"Dynamic interactions among the industrial sector and its determinants in Jordan"

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DYNAMIC INTERACTIONS AMONG THE INDUSTRIAL SECTOR AND ITS DETERMINANTS IN JORDAN

Abstract

The industrial sector is one of the most vital sectors in the national economy, so different local and global factors affect its performance. The study examines the impact of the global and local macroeconomic variables on the industrial index of the Amman Stock Exchange. This study covered the period from January 2007 to December 2016, which is considered as a crucial period in the Middle Eastern countries. This period encompasses the worldwide economic meltdown from 2007 to 2008, the Arab spring of 2010 and the wars in Syria and Iraq from 2012 to 2014. The macroeconomic variables used in this study as domestic variables from Jordan were the deposit interest rate (IN), inflation rate (INF), money supply 2 (MS2), trade balance (TR), producer price index (PPI) and the industrial production index (IPI). At the same time the global oil price (WTI) was used as a global factor to measure the external shocks. This study used the ARDL bound testing approach to examine the co-integration, short-run and long-run relationships. Moreover, Granger causality test was used to detect the causality relationship in the short and long run between the selected macroeconomic indicators and the industrial index. It was found out that the inflation rate positively influenced the industrial index, which provides some evidence that the industrial sector in Jordan acts as a hedge against inflation. In addition, the global oil price showed a significant negative impact on the industrial sector. Some important implications for investors, government bodies, and policymakers are discussed.

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INTRODUCTION

The relationship between stock prices and the fundamental economic activities was well documented for developed countries such as the US and UK (see Fama, 1990, 1991; Chen, 1991; Chen, Roll, & Ross, 1986). However, the performance of stock prices in developing countries is less clear. Further, most of the previous studies have focused on the stock prices in its aggregate level, while few studies focused on the sectoral level, such as financial sectors. The relationship between the macroeconomic activities and non-financial sectors, such as the industrial sector found the significant attention of researchers in recent decades due to changes in the monetary policies and technological advancement. Indeed, the industrial sector was considered as the main engine for the growth of a country and was positively associated with the labor force because an increase in the former leads a reduction in unemployment (Kaldor, 1967; Tregenna, 2008).

However, several domestic and global factors can influence the performance of the industrial sector (Athanasoglou, Brissimis, & Delis, 2008). For instance, industrial companies heavily depend on the global oil prices and production, which, in turn, affect the performance of these firms and economies and finally stock markets (Elyasiani, Mansur, & Odusami, 2011). Specifically, the changes in oil price influence the costs of production in manufacturing firms and influence the cash flow. Therefore, these changes affect the profits of these firms and their equity prices in the stock market (Huang, Masulis, & Stoll, 1996). However, Maysami, Howe, and Rahmat (2004) argued that the domestic macroeconomic factors influence the emerging stock markets more than the global factors.

This study aims to examine the impact of the global and domestic macroeconomic variables: deposit interest rate (IN), broad money supply (MS2), inflation rate (INF), industrial production index (IPI), producer price index (PPI), trade balance (TR), and the West Texas Intermediate crude oil price (WTI) on the industrial sector of the Amman Stock Exchange (ASE) in Jordan. Indeed, previous studies regarding the relationship between the macroeconomic indicators and stock prices in Jordan tended to focus on the general price index. For instance, Bekhet and Matar (2012), Bekhet and Matar (2013), Maghyereh (2002), Al-Sharkas (2004), Al-Zararee and Ananzeh (2014) studied the relationship between macroeconomic variables and the general price index of ASE. Moreover, regarding the crude oil price, previous studies overlooked the short-run and long-run relationships between the WTI, which is a crucial oil benchmark, and the industrial index in Jordan. For instance, Bouri, Awartani, and Maghyereh (2016) investigated the mean and variance causality relationship between the oil price (Brent) and the sectoral indices in Jordan using the GARCH process and daily data. Others such as Bouri (2015), Hammami, Ghenimi, and Bouri (2019) and Ajmi, El-Montasser, Hammoudeh, and Nguyen (2014) used the WTI with the general index, while Abuoliem, Nor, Matar, and Hallahan (2019) recently explored it with the financial index. Therefore, the question if the WTI crude oil prices influence the industrial sector in terms of short- and long-run relationship in Jordan has not yet been answered.

Based on the premise of Abuoliem et al. (2019), this paper contributes to the literature by reexamining the relationship with a vital yet different sectoral index within the Middle Eastern context, i.e. industrial index. Further, with the sample starting from January 2007, i.e., after the sectoral restructuring of ASE in 2006 the study covered the periods of the global financial crisis (GFC) of 2008, Arab spring crisis (ASC) of 2010 and the wars in neighboring countries (Iraq and Syria) in 2012–2014. Accordingly, this research aims to investigate the impact of local and global macroeconomic indicators on the industrial sector in a developing country during these periods of crises[1].

In Jordan, the ASE was comprised of four main sectors (insurance, services, banking and industries) but later in 2006, it restructured to only the financial sector, industrial sector, and services sector. Indeed, the industrial sector in Jordan contributes around 24% of GDP (Khrawish & Khraiwesh, 2010). Further, recent statistics show that this sector plays a significant role in Jordan by employing more than 240,000 workers (Jordan Investment Commission, 2017). It also consists of essential subsectors, including pharmaceutical and medical industries, chemical industries, food and beverages, mining and extraction industries, and engineering and construction, among others.

This paper proceeds as follows: the next section reviews the relevant literature in this field. Section 2 provides the data and methodology. Results and discussion are provided in section 3, followed by the conclusion.

1 These events caused an imbalance in the economic indicators in Jordan, such as inflation and foreign trade. For example, the inflation rate increased by 6% in 2013 when compared to 2010, and this occurred due to rent inflation driven by the rise in the number of refugees from Syria and Iraq. Besides, exports decreased by 30% in the first quarter of 2013 as compared to the same period in 2012 (IMF, 2014). Abuqudairi (2014) stated that 20% of Jordanian exports were destined for Iraq, and in 2013, exports to Iraq reached US$ 1.25 billion before terrorist fighting erupted, which halted exports during the crisis.

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1. LITERATURE REVIEW

Several studies have explored the relationship between macroeconomic indicators and stock prices. Abuoliem et al. (2019) used the ARDL bound testing approach to examine the relationship between different macroeconomic indicators and financial index in Jordan. They found that the deposit interest rate had a significant and positive influence on the financial index in the long run because when the interest rate increases, it reduces the incentive to invest and encourages depositing of money in banks, and therefore, augmenting the growth of the financial sector. In contrast, they found that crude oil prices had a significant and negative impact on the financial index. The negative effect of oil price indicates that the increases in oil price lead to a rise in the costs and finally reduce profits. Jain, Narayan, and Thomson (2011) examined the relationship between exchange rate, interest rates, and stock returns of four major banks in Australia. They found that short-term interest rate negatively influences all banks' stock returns. Their results are consistent with the empirical theories.

