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Crude oil prices, macroeconomic indicators and the financial sector in Jordan: Dynamic causes and responses

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Abstract. This study contributes to the literature on the relationship between fundamental economic factors and stock price movements. We evaluate the relationship between domestic and international macroeconomic indicators and financial sector index in a frontier market that is Amman Stock Exchange (ASE) in Jordan. We employed the ARDL bound testing approach and the VECM Granger causality test to examine long and short run relationships and the direction of causality among the variables. Monthly time series data from January 2007 to December 2016 were used to identify the relationships for interest rate (positive), inflation rate (insignificant), money supply (insignificant), industrial production index (insignificant), producer price index (negative), trade balance (insignificant), and crude oil price (negative). Our findings indicate that the deposit interest rate positively influenced the financial sector in the short run and the long run, while the producer price index and global oil price had significant negative impacts on the financial sector. This study contributes actionable insight for policy makers and investors regarding how global and domestic factors have significant impact on the financial index in Jordan. The current study provides several important implications and recommendations for investors, policy makers and the government. For example, the results imply that global oil prices have a

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significant impact on the financial index in Jordan, which indicates that the ASE is correlated with the global markets and is sensitive to shocks of the global indicators.

Keywords: financial market, econometrics, ARDL, VECM, causality, Jordan.

JEL Classification: E44, G12

1. INTRODUCTION

The relationship between fundamental economic factors and stock price movements has long been the subject of investigation in economics and finance literature, yet, it is not a settled area. Early research by Friedman and Schwartz (1963) found that changes in money supply could have a significant impact on stock prices. Studies by Fama and Schwert (1977), Fama (1981), and Geske and Roll (1983) document negative relations between stock returns and both expected and unexpected components of inflation rate. However, Roll (1988) found that only around a third of variation in stock prices could be explained by fundamental economic factors, a finding supported by Cutler, Poterba and Summers (1989) who evaluated the extent to which major movements in stock market indices could be explained by the arrival of news as fundamental economic shocks. Later studies by Fama and French (1988, 1989), Fama (1990) and Schwert (1990) found that three proxies for business conditions, the dividend yield, the default spread and the term spread, could better explain significant variation in stock prices. The majority of the research in the 1990's and 2000's continued to focus on the relationship between economic factors and stock price movements in developed markets. In the mid 2000's researchers turned their attention to emerging markets and the current decade has seen the scope of studies extended to frontier markets.

Global crude oil price fluctuations play a critical role in many economies around the world and have important implications for stock markets (Mensi, 2017), particularly emerging and frontier ones. In addition, crude oil prices are considered to be a major indicator for an economy and the stock markets of a country (Noor & Dutta, 2017). However, the impact of oil prices differs from oil-importing countries to oil-exporting countries. For exporting countries, increase in oil price has a positive influence on the trade balance, which will lead to surpluses, which will then increase the profits of domestic firms, and finally increase the demand on these firms' stocks (Adaramola, 2012). Moreover, macroeconomic indicators and stock prices have a strong correlation, as stock prices are significantly influenced by macroeconomic indicators (Borjigin et al., 2018). Against this background, the current study contributes to the research on the relationship between economic influences and stock prices in a frontier market by using both domestic and global macroeconomic indicators to explain the relationship between these indicators and the most important sector at the Amman Stock Exchange (ASE).

This study focused on Jordan's financial sector, which includes the banks and real estate sectors as well as the financial services sector. The study differed from previous studies because we focused on the period (January 2007 – December 2016) that is after the new distribution of ASE in June 2006. Second, this study covered the periods of the financial and political crises, such as the global financial crises of 2008, Arab spring crises of 2010 and the wars in Iraq and Syria in 2013. These events resulted in about two million refugees moving into a small country like Jordan. These refugee movements caused an imbalance in the macroeconomic indicators such as foreign trade and inflation. Moreover, crises such as the global financial crisis 2008-2009 have increased the risk aversion, fear and pressure in the stock markets around the globe thereby affected investors' expectations (Shahzad et al., 2017).

The ASE is considered to be one of the most effective markets in the Middle East. The S&P country classification has classified it as a frontier market and ranked it among the top 10 emerging markets in the Middle East (Bekhet & Matar, 2013). In particular, the financial sector plays an important role in influencing

the national economy through the banks, which are considered the main financier of the economy (Drigă & Dura, 2014).

Figure 1 shows the financial index (FI) during the study period. The chart reveals that FI was significantly influenced, especially in 2008 and 2014. At end of July 2008, the index reached its maximum level of 5,574 points. The index showed a significant decline during the four months that followed. At the end of November 2008, the FI had reduced to 3,735. In fact, data in the figure show that there is a decline during the periods between 2010-11 and 2011-13. During the period of January 2010 to December 2011, the index lost 568 points due to the decrease from 3,012 points to 2,444 points. Therefore, the significant decline in the index highlights that the extent of the impact on this index and the importance of studying the variables that can influence this index.

