship in the long term. If two variables are co-integrated, the indication is that the relationship among them is in equilibrium. Furthermore, it is likely that co-integration variables may deviate from their relationship in the short term, but their association may come back in the long term. For each series (variable), the KPSS, P-P, and ADF tests were employed with the constant and trend for all variables in their level I(0), and then the first difference I(1). Table 3 presents the findings of the three-stationary tests with constant in seven series for I(0) and I(1).

Table 3: Stationary tests

Variables	**ADF**	**P-P**	**KPSS**
LSPI	-0.98	-0.98	0.61**
LM2	-1.02	-1.00	0.66**
LGDP	-1.16	-1.16	0.69**
LFDI	-1.54	-1.42	0.46**
CPI	1.36	1.23	0.69**
EX	-1.69	-1.37	0.58**
DR	-2.66	-2.02	0.71***
ΔLSPI	-5.16***	-5.19***	0.06
ΔLM2	-3.46**	-3.41**	0.18

ΔLGDP	-3.69***	-3.37**	0.10
ΔLFDI	-7.97***	-8.16***	0.15
ΔCPI	-4.44***	-4.42***	0.21
ΔEX	-3.54**	-3.49**	0.23
ΔDR	-3.84***	-3.53**	0.15

The results of the ADF test indicate that we are not able to reject the H0 of stationarity for all variables in the *I(0)* forms. Whilst, the *H(0)* is rejected when the ADF test is employed on the *I(1)* for each variable. This indicates that the variables of the study are deemed stationary in the order *I(1)*. The results of the P-P test imply that all variables *H(0)* of stationery cannot be rejected in the *I(0)* form which is considered stationary at *I(0)*. Whilst, the *H(0)* is rejected when the P-P is employed on the *I(1)*. The *I(1)* of all variables are considered stationary of order one, *I(1)*. Table (4.2) also reports the results of the KPSS test for both levels and the first difference supports the results of the P-P test. For all variables, we can reject the H_0 of stationary at the usual level of significance and imply that all macroeconomic variables are stationary on the first difference. Consequently, all variables are considered stationary at *I(1)*, so it is appropriate to analyze whether the variables are co-integrated or not by using VECM.

Before testing the co-integration among the variables, the lag length test was conducted by estimating the unrestricted VAR model for two-time phases, one with 2 lags and the other with 1 lag depending on the main criterion of lag selection, which is SBC, AIC, HQ, FPE, and LR. The findings are presented in Table 4 which shows that the optimal lag is considered one in unrestricted VAR depending on LR, FBE, SBC, and HQ. However, choosing the optimal lag length depend on the minimum values of each criterion.

Table 4: Lag length selection criterion for co-integration

Lag in VAR	**LR**	**FBE**	**AIC**	**SBC**	**HQ**
0	-	0.00	10.89	11.20	10.99
1	360.30*	1.46*	-0.55	1.98*	0.30*
2	57.76	1.77	-0.79*	3.97	0.81

Notes:1. * indicates lag order selected by the criterion for each test at 5% level.

2. LR: sequential modified LR test statistic (each test at 5% level of significance).

4 Discussions

Vector Error Correction Model (VECM) test of co-integration was applied to approve if there are any long-run relationships between the SPI and the selected macroeconomic variables. The findings approve that co-integration is detected in three models of LSPI, LGDP, and EX respectively. The long-term coefficients of all the variables in the three models are presented in equation results 1-3.

Equation results of model 1: The long-run coefficient for the LSPI approach

LSPI model								
$LSPI_t = 43.3 + 1.19LM2_{t-1} - 2.91LGDP_{t-1} + 0.14LFDI_{t-1} + 5.35EX_{t-1} - 0.37DR_{t-1} - 0.01\ CPI_{t-1} + 0.92D1_t + 2.98D2_t$								
t-value	1.590	-1.672	1.685	2.136^{**}	-3.313^{***}	-1.814^{*}	1.695	3.893^{***}
	$-0.66D3_t$							
t-value	-2.197^{**}							

Note: ***, **, * denotes 1%, 5% and 10%. level of significance, respectively.