In another work, Hassan and Al Refai (2012) analyzed the impact of different macroeconomic indicators on equity returns in Jordan. They found that the deposit interest rate does not influence the equity returns. Rjoub, Civcir, and Resatoglu (2017) studied the impact of micro and macroeconomic indicators on the stock prices in the banking sector in Turkey. They found that the interest rate was significantly related to the banks' stock prices because the interest rate influences the banks' net interest income, as well as the level of other interest-sensitive income. In contrast, Demir and Ersan (2016) revealed that macroeconomic indicators (gross industrial production, consumer price index, money supply, interest rate and oil price) do not influence the stock returns of tourism companies in Turkey.

Maysami, Howe, and Rahmat (2004) studied the co-integration relationship between the macroeconomic variables (exchange rate (EX), interest rate (IR), money supply (MS), inflation (INF), industrial production (IPI) and three sector indices in the Singapore Stock Exchange (finance index, hotel index, and property index). The results of the finance index model showed that MS had a weak positive effect, while IPI had an insignificant influence. The insignificant impact of IPI may be because the accumulation of real assets and investments in the finance sector was observed as alternative investments. For the hotel index model, they found that IPI had a significant positive impact, while MS had an insignificant negative impact. In the third model (i.e., property index), the results showed that MS and IPI positively influenced the property index.

In another study, Leong and Hui (2014) used the linear regression. They found that the money supply and industrial production had a positive impact on the hotel stock returns in Singapore. With these results, we can conclude that the relationship between macroeconomic indicators such as MS and IPI and the sectoral indices appear inconsistent. In other words, findings can be different from one sector (or country) to another, warranting further investigations.

For the inflation rate, the empirical literature suggested different relationships between the inflation rate and stock returns. According to Fisher's hypothesis, stock returns can act as a hedge against inflation, and the nominal stock returns increase with expected inflation in a one-to-one ratio. Therefore, Fisher's hypothesis suggests a positive relationship between inflation rate and stock returns. In contrast, Fama (1981) introduced the proxy effect hypothesis. He argued that there is a negative relationship between inflation rate and stock returns because the economic activities such as GDP positively correlated with stock returns, while negatively influenced by inflation, and therefore, a negative relationship between inflation rate and stock returns. However, Maysami et al. (2004) found a positive correlation between the inflation rate and the finance sector's stock returns in Singapore. Alagidede (2009) likewise found a positive relationship with the stock returns in Kenya, Nigeria, and Tunisia consistent with Fisher's hypothesis. In contrast, Al-Tamimi, Alwan, and Abdel Rahman (2011) found a negative relationship with the stock prices of 17 companies in the UAE consistent with the proxy effect hypothesis.

Kim, McKenzie, and Faff (2004) studied the impact of the macroeconomic news announcements (trade balance, PPI, CPI, unemployment, and retail sales) on the mean and volatility returns in three markets (foreign exchange market, US stock market, and bond market). They found that the unexpected trade balance news significantly influenced the mean returns in the foreign exchange market. On the other hand, the producer price and consumer price information were significant for the US stock market. Finally, they found that all variables affected the bond market. Adams, McQueen, and Wood (2004) found that an unexpected increase in CPI and PPI caused the stock prices to fall. Their results for CPI were consistent with a proxy effect.

Ray (2012) applied the multiple regression model to examine the relationship between 13 macroeconomic indicators and stock prices in India. He found that money supply and industrial production index had a positive and statistically significant impact on stock prices. In contrast, the results showed that oil prices had a negative influence on stock prices. Indeed, India was considered as an oil-importing country. The increase in oil prices leads to an increase in the manufacturing and transportations costs, and therefore, negatively influences the cash flows of firms, which, in turn, negatively influences their stock prices. On the other hand, he found that CPI, trade balance, and interest rate had an insignificant impact on stock prices.

Finally, concerning crude oil, several studies such as Mensi, Hammoudeh, Shahzad, and Shahbaz (2017) and Noor and Dutta (2017) argued that the global oil is one of the essential global factors that can influence the economies and stock markets. Indeed, the increase in oil prices is beneficial for the oil-exporting countries, and positively affects their stock prices, since these countries mainly depend on the exports of the oil products while negatively influencing the stock prices in the oil-importing countries due to the increase in the production costs and finally decreasing the cash flows (Gan, Lee, Yong, & Zhang, 2006).

Although numerous studies have investigated the relationship between the crude oil prices and stock prices, findings of previous studies were inconsistent. For instance, Arouri (2011) tested if crude oil prices move the European sector stock markets. He found that there was no relationship between oil price changes and stock returns of the European industrial sectors. However, he found a weak causality relationship running from the crude oil price to stock returns of the industrial sectors. In another study, Nandha and Faff (2008) examined the effect of WTI on 35 global industries indices. They found that the decrease and increase in oil prices had symmetric impacts on the stock returns, and the stock returns of all sectors were negatively influenced by the oil prices, except for the gas, oil, and mining industries. Indeed, the relationship between oil price and stock market indices can be different from one sector to another and from one country to another (Arouri, 2011).

In this study, the WTI crude oil price as a global oil price was used to examine the relationship in the long run and short run with the industrial index in Jordan. Several countries like Qatar, Kuwait, United Arab Emirates, Oman, Saudi Arabia, and Bahrain are closely monitoring WTI price. Their oil prices take their cues periodically on a daily or a weekly basis from the futures prices for WTI (Adaramola, 2012).

2. DATA AND METHODOLOGY

The current study focused on the period from January 2007 to December 2016 using monthly time series data. Figure 1 shows the ASE industrial index during the period of the study. It can be seen that the index increased from 2,510 points in February 2007 to 5,660 points in June 2008 and then decreased to only 2,917 at the end of October 2008, consistent with the GFC. Nevertheless, the index did not improve after GFC, where it continued by decreasing slowly to reach 1,849 points in December 2015. Later, the index showed a very slight improvement to reach 2,093 points in December 2016.

This study is built upon prior research by Abuoliem et al. (2019), which explored the identical indicators with the financial index. This paper used the same dataset as the authors (except for the dependent variable) to investigate the relationship between these indicators and industrial index and if similar relationship holds with another important sector in the economy.

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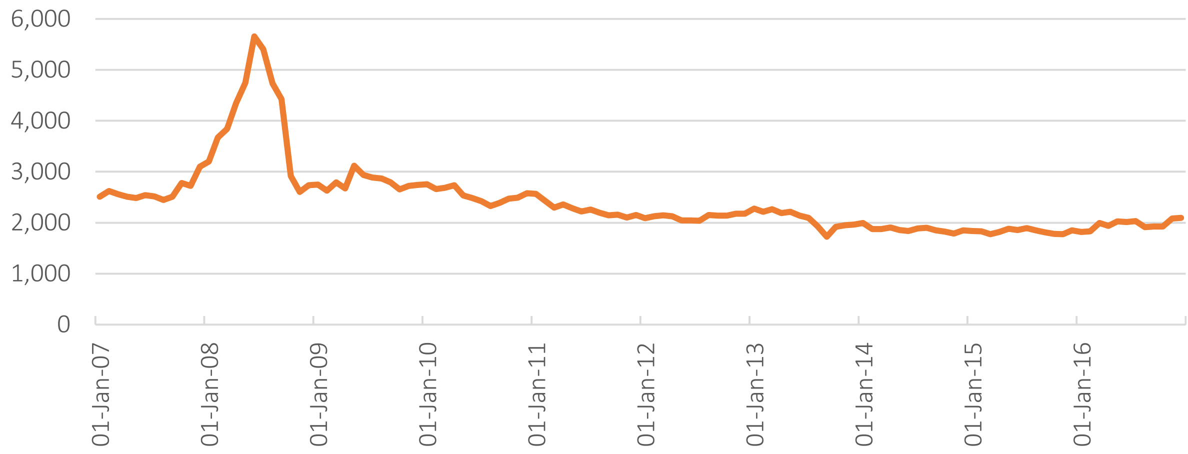