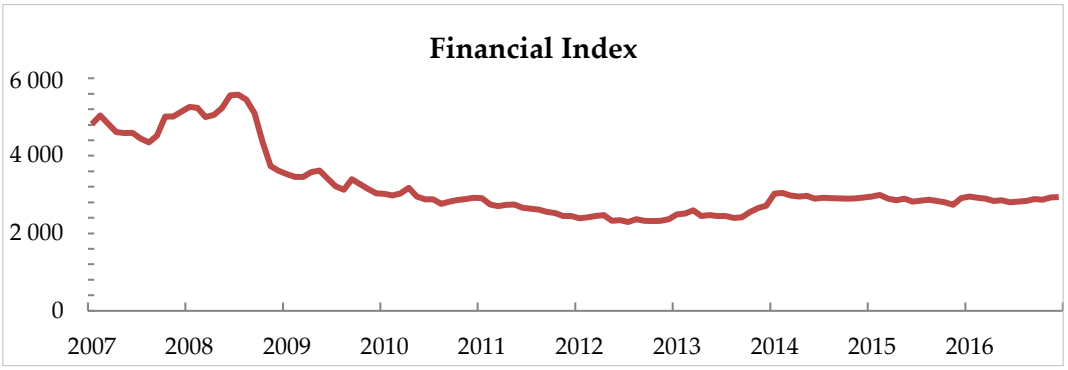


Figure 1. ASE financial index (2007-2016)
Source: Amman Stock Exchange.

The current study is reported as follows. Section 2 discusses the literature review, while data and methodology are provided in section 3. Section 4 presents the results and analysis. The conclusion and the policy implication, as well as the recommendations, are reported in section 5.

2. LITERATURE REVIEW

Studies such as Endress and Gear (2015); Hussain, Rafique, Khalil and Nawaz (2013); Bekhet and Matar (2013); Valera, Holmes and Hassan (2017); Adaramola (2012); Lin, Fang and Cheng (2010) focused largely on frontier markets and the stock price movements and recognised that stock prices can be influenced by the changes in different global and domestic economic indicators, as well as by movements in international stock markets. This is because domestic stock markets are correlated with the international stock markets (Peiró, 2016). This relationship is in line with the evidence provided by Fama (1981), who argued that different macroeconomic indicators (domestic and international) can influence stock prices, and the stock market can reflect the economic condition of a country.

Asmy et al. (2009) concluded that stock prices have a negative relationship with money supply in the long run, but a positive relationship in the short run. Hussain et al. (2013) conducted a study to examine the effect of macroeconomic variables on price index of the Karachi Stock Exchange (KSE-100). The results showed that interest rates have a significant negative impact on the price of the KSE-100 index but money supply showed a significantly positive impact on the KSE-100 index. Nishat, Shaneen and Hijazi (2004) concluded that there is a positive impact of industrial production on stock market index. Siliverstovs and Duong (2006) also demonstrated a positive influence of industrial production on stock market index in European economies.

Using the GARCH (1,1) model, Boldanov et al. (2016) investigated the relationship between oil prices and stock volatility in three oil-importing countries (Japan, China, and the United States) and three oil-exporting countries (Russia, Canada and Norway). They found that the change in oil prices have a positive impact on the stock prices in all the importing countries. Park and Ratti (2008) and Filis (2010) examined the impact of oil price movements on stock prices and found that almost all oil-importing countries' stock prices responded significantly to the oil price movements. Table 1 shows more findings and methods have been used in the previous studies regarding the relationship between the set macroeconomic indicators and stock prices.

Table 1

Summary of key findings for macroeconomic indicators and stock prices

Macroeconomic Variable	Author	Country	Method	Findings
IR	Mumo (2017)	Kenya	VECM model	Positive
IR	Leong and Hui (2014)	Singapore	linear regression	Negative
IR	Vaz, Ariff and Brooks (2008)	Australia	event study	No relationship
M2	Leong and Hui (2014)	Singapore	Linear regression	Positive
M2	Bekhet and Matar (2013)	Jordan	ARDL Approach	Negative
M2	Maysami, Howe and Hamza (2004)	Singapore	Johansen & VECM	No relationship
INFR	Ouma and Muriu (2014)	Kenya	OLS	Positive
INFR	Otieno, Ngugi and Muriu (2018)	Kenya	FIECM & ARFIMA	negative
INFR	Dritsaki (2005)	Greece	Granger causality test	Bidirectional causality
IPI	Filis (2010)	Greece	VECM & VAR	Positive
IPI	Humpe and Macmillan (2009)	US, Japan	Johansen & VECM	No relationship
IPI	Bekhet and Matar (2013)	Jordan	ARDL Approach	No relationship
PPI	Sirucek (2012)	US	OLS	Positive
PPI	Flannery and Protopapadakis (2002)	US	GARCH Model	Negative
TB	Antonakakis, Gupta and Tiwari (2018)	US	GARCH model	Negative
TB	Mehrara (2006)	Iran	Toda-Yamamoto	Unidirectional causality
TB	Basabi and Jaydeep (2000)	India	Toda-Yamamoto	No relationship
OIL	Raza, Shahzad, Tiwari and Shahbaz (2016)	Emerging markets	NARDL Approach	positive
OIL	Reboredo et al. (2017)	European Renewable Energy Index	wavelet causality test	Bidirectional causality
OIL	Bouri (2015)	Jordan	Causality in variance model	Unidirectional causality

Notes: IR (interest rate), M2 (Money supply), INFR (Inflation rate), IPI (Industrial production index), PPI (Producer price index), TB (Trade balance) and OIL (Crude oil prices). Source: Compiled by the authors.

All in all, existing literature highlights the importance of investigating the relationship between the macroeconomic indicators and stock prices. Based on this premise, our study contributes to the literature by evaluating the relationship between domestic and international macroeconomic indicators and financial sector index in the context of a frontier market.