For the stock price index model, the long-run coefficient is significant for the exchange rate at 5% level, discount rate at 1%, consumer price index at 10% level of significance. Besides, the results conclude that the GFC and Syrian civil war variables have a long-term impact on the stock price index. Except for the GDP coefficient, which has a negative sign, the stock price index model's results show that all macroeconomic variables have the correct sign as expected. Furthermore, this conclusion shows that the exchange rate has a considerable positive impact on Jordan's stock price index, whilst the discount rate and inflation have significant negative effects; the results are compatible with economic theory. The stock price index model's findings also reveal that D1 has had no major long-term effects, implying that the Gulf War, September 11, the Iraqi invasion, and the Amman bombing had little impact on the SPI. Nonetheless, the substantial positive indication of D2 shows that the Syrian civil war is having a positive impact on the stock market index. Furthermore, the D3's significant negative sign shows that the GFC will have a long-term negative impact.

Equation results of model 2: long-term coefficient for LGDP approach

LGDP model
$LGDP_t = 16.21 - 0.04LSPI_{t-1} + 0.23LM2_{t-1} + 0.02LFDI_{t-1} + 2.83EX_{t-1} - 0.04DR_{t-1} - 0.00CPI_{t-1} - 0.29D1_t$
t-value -1.239 3.138^{***} 2.620^{***} 4.905^{***} -4.13^{***} -2.191^{***} -4.195^{***}
$+0.19D2_t + 0.06D3_t$
t-value 3.122^{***} 1.236

Note: ***, **, * denotes 1%, 5% and 10%. level of significance, respectively.

We may deduce a significant positive relationship between GDP and money supply, FDI, and exchange rate from the previous equation, indicating the importance of these variables in Jordan's economic growth. Furthermore, alongside inflation, there is a large negative relationship between GDP and discount rate. The findings of non-macroeconomic variables demonstrate that the GFC and Syrian civil conflict have a positive influence on GDP, whereas the Gulf War, September 11, the Iraqi invasion, and the Amman bombing have a negative impact.

Equation results of model 3 : The long-run coefficient for the EX approach

EX model
$EX_t = 0.21 + 0.05LSPI_{t-1} + 0.13LM2_{t-1} - 0.16LGDP_{t-1} + 0.00LFDI_{t-1} - 0.00DR_{t-1} + 0.00CPI_{t-1} + 0.13D1_t$
t-value 2.533^{**} 3.289^{***} -2.414^{**} 0.697 2.006^{*} 3.198^{***} 5.428^{***}
$-0.02D2_t - 0.05D3_t$
t-value -0.887 -2.143^{**}

Note: ***, **, * denotes 1%, 5% and 10%. level of significance, respectively.

The results of the exchange rate model indicate that GDP, discount rate, and GFC have a significant negative impact on the exchange rate. However, the stock price index, money supply, inflation, Gulf war, September 11, the Iraqi invasion, and the Amman bombing have a positive significant impact.

The main evidence for confirming the existence of a long-term equilibrium relationship and proving the speed adjusting back from short-run disequilibrium to the long-run equilibrium, the value of the *ECT* coefficient must be significant and negative. If the *ECT* coefficient is significant and negative, then the co-integration is present among the variables ([52-53]). The findings of the short-run relationship with intercept for three models and ECT coefficients are presented in equation results 1– 3.

Equation results of model 1 : The short-run coefficient of LSPI approach

ΔLSPI model with intercept:
$\Delta LSPI_t = 21.87 + 0.26\Delta LSPI_{t-1} + 0.60\Delta LM2_t - 1.47\Delta LGDP_t + 0.11\Delta LFDI_t + 0.11\Delta LFDI_{t-1} + 0.31\Delta EX_t$
t-value 2.105^{**} 1.786^{*} -1.939^{*} 3.390^{***} 3.749^{***} 0.366
$-1.38\Delta EX_{t-1} - 0.00\Delta DR_t + 0.20\Delta DR_{t-1} - 0.00\Delta CPI_t + 0.46\Delta D1_t + 1.50\Delta D2_t - 0.33\Delta D3_t - 0.504ECT_{t-1}$
t-value -1.725^{*} -0.160 6.462^{***} -1.915^{*} 2.371^{**} 8.006^{***} -2.387^{**} -3.769^{***}
Serial Correlation χ^2 (1) =[0.109] Functional Form χ^2 (1) =[0.252] Normality χ^2 (2) =[0.807]
Heteroscedasticity χ^2 (1) =[0.959] D-W = 2.43

The stock price index model points to significant correlations between the stock price index and all the variables at various levels of significance, indicating the importance and impact of selected macroeconomic variables on ASE and JE. Furthermore, with the exception of GDP, all macroeconomic variables have some correct signals. When the coefficient of ECTt-1 is significant and negative, any disequilibrium in the short term can convert to equilibrium in the long run. Non-macroeconomic variables such as D1 have positive substantial impacts on the results as well (Gulf-war, September 11, the Iraqi invasion, the Amman bombing) and D2 (Syrian civil war). In contrast, there is a negative significant impact of GFC.