Figure 1. ASE industrial index (2007–2016)

The data of money supply (MS2), industrial production index (IPI), producer price index (PPI), trade balance (TR), and the crude oil price (WTI) were obtained from Thomson Reuters Datastream. Weighted average deposit rate (IN) and inflation rate (INF) were obtained from the Jordanian Department of Statistics. Finally, data of the industrial sector index were collected from the Amman Stock Exchange. The variables were carefully selected since they are theoretically interrelated. In detail, IN and MS2 represent the monetary variables. The money supply is a vital variable and widely used in the literature. The change in MS2 has a direct and indirect impact on stock prices through portfolio changes and their influence on real activity variables. INF, PPI, and IPI are economic indicators. TR was used as an external indicator that can influence the stock market via the exchange rate. Finally, WTI was used as a global benchmark that can influence the stock prices via various channels, such as oil determinants, high production and transportation costs, which affect the production costs in manufacturing firms.

In this study, the data were transformed into logarithm form for all the variables except for INF, IR, and TR because these variables were ratios such as interest rate or had negative values such as inflation rate and trade balance.

The main objectives of this study are to examine the long-run, short-run and causality relationship between domestic and global macroeconomic indicators and the industrial index in ASE. Thus, the primary model of the relationship between the macroeconomic indicators and industrial index takes the following form:

$$LII_t = \gamma_0 + \beta_1 IN_t + \beta_2 LMS2_t + \\ +\beta_3 INF_t + \beta_4 LIPI_t + \beta_5 LPPI_t + \\ +\beta_6 TR_t + \beta_7 LWTI_t + \varepsilon_t. \quad (1)$$

In Equation 1, LII_t indicates the industrial index, γ_0 denotes the intercept term, $\beta_1 ... \beta_7$ are the coefficients of the explanatory variables, and ε_t reflects the error term. The variables IN, $LMS2$, INF, $LIPI$, $LPPI$, TR, and $LWTI$ are deposit rate, money supply 2, inflation rate, industrial production index, producer price index, trade balance, and oil prices, respectively.

To examine the short-run and long-run relationships among the variables, different steps of the methodology were used. In time series analysis, the unit root tests are necessary tests to detect the stationary properties of the variables. Before using the ARDL bound testing approach, one needs to ensure that the variables are stationary at I(0), I(1) but not at I(2) level to avoid the spurious results. Therefore, the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (P-P) tests will be used in the current study to detect the stationary properties.

Pesaran, Shin, and Smith (2001) introduced the ARDL bound testing approach to examine the co-integration, long-run, and short-run relationships. This approach showed some advantages over than the other tests, such as the Johansen-Juselius co-integration test (J-J). For instance, one can use the bound testing if the variables are stationary at the level I(0) or

$$\begin{bmatrix} \Delta LII \\ \Delta IN \\ \Delta LMS2 \\ \Delta INF \\ \Delta LIPI \\ \Delta LPPI \\ \Delta TR \\ \Delta LWTI \end{bmatrix} = \begin{bmatrix} \omega_{10} \\ \omega_{20} \\ \omega_{30} \\ \omega_{40} \\ \omega_{50} \\ \omega_{60} \\ \omega_{70} \\ \omega_{80} \end{bmatrix} + \begin{bmatrix} \pi_{11} & \pi_{12} & \pi_{13} & \pi_{14} & \pi_{15} & \pi_{16} & \pi_{17} & \pi_{18} \\ \pi_{21} & \pi_{22} & \pi_{23} & \pi_{24} & \pi_{25} & \pi_{26} & \pi_{27} & \pi_{28} \\ \pi_{31} & \pi_{32} & \pi_{33} & \pi_{34} & \pi_{35} & \pi_{36} & \pi_{37} & \pi_{38} \\ \pi_{41} & \pi_{42} & \pi_{43} & \pi_{44} & \pi_{45} & \pi_{46} & \pi_{47} & \pi_{48} \\ \pi_{51} & \pi_{52} & \pi_{53} & \pi_{54} & \pi_{55} & \pi_{56} & \pi_{57} & \pi_{58} \\ \pi_{61} & \pi_{62} & \pi_{63} & \pi_{64} & \pi_{65} & \pi_{66} & \pi_{67} & \pi_{68} \\ \pi_{71} & \pi_{72} & \pi_{73} & \pi_{74} & \pi_{75} & \pi_{76} & \pi_{77} & \pi_{78} \\ \pi_{81} & \pi_{82} & \pi_{83} & \pi_{84} & \pi_{85} & \pi_{86} & \pi_{87} & \pi_{88} \end{bmatrix} \begin{bmatrix} LII \\ IN \\ LMS2 \\ INF \\ LIPI \\ LPPI \\ TR \\ LWTI \end{bmatrix}_{t-1} +$$

$$+\sum_{i=1}^{n} \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} & \alpha_{15} & \alpha_{16} & \alpha_{17} & \alpha_{18} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} & \alpha_{24} & \alpha_{25} & \alpha_{26} & \alpha_{27} & \alpha_{28} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} & \alpha_{34} & \alpha_{35} & \alpha_{36} & \alpha_{37} & \alpha_{38} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & \alpha_{44} & \alpha_{45} & \alpha_{46} & \alpha_{47} & \alpha_{48} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & \alpha_{55} & \alpha_{56} & \alpha_{57} & \alpha_{58} \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & \alpha_{66} & \alpha_{67} & \alpha_{68} \\ \alpha_{71} & \alpha_{72} & \alpha_{73} & \alpha_{74} & \alpha_{75} & \alpha_{76} & \alpha_{77} & \alpha_{78} \\ \alpha_{81} & \alpha_{82} & \alpha_{83} & \alpha_{84} & \alpha_{85} & \alpha_{86} & \alpha_{87} & \alpha_{88} \end{bmatrix} \begin{bmatrix} \Delta LII \\ \Delta IN \\ \Delta LMS2 \\ \Delta INF \\ \Delta LIPI \\ \Delta LPPI \\ \Delta TR \\ \Delta LWTI \end{bmatrix}_{t-i} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \\ \varepsilon_{8t} \end{bmatrix}, \quad (2)$$

where $\omega_{10}...\omega_{80}$, reflect the intercept terms, $\pi_{11}...\pi_{88}$ are the coefficients of the long-run relationships, $\alpha_{11}...\alpha_{88}$ are the coefficients of short-run relationships, ε_{1t}-ε_{8t} denote the error terms.

at the first difference I(1) or in mixed form, i.e., some variables I(0) and others I(1) (Pesaran, Shin, & Smith, 2001). Moreover, the ARDL bound testing approach is suitable for the small sample size, while other tests such as the J-J test require large samples (Bekhet, Matar, & Yasmin, 2017). However, the ARDL bound testing approach is inapplicable with the variables that stationary at their second difference, i.e., I(2). Therefore, to examine the co-integration, long-run and short-run relationships between the macroeconomic variables and the industrial index, the ARDL bounds testing approach can be formulated as follows (see formula (2)).