3. METHODOLOGY

The data for the current study were collected as monthly data for the period of January 2007 to December 2016. The study variables considered are the important macroeconomic indicators that play a significant role in the country. The data were collected from different sources. Interest rate (IR) and inflation rate (INFR) were collected from the Hashemite Kingdom of Jordan Department of Statistics; money supply (M2), industrial production index (IPI), producer price index (PPI), trade balance (TB) and crude oil price (OIL) were from the Thomson Reuters Datastream; the financial index price (FI) data were from the ASE. The long run relationship between the set macroeconomic indicators and financial index takes the following form:

$$LFI_t = a_0 + a_1 IR_t + a_2 LM2_t + a_3 INFR_t + a_4 LIPI_t + a_5 LPPI_t + a_6 TB_t + a_7 LOIL_t + \varepsilon_t \quad (1)$$

Where, $a_1 \ldots . a_7$ indicates the coefficient of the variables, a_0 is intercept term, ε_t represents the error term. We converted the variables into log form, except for IR, INFR and TB because these variables either include ratios such as IR or have negative values such as INFR and TB. Accordingly, LFI denotes to the financial index, while IR, LM2, INFR, LIPI, LPPI, TB, LOIL indicate the macroeconomic variables i.e. interest rate, a broad money supply, inflation rate, industrial production index, producer price index, trade balance and crude oil prices respectively. The current study examines the co-integration and the direction of the causality relationship between the domestic and international macroeconomic indicators and the financial sector index in Jordan. In doing so, the time series is to be tested to identify the stationary and integrated order. Therefore, Augmented Dickey Fuller (ADF) and Phillips-Perron (P-P) will be estimated to identify the stationary order of the time series. If some variables are stationary at level I(0) or/and at first difference I(1), then Autoregressive Distributed Lag (ARDL) approach will be useful because ARDL deals with the variables that are stationary at level I(0) or first difference I(1) or mixed. ARDL cannot be applied in case any variable was found to be stationary at second difference I(2). However, the ARDL approach has some advantages over the other existing methods. For example, the method is relatively simple to implement and is recommended for a small sample size (Ghatak & Siddiki, 2001; Narayan, 2005; Pesaran, Shin & Smith, 2001; Matar, 2016). Moreover, the variables are not restricted by a specific lag-length, which provides better results (Laurenceson & Chai, 2003; Leong et al., 2018).

The current study also aims to analyse the causality relationship among the variables. The causality relationship can be estimated using different methods and models such as Vector Autoregressive (VAR) model and Vector Error Correction Model (VECM) model. The VECM is employed to identify the causality relationship in the short and long run once the results show there is co-integration between the variables (Insukindro, 2018). Otherwise, VAR model can be employed to examine the causality relationship. In fact, VECM has some advantages over the VAR model such as VECM provides the causality relationship in the long and short run (Bachmeier & Griffin, 2006) while VAR provides the short run relationship. In our study, the ARDL bounds testing approach takes the following form:

$$\Delta LFI_t = \alpha_{10} + \partial_{11}LFI_{t-1} + \partial_{12}IR_{t-1} + \partial_{13}LM2_{t-1} + \partial_{14}INFR_{t-1}\,\partial_{15}LIPI_{t-1} + \partial_{16}LPPI_{t-1} + \partial_{17}TB_{t-1} + \partial_{18}LOIL_{t-1} + \sum_{i=1}^{n}\theta_{11}\Delta LFI_{t-i} + \sum_{i=1}^{n}\theta_{12}\Delta IR_{t-i} + \sum_{i=1}^{n}\theta_{13}\Delta LM2_{t-i} + \sum_{i=1}^{n}\theta_{14}\Delta INFR_{t-i} + \sum_{i=1}^{n}\theta_{15}\Delta LIPI_{t-i} + \sum_{i=1}^{n}\theta_{16}\Delta LPPI_{t-i} + \sum_{i=1}^{n}\theta_{17}\Delta TB_{t-i} + \sum_{i=1}^{n}\theta_{18}\Delta LOIL_{t-i} + \varepsilon_{1t} \quad (2)$$

Where, Δ is the first difference, α_{10} denotes the constant term, $\partial_{11}\ldots\partial_{18}$ are the short run coefficients, while $\theta_{11}\ldots\theta_{18}$ relates to the long run coefficients, and finally ε represents the error terms.

The null hypothesis (H0) of the ARDL bound testing approach suggests that there is no co-integration and long run relationship among the variables, whereas the alternative hypothesis (H1) suggests that there is co-integration and a long run relationship among the variables. The acceptance or rejection of these hypotheses is subject to the following:

H0: No Co-integration relationship	H1: Co-integration relationship
$\theta_{11}+\theta_{12}+\theta_{13}+\theta_{14}+\theta_{15}+\theta_{16}+\theta_{17}+\theta_{18}=0$	$\theta_{11}+\theta_{12}+\theta_{13}+\theta_{14}+\theta_{15}+\theta_{16}+\theta_{17}+\theta_{18}\neq 0$

Further, to accept or reject the null hypothesis above, the F-statistic of bound testing should be compared with the critical values, and one of the following results will be found:

If $\{F-stat > I(1)_{critical}\}$ then the null hypothesis of no co-integration is rejected.

If $\{F-stat < I(0)_{critical}\}$ then the null hypothesis of no co-integration is accepted.

If $\{I(0)_{critical} < F-stat < I(1)_{critical}\}$, then the outcome isinconclusive.