Equation results of model 2: The short-run coefficient of LGDP approach

LGDP model with intercept:
$\Delta LGDP_t = 10.11 - 0.23\Delta LGDP_{t-1} - 0.02\Delta LSPI_t + 0.54\Delta LM2_t + 0.01\Delta LFDI_t + 0.38\Delta EX_t - 0.39\Delta EX_{t-1}$
t-value -2.084^{**} -1.267 4.927^{***} 2.564^{***} 1.835^{*} -2.728^{***}
$+0.00\Delta DR_t + 0.00\Delta CPI_t - 0.18\Delta D1_t + 0.12\Delta D2_t + 0.04\Delta D3_t - 0.62ECT_{t-1}$
t-value 1.148 0.778 -5.629^{***} 3.664^{***} 1.272 -6.644^{***}
Serial Correlation χ^2 (1) =[0.325] Functional Form χ^2 (1) =[0.683] Normality χ^2 (2) =[0.959]
Heteroscedasticity χ^2 (1) =[0.356] D-W = 2.275

In the GDP approach, there is a positive significant relationship between GDP and M2, FDI, and EX. Besides, there is a negative impact of D1 (Gulf-war, September 11, the Iraqi invasion, the Amman bombing) and a positive impact of D2 (Syrian civil war). Moreover, any disequilibrium in the short-term can convert across equilibrium in the long term when the coefficient of ECT_{t-1} is significant and negative.

Equation results of model 3: The short-run coefficient of EX approach

EX model with intercept :						
$\Delta EX_t = 0.218 - 0.01\Delta LSPI_t - 0.22\Delta LM2_t - 0.20\Delta LM2_{t-1} + 0.00\Delta LFDI_t + 0.01\Delta LFDI_{t-1} - 0.010\Delta DR_t$						
t-value	-0.719	-2.608^{***}	-2.801^{***}	1.619	1.809^{*}	-1.938^{*}
$-0.95\Delta CPI_t - 0.13\Delta D1_t - 0.02\Delta D2_t - 0.05\Delta D3_t - 1.00ECT_{t-1}$						
t-value	-0.620	-5.428^{***}	-0.887	-2.143^{**}	NA	
Serial Correlation χ^2 (1) =[0.006]			Functional Form χ^2 (1) =[0.017]		Normality χ^2 (2) =[0.388]	
Heteroscedasticity χ^2 (1) =[0.022]			D-W = 2.738			

In the exchange rate model, there is a significant negative relationship between EX and each of money supply and discount rate and also a positive relationship with FDI. Furthermore, EX has been impacted negatively by D1 (Gulf-war, September 11, the Iraqi invasion, the Amman bombing) and D3 (GFC). In addition, the ECT_{t-1} coefficient is found to be not applicable due to the long-lasting stability of the exchange rate in Jordan during the 1991-2013 period.

The ECT_{t-1} coefficient of the SPI approach is negative and with high significance [-0.504] at 1% with a correct sign. It is undeniable, an implication of promptness adjusted back to the equilibrium, where 50.4% of disequilibrium from the previous year can come back to the long-term equilibrium in the current year. Furthermore, in money supply and GDP models, the ECT_{t-1} coefficients are shown to be significant with the right sign, implying long-run equilibrium relationships between variables and highlighting the transition from short-run disequilibrium to long-run equilibrium.

However, the rate of an adjustment returning to equilibrium for the GDP model is much faster than the other models' ECT_{t-1} absolute value which is indicative of a very low speed towards its long-term equilibrium. Similar findings have been expressed by other studies (e.g. [54-61]). Long-run coefficients in the SPI technique revealed that the currency rate, discount rate, inflation, GFC, and Syrian civil war all had significant long-term movements. This indicates that these three macroeconomic variables are highly effective and can have a long-term impact on the stock price index.

All significant coefficients had the right sign, meaning that they supported the hypothesis that the ER has a positive impact on SPI and that both the discount rate and inflation have negative effects. The results for non-macroeconomic variables revealed that the Syrian civil war has a positive effect on the SPI whereas the GFC has a negative effect. It also showed that the Gulf War, Iraqi invasion, September 11th, and Amman bombings variables had a positive impact on the money supply and exchange rate while having a negative impact on GDP. The Syrian civil conflict has had a negative influence on the money supply, GDP, and foreign direct investment. Moreover, the GFC was negatively affecting both the money supply and exchange rate.