In the ARDL bound testing approach, the null hypothesis (H_0) suggests that there is no co-integration relationship running from the macroeconomic indicators to the industrial index. Taking into consideration Equation (2), H_0 cannot be rejected, and there is no co-integration running from the macroeconomic variables to the industrial index if $\pi_{11} = \pi_{12} = \pi_{13} = \pi_{14} = \pi_{15} = \pi_{16} = \pi_{17} = \pi_{18} = 0$. In contrast, H_0 can be rejected, indicating that there is a co-integration running from the macroeconomic variables to the industrial index if $\pi_{11} \neq \pi_{12} \neq \pi_{13} \neq \pi_{14} \neq \pi_{15} \neq \pi_{16} \neq \pi_{17} \neq \pi_{18} \neq 0$.

Further, to examine the causality relationship among the variables, different models can be used, such as the Vector Error Correction Model (VECM) and the Vector Autoregressive Model (VAR). Indeed, the VAR model can detect the causality relationship in the short-run, while the VECM model is suitable to identify the causality relationship in the long run and short run (Bachmeier & Griffin, 2006). However, the VECM model can be estimated to examine the short run and long-run causality relationships if the results showed that there is a co-integration relationship among the variables (Insukindro, 2018). Otherwise, the VAR model can be employed to examine the short-run causality relationship. In the VECM framework, the causality relationship can be estimated in two ways. First, the short-run causality relationship and can be detected utilizing the Wald test and F-statistic. Second, the long-run causality relationship and can be examined by the t-test. Therefore, in the current study, to estimate the Granger causality through the VECM model, the equation of the causality relationship takes the following form:

Further, the Cumulative Sum (CUSUM) and the Cumulative Sum of Square (CUSUMQ) stability tests will be estimated to determine if the model under study is stable in the short run and long run. CUSUM and CUSUMQ are necessary stability tests because they illustrate two things. First, the tests can identify any structural change in the model. Second, they can examine the long-run and short-run stability. Brown, Durbin, and Evans (1975) argued that the CUSUMQ test is a useful supplement to the CUSUM test. However, several studies have shown

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$$\begin{bmatrix} \Delta LII \\ \Delta IN \\ \Delta LMS2 \\ \Delta INF \\ \Delta LIPI \\ \Delta LPPI \\ \Delta TR \\ \Delta LWTI \end{bmatrix} = \begin{bmatrix} \pi_{10} \\ \pi_{20} \\ \pi_{30} \\ \pi_{40} \\ \pi_{50} \\ \pi_{60} \\ \pi_{70} \\ \pi_{80} \end{bmatrix} + \sum_{i=1}^{n} \begin{bmatrix} \lambda_{11} & \lambda_{12} & \lambda_{13} & \lambda_{14} & \lambda_{15} & \lambda_{16} & \lambda_{17} & \lambda_{18} \\ \lambda_{21} & \lambda_{22} & \lambda_{23} & \lambda_{11} & \lambda_{25} & \lambda_{26} & \lambda_{27} & \lambda_{28} \\ \lambda_{31} & \lambda_{32} & \lambda_{33} & \lambda_{34} & \lambda_{35} & \lambda_{36} & \lambda_{37} & \lambda_{38} \\ \lambda_{41} & \lambda_{42} & \lambda_{43} & \lambda_{44} & \lambda_{45} & \lambda_{46} & \lambda_{47} & \lambda_{48} \\ \lambda_{51} & \lambda_{52} & \lambda_{53} & \lambda_{54} & \lambda_{55} & \lambda_{56} & \lambda_{57} & \lambda_{58} \\ \lambda_{61} & \lambda_{62} & \lambda_{63} & \lambda_{64} & \lambda_{65} & \lambda_{66} & \lambda_{67} & \lambda_{68} \\ \lambda_{71} & \lambda_{72} & \lambda_{73} & \lambda_{74} & \lambda_{75} & \lambda_{76} & \lambda_{77} & \lambda_{78} \\ \lambda_{81} & \lambda_{82} & \lambda_{83} & \lambda_{84} & \lambda_{85} & \lambda_{86} & \lambda_{87} & \lambda_{88} \end{bmatrix} \begin{bmatrix} \Delta LII \\ \Delta IN \\ \Delta LMS2 \\ \Delta INF \\ \Delta LIPI \\ \Delta LPPI \\ \Delta TR \\ \Delta LWTI \end{bmatrix}_{t-n} + \begin{bmatrix} \phi 1ECT \\ \phi 2ECT \\ \phi 3ECT \\ \phi 4ECT \\ \phi 5ECT \\ \phi 6ECT \\ \phi 7ECT \\ \phi 8ECT \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \\ \varepsilon_{8t} \end{bmatrix}, \quad (3)$$

where Δ denotes the first difference operator, ECT reflects the Error Correction Term, π_{10} to π_{80} are the intercept terms, λ_{11} to λ_{88} denote the coefficients of the short-run relationship, and finally $\phi 1$-$\phi 8$ are the coefficients of ECT.

that CUSUM and CUSUMQ tests are always associated with co-integration tests, especially with the ARDL bound testing approach such as those found in Akinlo (2006) and Baharumshah, Mohd, and Masih (2009). Therefore, the current study will use both CUSUM and CUSUMQ to identify the stability of the residual in the short run and long run.

3. RESULTS AND DISCUSSION

Based on the methods presented earlier, the findings and discussions are systematically outlined in this section according to the relevant tests. The results are discussed as follows.

3.1. Descriptive statistics

The main variables in this study were the industrial index and macroeconomic indicators in ASE. In summary, all data in the current study were within three standard deviations from their means, except for *LII* and *INF*. *INF*, *LPPI*, *TR*, and *LWTI* showed negative skewness values, while *LII*, *IN*, *LMS*2, and *LIPI* were positively skewed. The results indicated the leptokurtic distributions for *LII*, *INF*, and *LPPI* (slight). With *p*-values of less than 5%, the Jarque-Bera normality test showed that one could reject the null hypothesis for *LII*, *IN*, *LMS*2, *INF*, and *LWTI*.

The multicollinearity test was adopted to detect if the explanatory variables in the model were highly linearly related. Table 2 indicates that the highest correlation value is –0.69 between money supply and trade balance (moderate negative correlation). The measurement developed by Rowntree (1981) categorized the correlation between 0.41 and 0.71 as moderate. Therefore, one can conclude that there is no multicollinearity issue, and no perfect linear relationship existed among the explanatory variables.

Table 1. Descriptive statistics

Source: Data were sourced from the Jordanian Department of Statistics, Thomson Reuters Datastream and Amman Stock Exchange. There was used the same dataset (independent variables) as in Abuoliem et al. (2019) was usedto explore a different relationship between these indicators and the LII. Except for the dependent variable and presentation, determinants data are identical to Abuoliem et al. (2019) published under the Creative Commons Attribution Works 3.0 Unported License (CC-BY).