However, as discussed earlier, to examine the direction of causality between the variables, VECM Granger causality will be applied once the results of the co-integration test showed that there is co-integration among the variables. The direction of causality relationship between two variables X and Y using the VECM model takes the following:

$$\Delta X_t = \emptyset_1 + \sum_{i=1}^{n}\alpha_1\Delta X_{t-1} + \sum_{i=1}^{n}\alpha_2\Delta Y_{t-1} + \partial_1 ECT_{t-1} + \varepsilon_{t1} \quad (3)$$

$$\Delta Y_t = \emptyset_2 + \sum_{i=1}^{n}\alpha_3\Delta Y_{t-1} + \sum_{i=1}^{n}\alpha_4\Delta Y_{t-1} + \partial_2 ECT_{t-1} + \varepsilon_{t2} \quad (4)$$

Where, Δ is the first difference, *ECT* denotes to the error correction term, $\emptyset$ indicates the intercept terms, α_1 *to* α_4 are the short run coefficients, while $\partial_1 and\ \partial_2$ is the speed of adjustment for the explanatory variables.

4. EMPIRICAL RESULTS AND DISCUSSION

We begin with some descriptive statistics. Table 2 shows that financial index has a mean (m) value of 3.49, with a standard deviation (sd) of 0.10. For the macroeconomic indicators, the statistics for interest rate

(m = 4.24, sd = 0.89), money supply (m = 4.36, sd = 0.10), industrial production index (m = 1.99, sd = 0.02), producer price index (m = 2.08, sd = 0.06), trade balance (m = -652.29, sd = 169.25), crude oil price (m = 1.87, sd = 0.14) and inflation rate (m = 0.11, sd = 1.02) are as described. Except for INFR, data are within 3 standard deviations from their means. These denote the absence of extreme outliers for these particular indicators.

With respect to skewness, the variables LFI, IR, LM2 and LIPI had positive skewness values while INFR, LPPI, TB and LOIL had negative skewness. In addition, LFI, INFR and LPPI were leptokurtic, while others had kurtosis less than 3. Moreover, Jarque-Bera's P-values indicate that null hypothesis of normal distribution for LFI, IR, LM2, INFR and LOIL are rejected, but not for LIPI, LPPI and TB.

Table 2

Descriptive statistics of the indicators

	LFI	**IR**	**LM2**	**INFR**	**LIPI**	**LPPI**	**TB**	**LOIL**
Mean	3.49	4.24	4.36	0.11	1.99	2.08	-652.29	1.87
Median	3.46	4.12	4.38	0.10	1.99	2.08	-663.40	1.91
Max	3.74	5.74	4.51	6.00	2.03	2.23	-260.65	2.14
Min	3.35	2.95	4.14	-3.40	1.93	1.93	-1034.5	1.52
Std. Dev.	0.10	0.89	0.10	1.02	0.02	0.06	169.25	0.14
Skewness	1.07	0.18	0.37	-1.36	0.02	-0.42	-0.02	-0.65
Kurtosis	3.02	1.56	2.05	11.74	2.98	3.20	2.24	2.38
J-Bera	23.166	10.9	7.30	419.00	0.01	3.87	2.88	10.37
P-value	0.00	0.00	0.02	0.00	0.99	0.14	0.23	0.00

Source: Analyzed by the authors based on data from Hashemite Kingdom of Jordan Department of Statistics, Datastream and ASE.

Table 3 shows the result of the stationary test for examining the unit root in the time series by utilizing ADF and P-P tests. The results reveal that the financial index is non-stationary at the level I(0), but stationary at first difference I(1). Furthermore, for the macroeconomic indicators, the results demonstrate that LM2, INFR, LIPI, LPPI and TB are stationery at their level (I=0) while IR and LOIL are stationary at the first difference (I=1). Hence, the variables are found to be stationary either at level I(0), at first difference I(1), or both. These results provide evidence that the appropriate co-integration method for the current study is the Autoregressive Distributed Lag (ARDL). One of the most important advantages of the ARDL approach is that it deals with the variables that are stationary in the mixed order of integration.

As can be concluded from Table 4, the calculated F-statistics indicate that there is a co-integration relationship for all the models, except when the interest rate and global oil prices are dependent variables. The co-integration is inconclusive because the F-Statistic was found to be within the lower and upper critical bounds. However, for the main model (i.e. financial index which is a dependent variable) the results show that there is co-integration and significance at the 5% level running from the macroeconomic indicators to the financial index. Hence, the F-statistic was higher than the upper critical bound at 5% significance.

The diagnostics tests such as Heteroskedasticity–ARCH and Serial Correlation Breusch-Godfrey demonstrate that the model is free from these problems. Heteroskedasticity–ARCH resulted in an F-statistic of 0.22 and a P-value of 0.80, while Serial Correlation Breusch-Godfrey also resulted in an F-statistic of 0.252 and a P-value of 0.777. These results demonstrate that we cannot reject the null hypothesis for both tests and that there is no heteroskedasticity or serial correlation in the model.

