Stock market performance: Reaction to interest rates and inflation rates

Article *in* Banks and Bank Systems · July 2022

DOI: 10.21511/bbs.17(2).2022.16

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16 PUBLICATIONS **51** CITATIONS

“Stock market performance: Reaction to interest rates and inflation rates”

AUTHORS	Marwan Alzoubi

ARTICLE INFO	Marwan Alzoubi (2022). Stock market performance: Reaction to interest rates and inflation rates. *Banks and Bank Systems*, *17*(2), 189-198. doi:10.21511/bbs.17(2).2022.16
DOI	http://dx.doi.org/10.21511/bbs.17(2).2022.16
RELEASED ON	Thursday, 07 July 2022
RECEIVED ON	Thursday, 03 March 2022
ACCEPTED ON	Tuesday, 03 May 2022

JOURNAL	"Banks and Bank Systems"
ISSN PRINT	1816-7403
ISSN ONLINE	1991-7074
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
39	4	8

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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STOCK MARKET PERFORMANCE: REACTION TO INTEREST RATES AND INFLATION RATES

Abstract

This paper investigates the wealth effects of the consumer price index, interest rate, domestic credit and real economic activity on the Amman Stock Exchange performance. Over the period 1991–2020 using the autoregressive distributed lag (ARDL) bounds test. While the interest rate is a powerful monetary tool to fight inflation and recession, it can be detrimental to investors. The target variables, consumer price index (CPI) and interest rate (IDR), are both highly significant with the correct signs. An increase of 1 percent in CPI and IDR leads to a fall in stock prices by 1.6 percent and 5 percent, respectively. While the central bank is targeting inflation by raising interest rates, its actions reflect negatively on the stock market. The short-run model confirms the causality from the independent variables to the dependent variable. Moreover, the error correction term (ECT) is very high and significant at the 1 percent level amounting to 83.3 percent, which confirms the evidence of the long-run relationship. Monetary objectives are really important, but financial stability is also important.

Keywords Amman Stock Exchange, Central Bank of Jordan, monetary policy, ARDL

JEL Classification G12, G28, E52

Received on: 3rd of March, 2022
Accepted on: 3rd of May, 2022
Published on: 7th of July, 2022

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

The aim of this paper is to investigate the impact of changes in both inflation and interest rates on stock prices in Jordan motivated by the lack of adequate research and consensus on developing countries and the anticipated adverse consequences on the wealth of stockholders. It is well known that the stock market performance deteriorates at times of high interest and inflation rates. Evidence from prior suggests that stock prices react negatively to changes in both variables. It is true that rising interest rates will have favorable impacts on inflation rate, but this action will have the unfavorable wealth effect on the stock market. The Central Bank of Jordan (CBJ) needs to consider these implications, since the stability of the financial markets is one of the main objectives of central banks.

To the author's knowledge, there is no such a study about Jordan, and its outcome may help in filling this gap for developing countries. It is of extreme importance to emphasize the wealth effects that result from the rise in interest rates. The demand for stocks goes down and stock prices decline. The prices of fixed income instruments will also react in the same way due to the inverse and strong relationship between interest rate movements and bond prices. It is therefore imperative for the monetary authorities to account for the wealth effect in addition to the monetary objectives.

Targeting price stability is important and needed but it can be very costly. While monetary policy in Jordan has been effective in curb-

ing inflation rate via its management of interest rate and money supply, there are concerns about the impact on the performance of the Amman Stock Exchange (ASE). If high inflation rate prevails, the CBJ raises its policy rates and bank rates follow. Consequently, the demand for credit falls, bank saving goes up and inflation rate declines. On the other hand, if recession prevails, the CBJ lowers its interest rates and the demand for credit goes up, which induces economic activity. These are the standard mechanisms that central banks follow to fight inflation and recession. The main instruments of the CBJ's monetary policy are the reserve requirements, the open market operations and the short-term interest rates, namely the deposit window rate, the repurchase (Repo) rate (the standing facilities) and the discount rate. The CBJ has been focusing on inflation targeting and exchange rate stability mainly through its management of short-term interest rate, but leaving other fundamental factors aside, such as the performance of the ASE. Changes in the CBJ's interest rates affect bank credit, deposit, demand for and supply of funds, bond yield, exchange rate, stock prices and economic growth.