Variables	Mean	Median	Max	Min	S. dev.	Skew	Kurt	J-B	*p*-value
LII	3.36	3.34	3.75	3.23	0.10	1.52	5.71	83.19	0.00
IN	4.24	4.12	5.74	2.95	0.89	0.18	1.56	10.9	0.00
LMS2	4.36	4.38	4.51	4.14	0.10	0.37	2.05	7.30	0.02
INF	0.11	0.10	6.00	–3.40	1.02	–1.36	11.74	419.0	0.00
LIPI	1.99	1.99	2.03	1.93	0.02	0.02	2.98	0.01	0.99
LPPI	2.08	2.08	2.23	1.93	0.06	–0.42	3.20	3.87	0.14
TR	–652.29	–663.40	–260.65	–1034.5	169.25	–0.02	2.24	2.88	0.23
LWTI	1.87	1.91	2.14	1.52	0.14	–0.65	2.38	10.37	0.00

Notes: S. dev.: (Standard deviation), Skew: (Skewness), Kurt: (Kurtosis), J-B: (Jarque-Bera normality test).

Table 2. Multicollinearity test-correlation matrix

Source: Analyzed by the authors.

Variables	*IN*	*LMS2*	*INF*	*LIPI*	*LPPI*	*TR*	*LWTI*
IN	1.000	–	–	–	–	–	–
LMS2	–0.68	1.000	–	–	–	–	–
INF	0.28	–0.41	1.000	–	–	–	–
LIPI	0.18	–0.04	–0.01	1.000	–	–	–
LPPI	–0.02	0.31	0.06	–0.01	1.000	–	–
TR	0.28	–0.69	0.05	–0.09	–0.39	1.000	–
LWTI	0.29	–0.30	0.59	0.008	0.42	–0.18	1.000

3.2. Unit root test

This study used the Augmented Dickey-Fuller (ADF) and Phillips-Perron (P-P) tests to examine the stationary properties. The null hypothesis in both tests suggests that a unit root is present in the time series, while the alternative hypothesis suggests that the time series are stationary. The results in Table 3 demonstrate that the variables are stationary at a mixed order of integration. In other words, for some variables, the null hypothesis of the unit root was rejected. Hence, they were stationary at their level form (I = 0), while for other variables, such null hypothesis was not rejected, and they became stationary at their first difference (I = 1).

Briefly stated, ADF and P-P tests show that LII was non-stationary at I(0) level but became stationary at first difference I(1). Unvarying description of the other macroeconomic indicators can be found in Abuoliem et al. (2019). Put another way, the results in both tests were consistent where some variables were stationary at their level, while others were (also) stationary at their first difference. Based on these findings, the ARDL bound testing approach is considered suitable to examine the co-integration and the relationship between the variables.

3.3. Diagnostic statistics

The primary model in the current study is where the macroeconomic indicators are the explanatory variables, and the industrial index is the constant variable. The current study used the diagnostic tests, including the serial correlation and heteroskedasticity, which are considered as essential tests to confirm if the model under study is free from serial correlation and heteroskedasticity problems. The null hypothesis of the Breusch-Godfrey test suggests that there is no serial correlation, whereas, for heteroskedasticity, it suggests

Table 3. Unit root tests

Source: Data were sourced from the Jordanian Department of Statistics, Thomson Reuters Datastream and Amman Stock Exchange. The same dataset (independent variables) as in Abuoliem et al. (2019) was used to explore a different relationship between these indicators and the LII. Except for the LII outcome and presentation, the determinants data are identical to Abuoliem et al. (2019), which was published under the Creative Commons Attribution Works 3.0 Unported License (CC-BY).

Augmented Dickey-Fuller								
Level	*LII*	*IN*	*LMS2*	*INF*	*LIPI*	*LPPI*	*TR*	*LWTI*
C	–1.76	–2.13	–3.24**	–3.73***	–4.23***	–3.43**	–1.78	–2.35
C+T	–2.87	–2.51	–1.74	–4.69***	–4.19***	–3.26*	–2.19	–2.76
1st diff	LII	IN	LMS2	INF	LIPI	LPPI	TR	LWTI
C	–5.65***	–3.38**	–6.24***	–9.86***	–7.05***	–3.75***	–6.66***	–4.73***
C+T	–5.62***	–3.35*	–7.05***	–9.82***	–7.04***	–3.92***	–6.70***	–7.74***
Phillips-Perron								
Level	*LII*	*IN*	*LMS2*	*INF*	*LIPI*	*LPPI*	*TR*	*LWTI*
C	–1.76	–1.07	–3.58**	–6.39***	–7.61***	–2.61*	–4.05***	–2.13
C+T	–2.95	–1.56	–1.77	–7.47***	–7.57***	–2.30	–6.20***	–2.54
1st diff	LII	IN	LMS2	INF	LIPI	LPPI	TR	LWTI
C	–8.96***	–6.86***	–9.54***	–18.22***	–20.17***	–6.77***	–21.84***	–7.93***
C+T	–8.93***	–6.85***	–10.31***	–18.14***	–20.09***	–6.93***	–21.85***	–7.92***

Notes: ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively. *C* and *C+T* show intercept and intercept + trend, respectively.

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that there is no ARCH effect in the residual. In Table 4, results of both tests indicate that *p*-value > 5% and therefore the null hypotheses of the serial correlation and heteroskedasticity tests cannot be rejected in both cases. Therefore, the primary model of the current study is free from serial correlation and heteroskedasticity problems.

Table 4. Diagnostic tests

Source: Analyzed by the authors.

Serial correlation Breusch – Godfrey	
F-statistic	0.172
p-value	0.679
Heteroskedasticity – ARCH	
F-statistic	0.482
p-value	0.488

3.4. Bounds test

Table 5 shows the results of the co-integration between the industrial index and the macroeconomic indicators. The null hypothesis of no co-integration for all models can be rejected, except for two models. First, when the interest rate was a dependent variable, the computed *F*-statistic value is within the lower and upper critical bounds, and, therefore, the decision is inconclusive. Second, when the crude oil price was a dependent variable, the results reveal no co-integration was running from the variables to *LWTI* since the *F*-statistic value is lower than the lowest critical bound. However, in the current study, we focused on the target model, where the industrial index was the dependent variable, and macroeconomic indicators were the explanatory variables. Therefore, the results indicate that the null hypothesis of no co-integration can be rejected since the *F*-statistic value is 4.45, which is more than the upper critical value at 1% (4.26). Therefore, the results show there was a co-integration relationship (significant at 1%) running from the macroeconomic indicators to the industrial index in Jordan. The results are consistent with findings of Abuoliem et al. (2019), who found a co-integration relationship between these macroeconomic indicators and financial index in Jordan.

3.5. Autoregressive distributed lag (ARDL) approach

In Table 6, the value of Durbin-Watson (D-W) is close to two, and, therefore, indicates that there is no autocorrelation in the residual (Aragón, Cerda, Delgado, Aguilar, & Navarro, 2019). On the other hand, the results of the long-run relationship between the macroeconomic indicators and industrial index reveal that money supply and crude oil price had a significant negative relationship with the industrial index. In contrast, inflation rate, and producer price index had a significant positive relationship with the industrial index.