The SPI model's short-term coefficient result revealed that all macroeconomic variables had a substantial short-term movement. This means that while all macroeconomic variables are highly effective and can regulate the SPI in the short term, not all of them can do so in the long run. The results of the non-macroeconomic factors show that the Gulf Conflict, Iraqi invasion, September 11th, Amman bombings, and Syrian civil war can all have a favorable impact on the SPI. In the short term, however, the recent GFC had a negative impact. Furthermore, the findings revealed that non-macroeconomic variables such as the Gulf War, Iraqi invasion, September 11th, and Amman bombings might have a beneficial impact on the money supply while having a negative impact on GDP and exchange rate variables. The Syrian civil war had a negative impact on the money supply, foreign direct investment, and the discount rate, but a favorable impact on GDP and inflation. The GFC had a negative impact on the money supply, exchange rate, and inflation.

5 Conclusion & Policy Implications

This research aims to compile a list of economic and non-economic elements that may have an impact on Jordan's stock market. Such study findings are quite essential and appeal to a wide range of parties, particularly financial market investors, whether individuals or organizations. The findings revealed that the SPI and the selected economic indicators are co-integrated. Furthermore, the favorable impact of the Gulf War, September 11, the Iraqi invasion, the Amman bombing, and the Syrian civil war can be rationalized by cash flows moving during the Iraqi invasion, which resulted in

the ASE boom in 2004-2005. Such a result is extremely important for the stakeholders, i.e. decision-makers and the government, who should concentrate on the impact of events on Jordan's economy, notably the Amman Stock Exchange. These findings are also consistent with previous empirical research (e.g. [21]; [62]; [58]; [63-66]; [46]; [22]; [26]). However, it is inconsistent with others ([24-25]; [67-71]).

The GFC's aftermath has had a detrimental impact on Jordan's stock market index for the past 14 years. As a result, decision-makers are made aware of the susceptibility of stock prices to non-economic variables, which entails doing a diagnostic check on the behavior of the stock price index during political and crisis events. Investment managers, analysts, and ordinary investors all benefitted greatly from the findings of this study. Understanding the interdependence of macroeconomic and non-macroeconomic variables with the stock price index should allow these individuals to build their portfolios that will help them earn higher-than-average returns. It should also allow them to create precise asset pricing models and predict future stock market volatility. Furthermore, non-macroeconomic characteristics will be important in projecting the investment situation for both local and foreign investors. As a result, their trade decisions are consistent with the findings of similar research in which both local investment and FDI are encouraged.

The importance of external shocks to the Amman Stock Exchange was shown by the constant and noticeable influence of non-macroeconomic events on SPI. Investors should keep their emphasis on the home economic sector while determining risk levels in these markets. According to the findings, the more markets are integrated with the global economy, the more vulnerable they are to external shocks such as the Gulf War, Iraqi invasion, global financial crisis, and Syrian civil war. Because non-macroeconomic variables are external, domestic policymakers may find it extremely difficult to govern them. However, a well-formulated policy, a procedure for determining the correct order of things, and its successful implementation may help to mitigate the adverse consequences. Eventually, for further studies we recommend investigating new different variables that may affect the financial markets such as, COVID-19, Ukrainian-Russian war, and Cryptocurrencies.

Conflict of interest

The authors declare that there is no conflict regarding the publication of this paper.

References

[1] Abugri, B. A. (2008). Empirical relationship between macroeconomic volatility and stock returns: Evidence from Latin American markets. *International Review of Financial Analysis*, *17*, 396–410. https://doi.org/10.1016/j.irfa.2006.09.002

[2] Fama E. F., & Schwert, W. G. (1977). Asset returns and inflation. *Journal of Financial Economics*, *5*,115-146. https://doi.org/10.1016/0304-405X(77)90014-9

[3] Chen, N. F., Roll, R., & Ross, S. (1986). Economic forces and the stock market. *Journal of* Business, *59*(3), 83-403. https://www.jstor.org/stable/2352710

[4] Chen, M. H. (2007). Macro and non-macro explanatory factors of Chinese hotel stock returns. *International Journal of Hospitality Management*, *26*(4), 991-1004. https://doi.org/10.1016/j.ijhm.2006.04.002