A vast number of research papers investigated the relationship between macroeconomic variables and stock prices, especially in developed countries. Their impacts can be explained in the context of the discounted cash flow model where changes in the macroeconomic variables affect both the cash flows and the discount rates leaving prices unaffected. Economic theory indicates that stock prices should react to unexpected information. It is therefore quite puzzling to explain the empirical finding, which states that stock prices react to both expected in addition to unexpected information.

Theoretically, sudden changes in any of the relevant macroeconomic variables affect firm's future cash flows and investors' required returns. For example, if inflation rate goes up, investors require inflation risk premium to compensate for the decline in the purchasing power. Firms may increase future cash flows in response to the increased inflation rate, otherwise stock prices should go down. Although changes in interest rates have a direct and inverse impact on fixed income securities, their relationship is the same with stock prices. In both cases, a rise in interest rates negatively affects the prices of bonds and stocks, but the relationship with fixed income securities is stronger.

Moreover, rising inflation and interest rates discourage future investments, spending, and raise the cost of capital, which affect stock prices negatively. Based on this discussion, the question of this study is whether changes in interest rates and inflation rates have wealth effects. Targeting inflation rate is a standard and important monetary policy objective for preserving aggregate wealth, but it adversely affects stockholders' wealth. Central banks should target the stability of the financial markets in addition to the monetary stability.

1. LITERATURE REVIEW AND HYPOTHESES

Extensive research has been conducted on the impact of macroeconomic indicators on stock prices due to their effects on future saving and investment. Inflation and interest rates are two of the most important indicators. It is long argued that stocks are good hedges against inflation (Fama, 1981; Fisher, 1930), implying that any change in expected inflation rate will not have a significant wealth effect. Any change in inflation rate will affect both the cash flows and the discount rates leaving stock prices neutral (Al-Sharkas & Al-Zoubi, 2011; Chen et al., 1986; Geske & Roll, 1983; Muradoglu et al., 2000). However, there is a strong evidence that stock prices react negatively to changes in expected and unexpected inflation and interest rates. These results are puzzling due to the common belief that stocks are hedges against inflation (Fama & Schwert, 1977; Fama, 1981; Hoguet, 2009; Tripathi & Kumar, 2015). Interest rate is an important monetary tool that has direct and indirect impacts on stock prices. The indirect impact is through its effect on borrowing. Lower rates of interest increase borrowing and lead to higher consumption and investment expenditures, which spurs economic activ-

http://dx.doi.org/10.21511/bbs.17(2).2022.16

ity and stock prices. The direct effect is coming from the present value; a decline in interest rate raises the present value of the stock.

Shahzad et al. (2021) estimate the impact of the U.S. industrial production index, the U.S. 10-year Treasury bond yield and the oil price on U.S stock prices, for the period 1985–2015 using the quantile autoregressive distributed lag (QARDL) model proposed by Cho et al. (2015). Their results reveal that all three variables significantly affect equity prices and that bond yield has a negative impact. Dixit and Gupta (2020) also report a negative relationship between interest rates and stock prices in India using the ARDL bound test. Tripathi and Kumar (2015) examine the effect of GDP, inflation rate, interest rate, exchange rate, money supply, and oil prices on stock returns in BRICS countries (Brazil, Russia, India, China, and South Africa) during the period 1995–2014. Their findings reveal that interest rate, exchange rate and oil prices negatively affect stock returns while GDP and inflation rate are not significant. Asprem (1989), Geske and Roll (1983), Jaffe and Mandelker (1976), and Wei (2009) document a negative effect of inflation and interest rate on stock prices. Pokhrel and Mishra (2020) suggest that interest rate negatively affects stock prices in the short run but not in the long run using the ARDL and error correction model. A number of studies reported a negative effect of interest rate and consumer prices index on stock prices such as Geske and Roll (1983), Chen et al. (1986), Asprem (1989), Mukherjee and Naka (1995), Gan et al. (2006), and Alghusin et al. (2020).