For the long-run relationship, the coefficient of LMS2 demonstrates that an increase of one unit in *LMS2* led to a decrease of 0.762 in *LII*. Based on the Keynesian economists, changes in money supply can negatively affect the stock prices if the changes in the money supply alter the expectations about future monetary policy. Specifically, a positive money supply shock will lead investors to expect to tighten the monetary policy in the future. The demand for funds will increase, which leads to raising the interest rate and discount rate, and, therefore, the expectations of the future earnings will fall, and finally, stock prices will be decreased (Sellin, 2001). Maysami et al. (2004) found that money supply had an insignificant negative impact on the hotel index.

Table 5. Bounds test

Models	*F*-stat	Decision	Critical bounds		
(LII, IN, LMS2, INF, LIPI, LPPI, TR, LWTI) (1, 0, 3, 0, 0, 3, 0, 1)	4.45***	Co-integration			
(IN, LII, LMS2, INF, LIPI, LPPI, TR, LWTI) (1, 1, 1, 0, 0, 3, 0, 0)	2.97	Inconclusive	Sig	I(0)	I(1)
(LMS2, LII, IN, INF, LIPI, LPPI, TR, LWTI) (1, 0, 0, 0, 1, 0, 0, 2)	3.70**	Co-integration	10%	2.03	3.13
(INF, LII, IN, LMS2, LIPI, LPPI, TR, LWTI) (1, 3, 1, 0, 2, 0, 0, 0)	9.34***	Co-integration	5%	2.32	3.50
(LIPI, LII, IN, LMS2, INF, LPPI, TR, LWTI) (2, 0, 1, 1, 0, 3, 3, 0)	5.23***	Co-integration	1%	2.96	4.26
(LPPI, LII, IN, LMS2, INF, LIPI, TR, LWTI) (3, 1, 1, 3, 1, 0, 1, 1)	11.10***	Co-integration	–	–	–
(TR, LII, IN, LMS2, INF, LIPI, LPPI, LWTI) (1, 1, 1, 1, 0, 1, 0, 1)	12.04***	Co-integration	–	–	–
(LWTI, LII, IN, LMS2, INF, LIPI, LPPI, TR) (3, 1, 0, 2, 0, 1, 0, 0)	1.91	No co-integration	–	–	–

Notes: ***, **, * denote the significance level of 1%, 5%, 10%, respectively, and used with an intercept and no trend.

Table 6. Long-run and short-run relationships

Variables	Coefficient	S. error	*t*-statistic	*p*-value	Decision
Long-run relationship					
IN	0.025	0.016	1.499	0.136	Insignificant
LMS2	–0.762	0.232	–3.273	0.001***	Significant
INF	0.025	0.012	1.993	0.048**	Significant
LIPI	–0.298	0.526	–0.566	0.572	Insignificant
LPPI	0.612	0.229	2.669	0.008**	Significant
TR	–0.000	0.0001	–0.323	0.747	Insignificant
LWTI	–0.540	0.141	–3.819	0.001***	Significant
C	6.907	1.548	4.461	0.000***	Significant
Short-run relationship					
ΔIN	0.0053	0.0034	1.5666	0.1203	Insignificant
ΔLMS2	0.8201	0.6506	1.2604	0.2104	Insignificant
ΔLMS2(–1)	1.3363	0.8858	1.5087	0.1345	Insignificant
ΔLMS2(–2)	–1.8194	0.6324	–2.8766	0.0049***	Significant
ΔINF	–0.0054	0.0024	–2.2307	0.0279**	Significant
ΔLIPI	–0.0629	0.1100	–0.5718	0.5687	Insignificant
ΔLPPI	0.9659	0.1843	5.2388	0.0000***	Significant
ΔLPPI(–1)	0.2798	0.2574	1.0868	0.2797	Insignificant
ΔLPPI(–2)	0.2534	0.1785	1.4192	0.1589	Insignificant
ΔTR	–0.0000	0.0000	–0.3290	0.7428	Insignificant
ΔLWTI	–0.1426	0.0499	2.8565	0.0052***	Significant
CointEq(–1)	–0.2107	0.0488	–4.3188	0.0000***	Significant
R-squared	(0.968)	D-W: (2.04)		*F*-stat	(206.403)
Adjusted *R*-squared	(0.963)	S.E. of regression (0.019)		Prob.	(0.000)

Notes: ***, **, * denotes the significance level of 1%, 5%, 10%, respectively, used with an intercept and no trend, D-W: denotes the Durbin-Watson Statistic.

Moreover, the results reveal that the oil price had a significant and negative impact on the industrial index. The coefficient of *LWTI* indicates that an increase of one unit in *LWTI* led to a decrease of 0.54 in *LII*. These results imply that the oil price is an important indicator and significantly influences the industrial sector in Jordan. Jordan is an oil-importing country and heavily dependent on oil for industrial activity. An increase in oil price leads to an increase in the costs of products and transportation, which, in turn, reduce the profits and the cash flow of manufacturing firms and finally can lead to the reduction of the stock prices of these firms. The findings are in line with Nandha and Faff (2008) who found that *WTI* negatively influenced 32 global industries indices.

The coefficient of *LPPI* shows that an increase of one unit in LPPI led to the increase of 0.612 in *LII* in the long run. The positive relationship can be explained in that when the product price increased, the costs of products made by firms will increase. This can affect the consumers because purchase prices can increase, although similarly, the profits of the firms and stock prices can also increase. Furthermore, the influence of the inflation rate on the industrial index was weak and positive. The coefficient of *INF* demonstrates that an increase of one percent in the inflation rate would increase of 0.025 in *LII*. These results are consistent with Fisher's effect, and the component stocks in the industrial sector can act as a hedge against inflation. The findings are in line with the findings of Maysami et al. (2004). However, they found a significant positive relationship between the inflation rate and the finance sector, while our findings showed a weak positive relationship between the inflation rate and the industrial sector. These results provide the evidence that the relationship between the macroeconomic factors and stock prices (returns) is different from one sector or to another one country to another.

Furthermore, our results demonstrate that interest rate, industrial production index, and trade balance had an insignificant impact on the industrial index in the long run. Maysami et al. (2004) found that *IPI* had an insignificant negative influ-

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Table 7. VECM Granger causality results

Variables	Short-run causality (*F*-statistic-Wald test)								Long-run causality (*t*-test)
	ΔLII	*ΔIN*	*ΔLMS2*	*ΔINF*	*ΔLIPI*	*ΔLPPI*	*ΔTR*	*ΔLWTI*	
LII	–	1.29	0.95	7.64***	1.54	2.23*	3.21**	4.14***	–4.22***
IN	1.28	–	3.19**	0.85	1.34	4.70***	0.76	1.48	0.77
LMS2	1.62	0.32	–	0.36	0.41	2.58*	1.39	0.39	0.99
INF	2.95**	0.30	0.12	–	0.31	4.67***	1.81	0.35	–3.87***
LIPI	0.77	0.10	0.50	0.29	–	7.75***	1.82	1.17	0.79
LPPI	3.31**	0.48	4.22***	4.42***	1.15	–	3.50**	2.62*	–2.52**
TR	0.15	1.57	1.44	2.58*	1.40	0.17	–	6.93***	–2.56**
LWTI	0.79	1.37	163	0.29	1.21	1.70	1.62	–	1.69

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

ence on the finance sector. Hassan and Al Refai (2012) found that the deposit interest had an insignificant impact on the equity returns in Jordan. Their study differed from the current study since the authors focused on the sectoral level in Jordan while they focused on the general index. However, the findings support their findings that deposit interest rate had an insignificant positive impact. Indeed, Jordan is a Middle Eastern country, and the religious disposition of the majority of the population may incline the investors to be not responsive to the changes in the interest rate. Consequently, the stock market is independent of interest rates (Hassan & Al Refai, 2012).