Table 3

ADF and P-P unit root tests

Variables	Level		First Order Difference	
	Constant	+ Trend	Constant	+ Trend
Augmented Dickey Fuller Results				
LFI	-1.83	-1.34	-5.74***	-5.87***
IR	-2.13	-2.51	-3.38**	-3.35*
LM2	-3.24**	-1.74	-6.24***	-7.05***
INFR	-3.73***	-4.69***	-9.86***	-9.82***
LIPI	-4.23***	-4.19***	-7.05***	-7.04***
LPPI	-3.43**	-3.26*	-3.75***	-3.92***
TB	-1.78	-2.19	-6.66***	-6.70***
LOIL	-2.35	-2.76	-4.73***	-7.74***
Phillips-Perron Results				
LFI	-1.82	-1.18	-7.79***	-7.95***
IR	-1.07	-1.56	-6.86***	-6.85***
LM2	-3.58**	-1.77	-9.54***	-10.31***
INFR	-6.39***	-7.47***	-18.22***	-18.14***
LIPI	-7.61***	-7.57***	-20.17***	-20.09***
LPPI	-2.61*	-2.30	-6.77***	-6.93***
TB	-4.05***	-6.20***	-21.84***	-21.85***
LOIL	-2.13	-2.54	-7.93***	-7.92***

Note: * p < 0.1; ** p < 0.05; *** p < 0.01. Source: Computed by the authors.

Table 4

Bounds Testing Model I: Financial Index

Models	F-Stat	Decision	Critical bound		
(LFI, IR, LM2, INFR, LIPI, LPPI, TB, LOIL) (2, 0, 0, 2, 2, 3, 0, 2)	4.18**	Co-integration			
(IR, LFI, LM2, INFR, LIPI, LPPI, TB, LOIL) (1, 1, 3, 0, 0, 5 ,0, 5)	2.82	Inconclusive	Sig	I(0)	I(1)
(LM2, LFI, IR, INFR, LIPI, LPPI, TB, LOIL) (1, 0, 0, 0, 1, 0, 0, 1)	3.39*	Co-integration	10%	2.03	3.13
(INFR, LFI, IR, LM2, LIPI, LPPI, TB, LOIL) (3, 0, 1, 0, 0, 2, 0, 2)	12.64***	Co-integration	5%	2.32	3.50
(LIPI, LFI, IR, LM2, INFR, LPPI, TB, LOIL) (4, 1, 1, 1, 0, 3, 0, 0)	5.58***	Co-integration	1%	2.96	4.26
(LPPI, LFI, IR, LM2, INFR, LIPI, TB, LOIL) (3, 1, 1, 3, 5, 5, 0, 4)	4.95***	Co-integration			
(TB, LFI, IR, LM2, INFR, LIPI, LPPI, LOIL) (1, 0, 1, 1, 0, 1, 0, 1)	11.45***	Co-integration			
(LOIL, LFI, IR, LM2, INFR, LIPI, LPPI, TB) (2, 1, 0, 1, 0, 0, 1, 0)	2.78	Inconclusive			

Note: used with an intercept and no trend. * p < 0.1; ** p < 0.05; *** p < 0.01. Source: Analyzed by the authors.

For the long run relationship, it can be observed from Table 5 that interest rate positively and significantly affects the financial index in Jordan. As interest rate increases, it reduces the incentive to invest and encourages depositing of money in banks, thereby, augmenting the growth of financial sector. The magnitude of the coefficient attached to the variable interest rate is 0.082, which shows that a 1% increase in rate of interest leads to an increase of approximately 0.082 points in LFI. These findings of the positive significant impact of the interest rate on the financial index are in line with the findings of Jawaid and Ul

Haq (2012) who found co-integration and positive relation between interest rate and the banking sector in emerging country such as Pakistan. In addition, Mumo (2017) also found evidence that there is a positive relationship between the interest rate and stock prices in an emerging market such as the Nairobi Stock Exchange in Kenya.

The results show that the producer price index has a significant negative impact on the financial index. In fact, an increase in the producer price index means an increase in the costs of products that were made by the companies and this leads to the use of more money to finish the products. This increase in capital consumption finally reduces the liquidity and investments in the banks and the financial institutions. The magnitude of the coefficient attached to LPPI is -0.687; the value of the coefficient indicates that one unit increase in LPPI will decrease LFI by approximately 0.687. Our finding of the negative impact of the LPPI on LFI is in line with Flannery and Protopapadakis (2002). Furthermore, we also modeled the effect of the global oil prices (LOIL) on the financial index of ASE. The impact of LOIL was found to negatively affect the LFI in the long run. The rise in the crude oil prices might lead to an increase in the costs of transportations and productions for the manufacturing firms, which results in the use of more money by these companies and finally leads to the reduction in the liquidity of the banks and financial institutions, which influence the financial sector. However, the coefficient value reveals that a one unit increase in LOIL leads to a decrease in LFI by approximately 0.254.

Money supply was found to have an insignificant impact on the financial index. The results are consistent with Maysami et al. (2004). Moreover, the impact of inflation was negative but insignificant on the financial index. In fact, the results of the negative coefficient in the long run are consistent with the proxy effect hypothesis by Fama (1981). However, these results are in line with the findings of Mumo (2017) who concluded that inflation rate is negative but has an insignificant impact on the stock prices in Kenya. The effect of industrial production index remained positive but had insignificant impact on the financial index of ASE. Finally, the influence of trade balance on the financial index was found to be insignificant. These findings are in contrast to the findings of Antonakakis et al. (2018).