[5] Claessens, S., Kose, M., & Terrones, M.E. (2010). The global financial crisis: How similar? How different? How costly? *Journal of Asian Economics*, *21*(3), 247-264. https://doi.org/10.2139/ssrn.1573958

[6] Bekhet, H.A., & Matar A.A. (2013a). Co-integration and causality analysis between stock market prices and their determinates in Jordan. *Economic Modelling*, 35(0), 508-514. https://doi.org/10.1016/j.econmod.2013.07.012

[7] Hussain, S. M. (2011). Simultaneous monetary policy announcements and international stock markets response: an intraday analysis. *Journal of Banking & Finance*, *35*, 752–764. https://doi.org/10.2139/ssrn.1573692

[8] Diamandis, P.F., & Drakos, A. A. (2011). Financial liberalization; exchange rates and stock prices: exogenous shocks in four Latin American countries. *Journal of Policy Modeling*, *33*, 381-394. https://doi.org/10.1016/j.jpolmod.2010.11.004S

[9] Gosnell, T., & Nejadmalayeri, A. (2010). Macroeconomic news and risk factor innovations. *Managerial Finance*, *36*(7), 566-582. https://doi.org/10.1108/03074351011050316

[10] Nidhiprabha, B. (2010). Effectiveness of Thailand's macroeconomic policy response to the global financial crisis. *ASEAN Economic Bulletin*, *27*(1), 121-135. https://doi.org/10.1355/ae27-1g

[11] Ghosh, S. (2009). Import demand of crude oil and economic growth: Evidence from India. *Energy Policy*, *37*(2), 699-702. https://doi.org/10.1016/j.enpol.2008.10.021

[12] Rahman, A., Sidek, N., & Tafri., F. (2009). Macroeconomic determinants of Malaysian stock market. *African Journal of Business Management*, *3*(3), 95-106. https://academicjournals.org/article/article1380530324_Rahman%20et%20al.pdf

[13] Apergis, N., & Miller, S. M. (2009). Do structural oil-market shocks affect stock prices? *Energy Economics*, 31, 569–575. https://doi.org/10.1016/j.eneco.2009.03.001

[14] Kim, S. J., McKenzie, M. D., & Faff, R. W. (2004). Macroeconomic news announcements and the role of expectations: evidence for US bond, stock, and foreign exchange markets. *Journal of Multinational Financial Management*, *14*(3), 217-232. https://doi.org/10.1142/9789813223585_0005

[15] Maysami, R., Howe, L., & Hamzah, M. (2004). Relationship between macroeconomic variables and stock market indices: Co-integration evidence from stock exchange of Singapore's all-s sector indices. *Jurnal Pengurusan*, *24*, 47-77. https://doi.org/10.17576/pengurusan-2005-24-03

[16] Maghyereh, A., & Omet, G. (2002). Financial liberalization and stock market efficiency: empirical evidence from an emerging market. *African Finance Journal*, *4*(2), 24-35. https://doi.org/10.21442/4151531223585_0005

[17] Omran, M., & Pointon, J. (2001). Does the inflation rate affect the performance of the stock market? The case of Egypt. *Emerging Markets Review*, *2*, 263-279. https://doi.org/10.1016/s1566-0141(01)00020-6

[18] Kearney, C. (2000). The determination and international transmission of stock market volatility. *Global Finance Journal*, *11*, 31–52. https://doi.org/10.1016/s1044-0283(00)00015-6

[19] Bekhet, H. A., & Matar, A. (2013c, April). The Impact of the global financial crisis on the economic growth and capital market returns: evidence from Jordan. In *The Twelfth Scientific Annual International Conference for Business (Human Capital in a Knowledge Economy)* (pp. 22-25).

[20] Rangel, J. G. (2011). Macroeconomic news, announcements, and stock market jump intensity dynamics. *Journal of Banking & Finance*, *35*, 1263–1276. https://doi.org/10.2139/ssrn.939625

[21] Masih, A.M., & Masih, R. (1997). Dynamic relationshipages and the propagation mechanism driving major international stock markets: An analysis of the pre-and post-crash eras. *The Quarterly Review of Economics and Finance*, *37*(4), 859-885. https://doi.org/10.1016/s1062-9769(97)90008-9

[22] Buckle, R. A., Kim, K., Kirkham, H., McLellan, N., & Sharma, J. (2007). A structural VAR business cycle model for a volatile small open economy. *Economic Modelling*, *24*(6), 990-1017. https://doi.org/10.1016/j.econmod.2007.04.003

[23] Yang, J., & Bessler, D. A. (2008). Contagion around the October 1987 stock market crash. *European Journal of Operational Research*, *184*, 291–310. https://doi.org/10.1016/j.ejor.2006.04.046.