As for the short-run relationship, the error correction term shows a negative coefficient and is statistically significant at 1%. This shows a tendency of convergence to exist in the case of long-run stable equilibrium. The speed of adjustment towards long-run stable equilibrium was 21.07% in a one-time interval. In detail, the results of the short-run relationship show that inflation rate, money supply, and oil price had negative relationships with the industrial index, while the producer price index had a positive relationship. Finally, the relationships between interest rate, industrial production index, and trade balance with the industrial index were insignificant.

All in all, the results are consistent with different studies about the Jordanian economy. The Central Bank of Jordan (CBJ) is unable to adopt a full contractionary monetary policy for different reasons. First, Jordan has adopted a fixed exchange rate with the US dollar. Second, with the continuous decline in the US interest rate, the CBJ preference is towards more output and inflation rate, which is to some extent not consistent with its announced policy (Sweidan, 2009). Poddar, Khachatryan, and Sab (2006) found that monetary policy in Jordan insignificantly affected the stock market, while the equity prices in ASE were not significant channels to transmitting the monetary policy to economic activity.

3.6. VECM Granger causality test

Granger causality test was used to detect the causality relationship among the variables. First, utilizing the *t*-test, our results demonstrate that there existed a long-run causality running from the macroeconomic indicators to the industrial index. Error Correction Term had a negative coefficient value (–0.12) and a *t*-statistic (–4.22) and statistically significant at 1%. Second, for the Wald test, the results of the short-run causality relationship reveal that bidirectional causality relationships existed between *LII* and *INF*, *LII*, and *LPPI*. Besides, we found unidirectional causality relationships running from *TR* and *LWTI* to *LII*.

For the causality relationship between the macroeconomic indicators, bidirectional causality relationships existed between *INF* and *LPPI*, *LMS*2, and *LPPI*. Moreover, except for *IN* and *LIPI*, we found that all variables cause *LPPI*, indicating that the producer price index is an essential indicator in Jordan and sensitive to the changes of domestic and global macroeconomic indicators. On the other hand, there is no significant causality relationship running from the monetary variables to the inflation rate in the short term indicating evidence that the monetary policy in Jordan seems inefficient. These results support the findings of Poddar, Khachatryan, and Sab (2006) and Sweidan (2009).

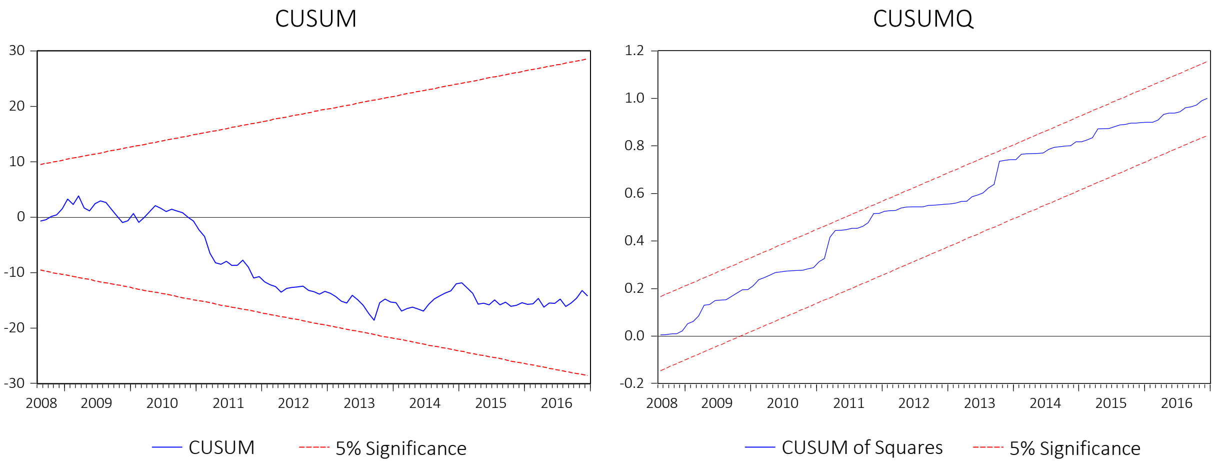

Figure 2. CUSUM and CUSUMQ (2007–2016)

To examine the short-run and long-run coefficients stability, we proceed with the CUSUM and CUSUMQ tests. Figure 2 reflects that the coefficients in both tests were stable in the short and long run where the lines did not cross the critical value of 5%.

3.7. Impulse response function and variance decomposition

The impulse response function (IRF) test was adopted to explore the effect of the macroeconomic shocks on the industrial index. The dashed lines denote the 95% confidence intervals for the response of industrial index to the changes in the macroeconomic indicators. The results of the IRF test in Figure 3 indicate that the change in the deposit interest rate started with a negative effect on the industrial index. However, the effect transitioned to a positive effect after seven months. Conversely, the change in the money supply started with an insignificant positive effect but within one month shifted to a negative effect on the industrial index during all remaining period.

Further, the change in crude oil price had an insignificant positive effect in the first two months. The effect shifted to negative after three months and this continued throughout the period, although the effect lessened and was insignificant in the long run. As for the change in the inflation rate, it started with a positive effect on the industrial index. The effect proceeded to be insignificant and negative after 12 months. After 24 months, it reverted to zero. The change in the industrial production index and producer price index had weak and insignificant effects on the industrial index. Finally, the change in trade balance shows responses near zero during all period, which indicates that *TB* did not affect the industrial index.

The variance decomposition analysis (VDA) results in Table 8 showed that all variables contributed zero to the industrial index in the first month.

Table 8. VDA of the explanatory variables in industrial index

Month	S.E.	*LII*	*IN*	*LMS2*	*INF*	*LIPI*	*LPPI*	*TR*	*WTI*
1	0. 024	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0. 061	90.961	0.574	2.218	3.597	0.653	1.362	0.042	0.590
12	0.067	82.475	1.169	6.893	4.134	1.271	1.218	0.072	2.765
18	0.069	79.394	1.461	7.555	4.210	1.752	1.170	0.070	4.385
24	0.070	77.585	1.475	8.019	4.256	1.959	1.144	0.080	5.478
30	0.071	76.337	1.544	8.553	4.190	2.120	1.140	0.089	6.024
36	0.071	75.470	1.654	9.004	4.141	2.232	1.137	0.090	6.268
42	0.072	74.920	1.730	9.338	4.110	2.290	1.136	0.089	6.382
48	0.072	74.577	1.761	9.589	4.091	2.315	1.136	0.089	6.438

Note: S.E. stands for standard errors.