Humpe and McMillan (2020) report a "positive long-run relation between stock prices, industrial production and consumer prices as well as a negative relationship with real 10-year interest rates" in G7 countries. In addition, Joshi and Giri (2015) analyze the impact of macroeconomic factors on stock prices (similar to Fama, 1981; Fama, 1990; Chen, 1991; Poon & Taylor, 1992; Canova & De Nicolo, 1995; Dickinson, 2000; Nasseh & Strauss, 2000). They also find that the impact of inflation rate on stock prices to be positive. However, the majority of the research papers were devoted to developed markets, which are highly efficient and closely connected with the economy (Alsmadi & Oudat, 2019).

Recently, more studies have been conducted in developing countries such as that of Chia and Lim (2015), which documents a positive effect of the interest rate and money supply on stock prices and a negative effect of inflation rate by using the ARDL approach in Malaysia for the period 1980–2011. A vast number of research papers offer reliable results regarding the effect of the macroeconomic factors such as Chen et al. (1986), Thornton (1993), Mukherjee and Naka (1995), Ibrahim (1999), Wong et al. (2006), Chen (2009), and Humpe and Macmillan (2009). Geske and Roll (1983), Fama (1990), Mukherjee and Naka (1995), Cheung and Ng (1998), Kwon and Shin (1999), Maysami and Koh (2000), Chaudhuri and Smiles (2004), and Pokhrel and Mishra (2020) show that GDP affects stock prices positively.

This study investigates both the long-run and short-run relationships between ASE price index and consumer price index and interest rate in Jordan. Economic activity and domestic credit are control variables. The hypotheses are:

H01: The performance of ASE is positively influenced by the consumer price index.

H02: The performance of ASE is positively influenced by the interest rate.

2. METHODOLOGY AND DATA

2.1. Data

This paper evaluates the impact of consumer price index (CPI), interest rate (IDR), domestic credit to the private sector in percent of GDP (DCGDP) and real Gross Domestic Product (RGDP) on the performance of Amman Stock Exchange represented by the general index (GENERAL). The dependent variable is the annual closing price of the ASE as a proxy for market performance, data is collected from the ASE, www.ase.com.jo, and data for the independent variables is collected from the Central Bank of Jordan, www.cbj.gov.jo. As shown in Table 1, all variables are in natural logarithm form, which helps reducing the heteroscedasticity and multicolinearity among the explanatory variables.

Table 1. Data discerption

Discerption	Measurement	Variable
LnGENENRAL	Natural logarithm of Amman Stock Exchange Index	Amman Stock Exchange General Index
LnRGDP	Natural logarithm of GDP at constant market prices	Gross Domestic Product at constant market prices
LnIDR	Natural logarithm of discount rate	Discount rate of the Central Bank of Jordan
LnCPI	Natural logarithm of Consumer Price Index	Consumer Price Index
LnDCGDP	Natural logarithm of domestic credit to the private sector in percent of GDP	domestic credit to the private sector in percent of GDP

2.2. The model

This paper implements the autoregressive distributed lag (ARDL) bounds test introduced by Pesaran et al. (2001) because the series are I(0) and I(1) and no regressor is I(2). The long-run and short-run coefficients are estimated simultaneously. The cointegration approach, which is derived from the ARDL model, is estimated using the ordinary least square method and it has certain attributes when compared to other cointegration approaches. It is more efficient with the small sample size and does not require the variables to be in the same order of integration. To estimate the parameters of the long-run equilibrium relationship and the short-run error correction approach, the following model is used:

$$General = f\left(RGDP,\ CPI,\ IDR,\ DCGDP\right), \quad (1)$$

where *General* = Amman Stock Exchange General Price Index, *RGDP* = Gross Domestic Product in real terms, *CPI* = Consumer Price Index, *IDR* = Interest Rate (the discount rate of the Central Bank of Jordan) and *DCGDP* = Domestic credit in percent of GDP. This model can be written as follows:

$$LnGENERAL = \beta_0 + \beta_1 LnRGDP_{t-i} + \\ + \beta_2 LnCPI_{t-i} + \beta_3 LnIDR_{t-i} + \\ + \beta_4 LnDCGDP_{t-i} + \varepsilon_t. \quad (2)$$