[24] Al-Rjoub, S. A., & Azzam, H. (2012). Financial crises, stock returns and volatility in an emerging stock market: the case of Jordan. *Journal of Economic Studies*, *39*(2), 178-211. https://doi.org/10.1108/01443581211222653

[25] Lim, K. P., Brooks, R. D., & Kim, J. H. (2008). The financial crisis and stock market efficiency: Empirical evidence from Asian countries. *International Review of Financial Analysis*, *17*, 571–591. https://doi.org/10.1016/j.irfa.2007.03.001

[26] Baharumshah, A. Z., Mohd, S. H., & Mansur, A. (2009). The stability of money demand in China: Evidence from the ARDL model. *Economic Systems*, *33*(3), 231-244. https://doi.org/10.1016/j.ecosys.2009.06.001

[27] Nikkinen, J., Omran, M., Sahlstrom, P., & Aijo, J. (2008). Stock returns and volatility following the September 11 attacks: Evidence from 53 equity markets. *International Review of Financial Analysis*, *17*, 27–46. https://doi.org/10.1016/j.irfa.2006.12.002

[28] Drakos, K. (2010). Terrorism activity, investor sentiment, and stock returns. *Review of Financial Economics*, *19*, 128–135. https://doi.org/10.1016/j.rfe.2010.01.001

[29] Lee, Y. M., & Wang, K. M. (2011). The effectiveness of the sunshine effect in Taiwan's stock market before and after the 1997 financial crisis. *Economic Modelling*, *28*, 710–727. https://doi.org/10.1016/j.econmod.2010.05.008

[30] Ho, G., Choy, K., Chung, S., & Lam, C. (2010). An examination of strategies under the financial tsunami. *Industrial Management & Data Systems*, 110(9), 1319-1336. https://doi.org/10.1108/02635571011087419

[31] Al-Hajieh, H., Redhead, K., & Rodgers, T. (2011). Investor sentiment and calendar anomaly effects: A case study of the impact of Ramadan on Islamic Middle Eastern Markets. *Research in International Business and Finance*, *25*, 345–356. https://doi.org/10.1016/j.ribaf.2011.03.004

[32] Cheong, C. S., Olshansky, A., & Zurbruegg, R. (2011). The influence of real estate risk on market volatility. *Journal of Property Investment & Finance*, *29*(2), 145-166. https://www.emerald.com/insight/content/doi/10.1108/14635781111112774/full/html

[33] Noor, M. H., & Dutta, A. (2017). On the relationship between oil and equity markets: Evidence from South Asia. *International Journal of Managerial Finance*, *13*(3), 287-303. https://doi.org/10.1108/ijmf-04-2016-0064

[34] Mensi, W., Hammoudeh, S., Shahzad, S. J. H., & Shahbaz, M. (2017). Modeling systemic risk and dependence structure between oil and stock markets using a variational mode decomposition-based copula method. *Journal of Banking & Finance*, *75*, 258-279. https://doi.org/10.1016/j.jbankfin.2016.11.017

[35] Mumo, M. P. (2017). Effects of macroeconomic volatility on stock prices in Kenya: A cointegration evidence from the Nairobi Securities Exchange (NSE). *International Journal of Economics and Finance*, *9*(2), 1-14. https://doi.org/10.5539/ijef.v9n2p1

[36] Grewal, J., Riedl, E. J., & Serafeim, G. (2018). Market reaction to mandatory nonfinancial disclosure. *Management Science, 64,* 136. https://doi.org/10.2139/ssrn.2657712

[37] Fuentes-Albero, C. (2019). Financial frictions, financial shocks, and aggregate volatility. *Journal of Money, Credit and Banking*, *51*(6), 1581-1621. https://doi.org/10.2139/ssrn.2520178

[38] Chang, B. H., Meo, M. S., Syed, Q. R., & Abro, Z. (2019). Dynamic analysis of the relationship between stock prices and macroeconomic variables: An empirical study of Pakistan stock exchange. *South Asian Journal of Business Studies, 8*(3), 229-245. https://doi.org/10.1108/sajbs-06-2018-0062