Table 5

ARDL Long-run relationship

Variable	Coefficient	S. Error	t-statistic	P-value	Decision
IR	0.082	0.018	4.373	0.000***	Significant
LM2	-0.056	0.276	-0.204	0.838	Insignificant
INFR	-0.007	0.019	-0.374	0.709	Insignificant
LIPI	0.157	0.713	0.220	0.825	Insignificant
LPPI	-0.687	0.274	-2.499	0.014**	Significant
TB	-0.000	0.000	-0.618	0.537	Insignificant
LOIL	-0.254	0.141	-1.796	0.075*	Significant
C	4.929	1.707	2.886	0.004***	Significant
R-squared	(0.988)	D-W: (2.02)		F-Stat	(449.44)
Adjusted R-squared	(0.985)			Prob.	(0.000)

Note: (1) used with an intercept and no trend, (2) D-W: denotes to Durbin-Watson Statistic, (3) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Source: Computed by the authors.

Table 6 presents the results of the short run relationship and the error correction term (ECT). The estimation of the model fulfills all three criteria, i.e. it is significant, negative and less than one in magnitude, which shows that the tendency of convergence to long run equilibrium exists. In addition, the speed of adjustment towards long run equilibrium is 12.6% in one time interval. However, the results of the short run reveal that IR and LPPI are positively correlated with LFI, whereas LIPI and LOIL are negatively correlated with LFI.

Table 6

ARDL Short-run Relationship

Variable	Coefficient	Std. Error	t-Statistic	P-value	Decision
ΔLFI(-1)	0.192	0.089	2.141	0.034**	Significant
ΔIR	0.010	0.002	3.840	0.000***	Significant
ΔLM2	-0.007	0.035	-0.201	0.840	Insignificant
ΔINFR	-0.001	0.001	-0.787	0.432	Insignificant
ΔINFR(-1)	-0.002	0.001	-1.488	0.139	Insignificant
ΔLIPI	-0.209	0.069	-3.041	0.003***	Significant
ΔLIPI(-1)	-0.125	0.063	-1.986	0.049**	Significant
ΔLPPI	0.501	0.108	4.632	0.000***	Significant
ΔLPPI(-1)	0.065	0.157	0.415	0.678	Insignificant
ΔLPPI(-2)	0.159	0.113	1.402	0.163	Insignificant
ΔTB	0.000	0.000	-0.627	0.531	Insignificant
ΔLOIL	0.049	0.033	1.494	0.138	Insignificant
ΔLOIL(-1)	-0.070	0.033	-2.088	0.039**	Significant
ECT(-1)	-0.126	0.029	-4.352	0.000***	Significant

Note: * p < 0.1; ** p < 0.05; *** p < 0.01. Source: Analyzed by the authors.

Table 7 shows the results of the VECM. The causality results demonstrate that there is long run causality relationship running from the macroeconomic indicators (IR, LM2, INFR, LIPI, LPPI, TB and LOIL) to the financial index. The ECT in the model showed a negative coefficient (-0.18) and t-statistic (-3.31) and a significant p-value at 1%. The results of the short run causality indicated that there is unidirectional causality running from LFI to IR and TB as well as from LPPI to LFI.

On the macroeconomic side, we found that the crude oil price affects the trade balance and producer price index in short run. In addition, money supply, inflation rate and industrial production significantly cause the interest rate in the short run. Further, inflation rate was found to highly and significantly affect the producer price index in short run.

Table 7

VECM Granger Causality

	Short run Causality								Long-run
	ΔLFI	ΔIR	ΔLM2	ΔINFR	ΔLIPI	ΔLPPI	ΔTB	ΔLOIL	
LFI	-	0.56	0.86	1.17	0.30	2.50**	0.64	1.25	-3.31***
IR	3.08**	-	2.24**	2.66**	2.56**	0.76	1.31	1.52	0.71
LM2	1.51	0.25	-	0.67	1.25	1.45	1.88*	0.56	0.71
INFR	1.51	1.54	0.26	-	0.22	1.59	0.51	0.35	-2.52**
LIPI	0.86	1.23	0.68	1.63	-	0.65	2.81**	0.71	1.32
LPPI	1.14	0.74	1.51	5.67***	0.23	-	0.34	7.23***	1.90
TB	2.05**	1.19	0.10	1.01	2.09*	0.44	-	1.90*	1.54
LOIL	0.72	0.89	1.02	1.42	0.45	1.69	1.07	-	1.67

Note: * p < 0.1; ** p < 0.05; *** p < 0.01. Source: Computed by the authors.

Eventually, to check the estimated model's stability and creditability of the long run coefficient with the short run dynamics responses of financial index and its causes, we utilized cumulative sum (CUSUM) and cumulative sum of square (CUSUMQ), impulse response function (IRF), and variance decomposition (VDA) tests. The results of the two plots of cumulative sums of recursive residuals and cumulative sum of residuals squared gave the desired results, thus establishing the stability of the models in the long run. The

graph lines did not cross any of the 5% critical bounds lines. Pesaran and Pesaran (1997) tested the stability of the long run coefficients utilizing the same procedure.