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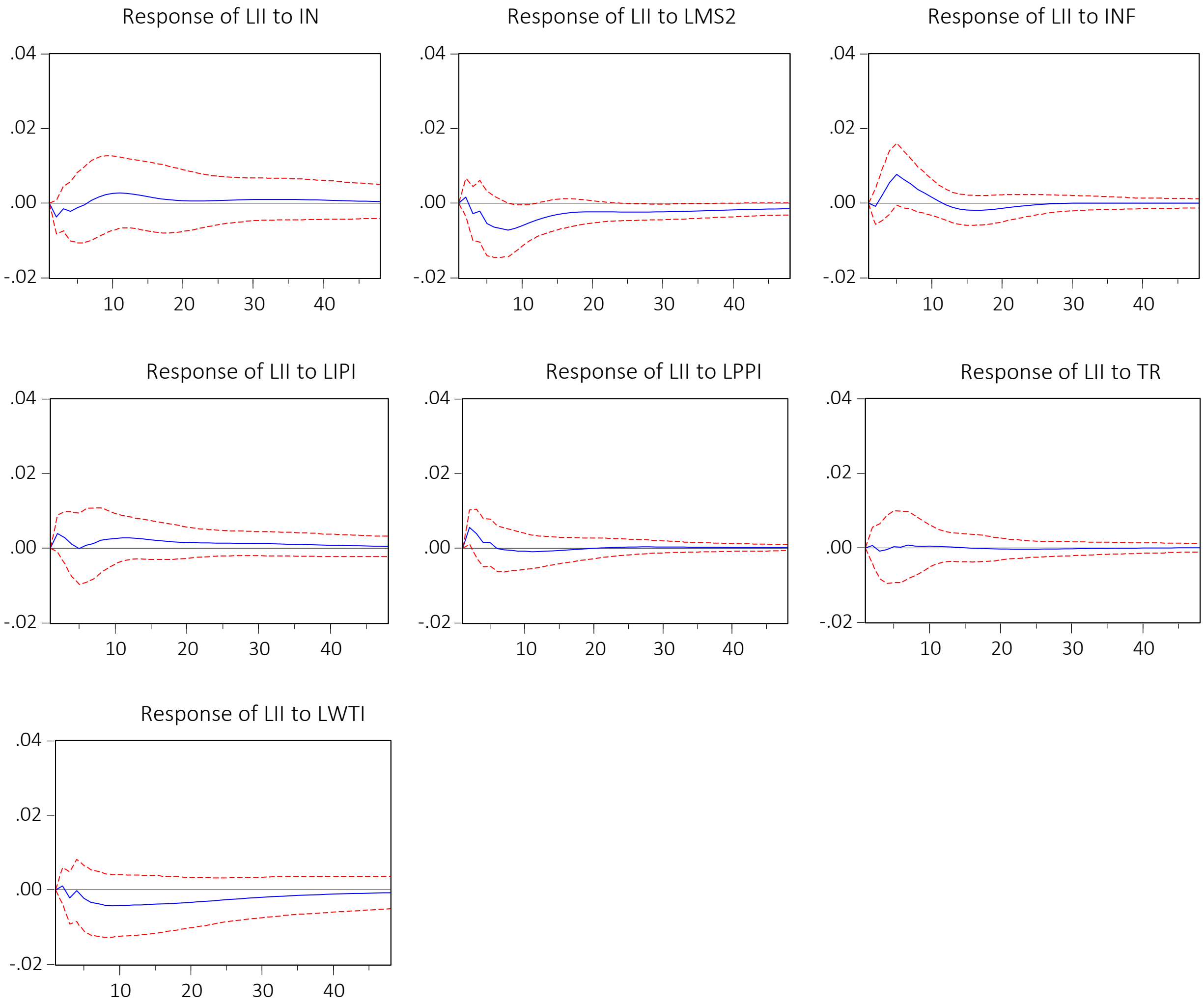

Figure 3. Response of industrial index to macroeconomic indicators

Further, money supply and oil prices were the factors that contributed most to explaining the industrial index among the explanatory variables after 48 months. The inflation rate only contributed approximately 4% after 48 months. *LIPI*, *LPPI*, and *TR* registered the lowest values, which indicate they had low contributions to the industrial index after 48 months.

CONCLUSION AND POLICY IMPLICATIONS

The current study focused on the relationship between selected macroeconomic variables and the industrial sector index in Jordan during crises from January 2007 to December 2016. The selected macroeconomic factors were composed of five domestic indicators, one external indicator, and one global indicator. In particular, inflation rate, money supply, deposit interest rate, producer price index, and industrial production index were used as domestic indicators. The trade balance was the external indicator, while the global oil prices served as an international indicator.

The ARDL bound testing approach was used to examine co-integration, short-run, and long-run relationships between the variables and showed that there was a co-integration relationship between macroeconomic indicators and industrial index. Moreover, it was found that money supply and oil prices had a negative relationship with the industrial index in the long run, whereas the inflation rate and producer price index had positive relationships. In contrast, industrial production, trade balance, and interest rate showed the insignificant relationships.

Further, VECM Granger causality test was used to detect the causality between the variables. The results showed that there was a long-run causality relationship running from the macroeconomic indicators to the industrial index. In the short-run causality, the results revealed that there were bidirectional causality relationships between *LII* and *INF*, as well as between *LII* and *LPPI*, whereas a unidirectional causality relationship running from *TR* and *LWTI* to *LII*.

The use of ARDL technique is not without limitations. For example, the ARDL bound testing approach is invalid with the data stationary at their second difference i.e., I(2) level. Moreover, the approach is suitable and useful only with small sample size. Nonetheless, the method is still considered valid given the context of this study. Moreover, it is still widely used by many researchers and published in top-tier journals, including Liu, Kumail, Ali, and Sadiq (2019), Zaidi and Saidi (2018) and Bekhet, Matar, and Yasmin (2017), to name a few. Future research can reexamine the relationships using the models such as the nonlinear autoregressive distributed lag (NARDL) and the structural vector autoregression (SVAR) model (see, for example, Hu, Liu, Pan, Chen, & Xia, 2018; Yang, Kim, Kim, & Ryu, 2018).

This study provides some important implications and recommendations. For instance, the negative impact of crude oil prices implies that the industrial index, including the manufacturing firms, can be influenced by the changes in oil price, due to an increase in costs. Accurately, the changes in oil prices can be reflected in the costs of production and transportation of manufacturers, which leads to a reduction in the cash flows and profits of these firms and finally affects their stock prices. Therefore, the recommendations for the government, policymakers, and investors are that they should closely and periodically monitor and forecast the movements of global oil prices to reduce the impact of shocks before the actual impact.

Moreover, the positive impact of the inflation rate on the industrial index implies that the common stocks in the industrial sector might hedge against inflation. One implication from this result is that investors can invest in the industrial index when they expect that inflation will increase. Another possible strategy for them is to include industrial constituents for diversification policy to mitigate the inflation risk while providing better risk-return trade-off by incorporating the equities from other sectors with low (or negative) correlation. Finally, results from this study will be useful for future studies that focus on the relationship among the macroeconomic indicators.

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