[39] Gopinathan, R., Durai, S.R.S. Stock market and macroeconomic variables: new evidence from India. *Financ Innov* 5, 29 (2019). https://doi.org/10.1186/s40854-019-0145-1

[40] Erdoğan, S., Gedikli, A., & Çevik, E. İ. (2020). Volatility spillover effects between Islamic stock markets and exchange rates: Evidence from three emerging countries. *Borsa Istanbul Review*, *20*(4), 322-333. https://doi.org/10.1016/j.bir.2020.04.003

[41] Tronzano, M. (2021). Financial crises, macroeconomic variables, and long-run risk: An econometric analysis of stock returns correlations (2000 to 2019). *Journal of Risk and Financial Management*, *14*(3), 127. https://doi.org/10.3390/jrfm14030127

[42] Bai, L., Wei, Y., Wei, G., Li, X., & Zhang, S. (2021). Infectious disease pandemic and permanent volatility of international stock markets: A long-term perspective. *Finance research letters*, *40*, 101709. https://doi.org/10.1016/j.frl.2020.101709

[43] Altinay, G. (2007). Short-run and long-run elasticities of import demand for crude oil in Turkey. *Energy Policy*, *35*(11), 5829-5835. https://doi.org/10.1016/j.enpol.2007.07.015

[44] Wang, Y. S. (2009). The impact of crisis events and macroeconomic activity on Taiwan's international inbound tourism demand. *Tourism Management*, *30*(1), 75-82. https://doi.org/10.1016/j.tourman.2008.04.010

[45] Kontonikas, A. (2010). A new test of the inflation–real marginal cost relationship: ARDL bounds approach. *Economics Letters*, *108*(2), 122-125. https://doi.org/10.1016/j.econlet.2010.04.046

[46] Cheung, W., Fung, S., & Tsai, S. (2010). Global capital market interdependence and spillover effect of credit risk: Evidence from the 2007–2009 global financial crisis. *Applied Financial Economics*, 20, 85–103. https://doi.org/10.1080/09603100903262962

[47] Chowdhury, K. (2012). Modeling the dynamics, structural breaks, and the determinants of the real exchange rate of Australia. *Journal of International Financial Markets, Institutions, and Money*, *22*, 343–358. https://doi.org/10.1016/j.intfin.2011.10.004

[48] Cheng, M. C., Tzeng, Z. C., & Kang, W. L. (2011). The Impact of Non-Macroeconomic Events on Taiwan Electronic Industry Stock Index Returns. *Global Economy and Finance Journal*, *4*(1), 80-101.

[49] Le, T. P. T. D., & Tran, H. L. M. (2021). The Contagion Effect from US Stock Market to the Vietnamese and the Philippine Stock Markets: The Evidence of DCC-GARCH Model. *The Journal of Asian Finance, Economics, and Business*, *8*(2), 759-770. https://doi.org/10.13106/jafeb.2021.vol8.no2.0759

[50] Johansen, S. (1991). Estimation and hypothesis testing of cointegrating vectors in Gaussian vector autoregressive models. *Econometrica*, *59*, 1551-80. https://doi.org/10.2307/2938278

[51] Gujarati, D.N & Porter, D. (2009) *Basic econometrics* (5th ed.). New York: The McGraw-Hill Companies.

[52] Kremers, J.J., Ericson, N. R. & Dolado, J. J., 1992. The power of cointegration tests. *Oxford Bulletin of Economics and Statistics*, *54*, 325–347. https://doi.org/10.1142/9789813223585_0005

[53] Narayan, P. K. (2005). The saving and investment nexus for China: Evidence from co-integration tests. *Applied Economics*, *37*, 1979–1990. https://doi.org/10.1080/00036840500278103

[54] Al-Sharkas, A. (2004). The dynamic relationship between macroeconomic factors and the Jordanian stock market. *International Journal of Applied Econometrics and Quantitative Studies*, *1*, 97-114. https://www.usc.es/economet/reviews/ijaeqs115.pdf

[55] Ibrahim, M. H., & Aziz, H. (2003). Macroeconomic variables and the Malaysian equity market: A view through rolling subsamples. *Journal of Economic Studies*, *30*(1), 6-27. https://doi.org/10.1108/01443580310455241

[56] Hammoudeh, S., & Sari, R. (2011). Financial CDS, stock market and interest rates: Which drives which? *North American Journal of Economics and Finance*, *22*, 257– 276. https://doi.org/10.1016/j.najef.2011.04.001

[57] Bekhet, H. A., & Matar, A. A. (2012b). Causality of macroeconomic variables impacting the stock market index: time series approach in Amman Stock Exchange. *Conference on Asian Forum on Business Education (AFBE)*. UNITEN, Selangor, Malaysia (July, 9–10/2012).