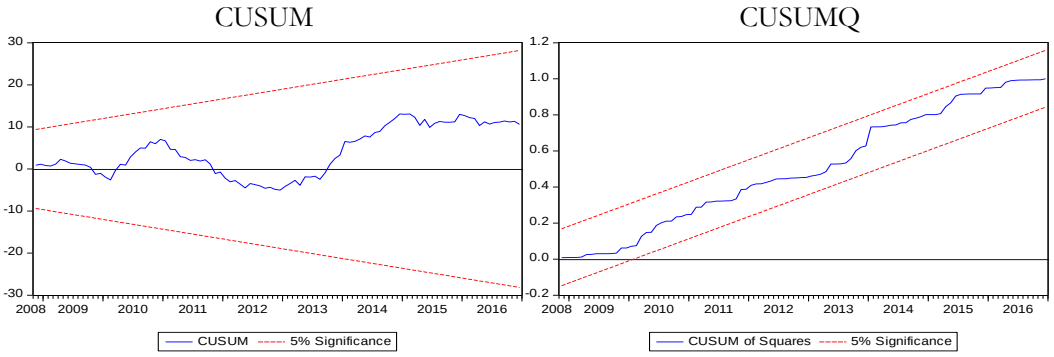
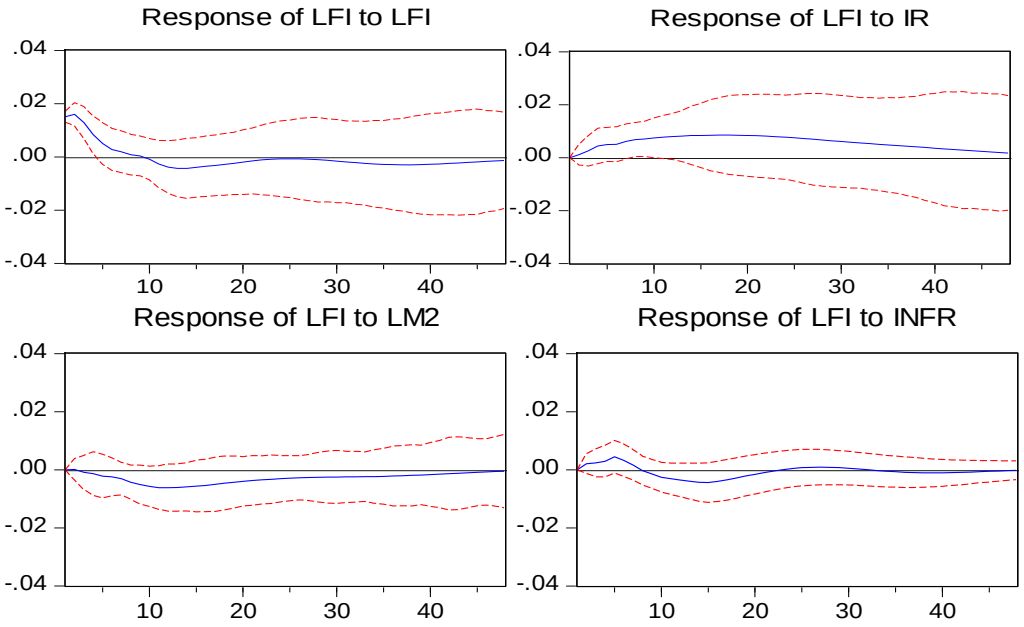


Figure 2. CUSUM and CUSUMQ for Financial Index Model (2007-2016)
Source: Analyzed by the authors.

Furthermore, we applied the IRF for 48 months to examine the short and long run response as well as to confirm the previous results. The results in Figure 3 indicate that IR registered a positive response during all periods. LPPI started with a positive response and within 3-4 months changed to be a negative response, while LOIL registered a weak negative response and reverted to insignificant positive response in the long run. Results are generally consistent with the findings described earlier. Moreover, INFR started with a positive response and later alternated between negative and positive. Money supply was found to have a negative response during all the period, while LIPI and TB showed some insignificant response. Therefore, the results of the IRF test confirmed the earlier results.



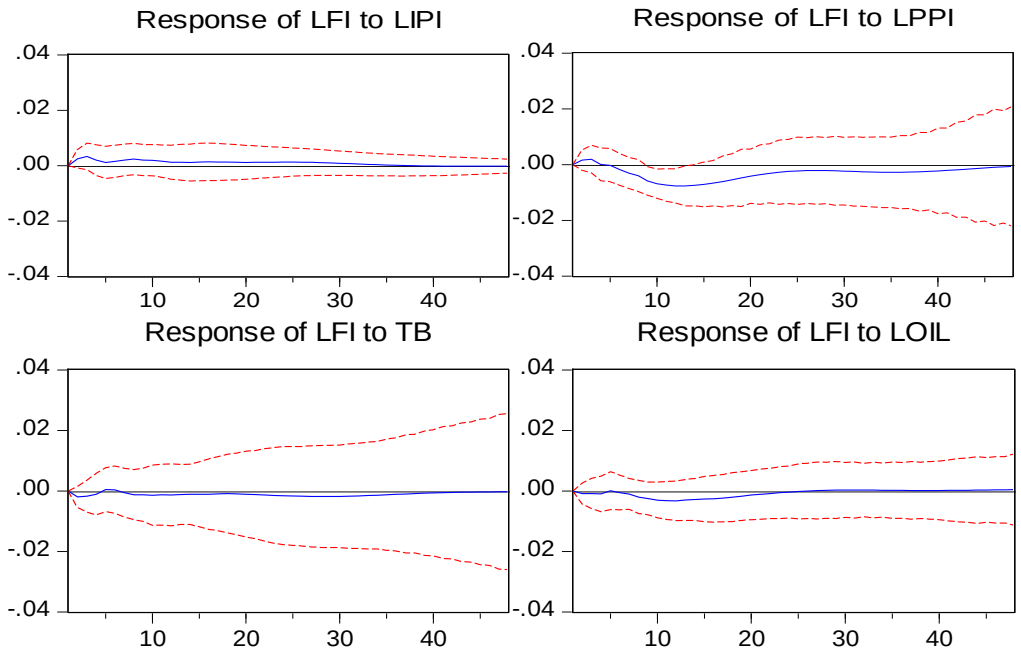


Figure 3. Impulse Response Function (IRF) for LFI model
Source: Analyzed by the authors.