[58] Bekhet, H. A., & Matar, A. (2013b) The influence of the global financial crisis on Jordanian equity market: VECM approach, *International. Journal of Monetary Economics and Finance*, *6*(4), 285-301. https://doi.org/10.1504/ijmef.2013.059946

[59] Abuoliem, N., Nor, S. M., Matar, A., & Hallahan, T. (2019). Crude oil prices, macroeconomic indicators and the financial sector in Jordan: Dynamic causes and responses. *Journal of International Studies*, *12*(3), 11-21. https://doi.org/10.14254/2071-8330.2019/12-3/11

[60] Lee, J. W., & Zhao, T. F. (2014). The dynamic relationship between stock prices and exchange rates: Evidence from Chinese stock markets. *Journal of Asian Finance, Economics, and Business*, *1*(1), 5-14. https://doi.org/10.13106/jafeb.2014.vol1.no1.5.

[61] Lee, J. W., & Brahmasrene, T. (2019). Long-run and short-run causality from exchange rates to the Korea composite stock price index. *The Journal of Asian Finance, Economics, and Business*, *6*(2), 257-267. https://doi.org/10.13106/jafeb.2019.vol6.no2.257.

[62] Bekiros, S. (2013). Contagion, decoupling and the spillover effects of the US financial crisis: Evidence from the BRIC markets. *International Review of Financial Analysis, 65,* 11-28. https://doi.org/10.1016/j.irfa.2013.07.007

[63] Ji, P. (2010). The impact of the global financial crisis on the cross-currency relationshipage of LIBOR–OIS spreads. *International Financial Markets, Institutions, and Money*, *20*, 575–589. https://doi.org/10.2139/ssrn.1407925

[64] Kenourgios, D., Samitas, A., & Paltalidis, N. (2011). Financial crises and stock market contagion in a multivariate time-varying asymmetric framework. *International Financial Markets, Institutions, and Money*, *21*, 92–106. https://doi.org/10.1016/j.intfin.2010.08.005

[65] Chakrabarti, R., & Roll, R. (2002). East 1Asia and Europe during the 1997Asian collapse: A clinical study of a financial crisis. *Journal of Financial Markets*, *5*, 1–30. https://doi.org/10.1016/s1386-4181(01)00022-2

[66] Ha, I. B., Khil, J., & Lee, B. S. (2001). On the rationality of Korea's stock market: was the recent Korean financial crisis due to fundamental factors?. *Journal of International Financial Markets, Institutions, and Money*, *11*, 423–441. https://doi.org/10.1016/s1042-4431(01)00041-5

[67] Guo, F., Chen, C. R., & Huang, Y. S. (2011). Markets contagion during the financial crisis: A regime-switching approach. *International Review of Economics and Finance*, *20*, 95–109. https://doi.org/10.1016/j.iref.2010.07.009

[68] Li, H., Jeon, B. N., Cho, S. Y., & Chiang, T. C. (2008). The impact of sovereign rating changes and financial contagion on stock market returns: Evidence from five Asian countries. *Global Finance Journal*, *19*, 46–55. https://doi.org/10.1016/j.gfj.2007.12.001

[69] Serwa, D., & Bohl, M.T. (2005). Financial contagion vulnerability and resistance: A comparison of European stock markets. *Economic Systems*, 29, 344–362. https://doi.org/10.1016/j.ecosys.2005.05.003

[70] Khalid, A. M., & Kawai, M. (2003). Was financial market contagion the source of the economic crisis in Asia? Evidence using a multivariate VAR model. *Journal of Asian Economics*, *14*, 131–156. https://doi.org/10.1016/s1049-0078(02)00243-9

[71] Nagayasu, J. (2001). Currency crisis and contagion: Evidence from exchange rates and sectoral stock indices of the Philippines and Thailand. *Journal of Asian Economics*, *12*, 529–546. https://doi.org/10.1016/s1049-0078(01)00101-4

[72] Sims, C. (1980). Macroeconomics and reality. *Econometrica*, 48, 1–48. https://doi.org/10.1142/9789813223585_0005