The VDA test enables researchers to determine the most fluctuating sources of the endogenous variable for the duration of the study, while it also permits the estimation of the part of each endogenous variable as explained by the different shocks for different time frames (Lutkepohl, 1990). VDA was calculated for 48 months in Table 8 in order to establish the effects of included explanatory variables i.e. macroeconomic variables on the constant variable (financial index). In the first month, it was assumed that all the variance in the financial index was explained by its own innovations and all macroeconomic variables contributed zero.

Table 8

VDA of LFI

Period	S.E.	LFI	IR	LM2	INFR	LIPI	LPPI	TB	LOIL
1	0.015	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.030	80.263	8.226	1.438	5.257	2.618	0.992	0.903	0.299
12	0.042	44.128	22.074	9.985	4.688	2.595	13.003	0.993	2.530
18	0.053	30.019	28.237	12.378	5.997	1.916	17.605	0.851	2.993
24	0.058	25.229	34.758	12.545	5.196	1.829	16.753	1.002	2.685
30	0.062	22.889	38.448	12.395	4.765	1.833	15.842	1.401	2.422
36	0.064	22.185	39.642	12.317	4.468	1.732	15.770	1.622	2.259
42	0.065	22.291	39.807	12.190	4.416	1.658	15.840	1.631	2.163
48	0.066	22.401	39.909	12.104	4.386	1.640	15.789	1.623	2.144

Note: S.E. stands for Standard Errors. Source: Computed by the authors.

It is evident in Table 8 that IR and LPPI are the factors that significantly contribute to explaining the variance in the financial index because IR and LPPI contributed approximately 55% to the financial index after 48 months. The strong contribution of interest rate over time indicates that IR would influence the financial index, especially in the long run. On the other hand, the trade balance and industrial production index registered the lowest values during the next 48 months, and this indicates that TB and LIP are insignificant in contributing to the financial index during such period. Moreover, INFR and oil price were

found to contribute 4.39% and 2.14% respectively to the financial index after 48 months. These results confirm our earlier findings from the ARDL. Hence, the interest rate and producer price are the major factors that affect the financial index. Finally, the results show that financial index in Jordan can be influenced and explained by various factors.

5. CONCLUSION

This study examined the short run and the long run relationship as well as the causality relationship between domestic and global macroeconomic indicators and the financial index price in Amman Stock Exchange in Jordan. The domestic macroeconomic indicators included the deposit interest rate, broad money supply, inflation rate, industrial production index, producer price index and the trade balance, while the global indicator was represented by the crude oil price. We employed ARDL to estimate the co-integration and short-long run relationship. The approach is considered appropriate to explore the long and short run relationship. We found that deposit rate positively influences the financial index in the short and the long run. Moreover, the producer price index and the crude oil price were found to have a significant negative impact on the financial index in the long run. In addition, to identify the causality relationship and the direction of causality, we utilized the VECM approach. The advantage of VECM is that can be used to identify the short and long run causality especially if cointegration relationship exists between the variables. The results revealed that the set explanatory variables Granger cause the financial index in the long run. Moreover, the results of the short run causality demonstrated that there is unidirectional causality running from LFI to IR and TB, as well as from LPPI to LFI. In addition, we found that the inflation rate and the money supply cause the interest rate, but there is no evidence that interest rate causes the money supply or inflation rate. Furthermore, the global oil price was found to significantly cause the producer price index and trade balance in Jordan. Lastly, we applied impulse response and variance decomposition tests to examine which variables contribute more to the financial index in the next 48 months. The findings of IRF suggested that the financial index significantly responds to the shock of the explanatory variables. Moreover, interest rate and producer price index were the major factors that forecast the variance and contribute to the financial index in Jordan.

These results provide implications for the government, policy makers and investors. Our findings of the positive interest rate on the financial index might be due to the banking sector, which has the largest equity amount in ASE. The increase in the deposit interest rate leads to increased liquidity in the banks and then increases the amount of investments. Subsequently, this can increase profits and thus stock prices of these banks, which is reflected on the financial index. In other words, as interest rate increases, it reduces the incentive to invest and encourages depositing of money in banks, thereby, augmenting the growth of financial sector. Moreover, the variables of the price level such as the producer price index showed a significant and negatively impacts on the financial index. These results imply that the increase in the producer price index means an increase in the costs of products that were made by the companies and this leads to the use of more money to finish the products. This increase in capital consumption finally reduces the liquidity and investments in the banks and the financial institutions.

Our findings also imply that the global oil prices have a significant impact on the financial index in Jordan, which indicates that the ASE is correlated with the global markets and is sensitive to shocks of the global indicators. Thus, the recommendations for the government and policy makers is to monitor the global oil prices and forecast future changes in oil prices to avoid as many negative effects as possible before they actually occur and impact the financial sector. Monitoring and forecasting oil prices will be useful for the economy and other sectors in Jordan because the results also revealed that the oil price significantly cause the producer price index and trade balance. Investors who are concerned with the changes in money supply

and inflation rate might be able to shift their investment into the financial sector given that it is not affected by these factors. Future research can extend our study by focusing on other sectors, such as the industrial and services sectors, which are also considered as important parts of the economy.

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