The conditional error correction of the ARDL model for the Amman Stock Exchange price index is presented below:

$$\Delta LnGeneral_t = \beta_0 + \beta_1 \left(LnGeneral\right)_{t-1} + \\ + \beta_2 \left(LnRGDP\right)_{t-1} + \beta_3 (LnCPI)_{t-1} + \\ \beta_4 (LnIDR)_{t-1} + \beta_5 \left(LnDCGDP\right)_{t-1} + \\ + \sum_{i=1}^{j} \beta_6 \Delta (LnGeneral)_{t-i} + \sum_{i=1}^{j} \beta_7 \Delta (LnRGDP)_{t-i} + \\ + \sum_{i=1}^{j} \beta_8 \Delta (LnCPI)_{t-i} + \sum_{i=1}^{j} \beta_9 \Delta (LnIDR)_{t-i} + \\ + \sum_{i=1}^{j} \beta_{10} \Delta (LnDCGDP)_{t-i} + \varepsilon_t \ . \quad (3)$$

3. RESULTS AND DISCUSSION

3.1. Unit root test

Because the Augmented Dickey-Fuller test (ADF) reveals that the variables are of order *I*(0) and *I*(1), the Engle-Granger (1987) causality test or Johansen-Juselius (1990) technique cannot be applied to find out the cointegration between the variables as they require that all the variables must be stationary of equal order (Bekhet, 2012). Table 2 shows that all independent variables, except domestic credit, are non-stationary at level and become stationary at first difference *I*(1), while domestic credit in percent of GDP series is stationary at level *I*(0), which justifies the use of the ARDL bound test. In this case, there are two kinds of relationships, the long-run and the short-run dynamic relationship.

Table 2. Unit root test

Variable	Stationarity test type	Augmented Dickey-Fuller test equation Schwars info criteria (SIC) – Intercept			Integration order
		T static value	Prob	Test critical values at 5 % level	
DCGDP	Level	–3.272	0.026	–2.971	I(0)
CPI	Level	–0.883	0.779	–2.967	I(1)
	First difference	–4.731	0.000	–2.971	
IDR	Level	–2.345	0.165	–2.971	I(1)
	First difference	–3.769	0.008	––2.971	
RGDP	Level	–2.791	0.072	–2.971	I(1)
	First difference	–3.368	0.021	–2.971	
GENERAL	Level	–1.863	0.344	–2.967	I(1)
	First difference	–4.949	0.000	–2.971	

http://dx.doi.org/10.21511/bbs.17(2).2022.16

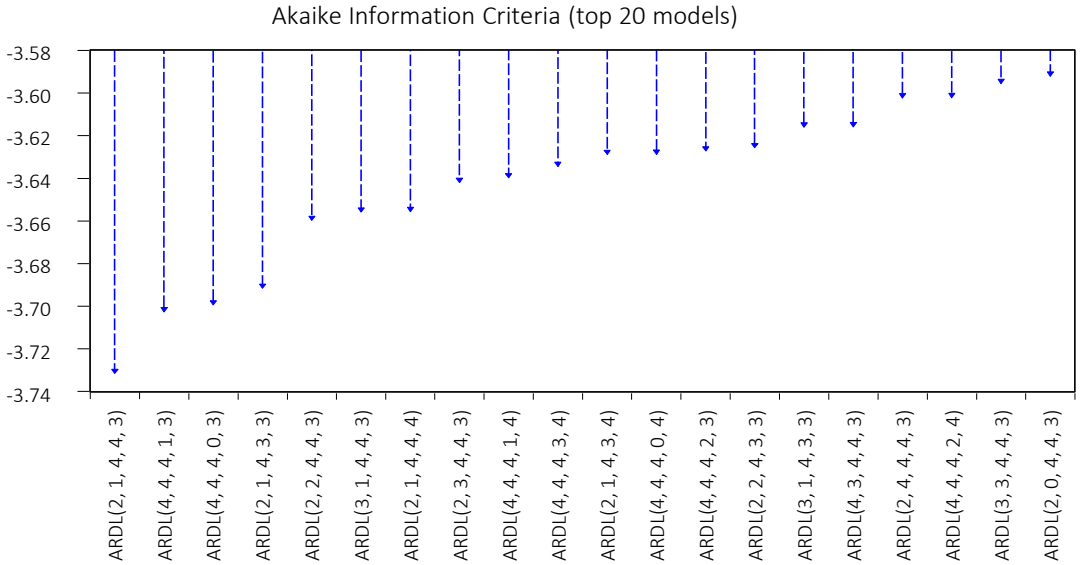

Figure 1. Selection criteria

3.2. Selection of optimal lag

The optimal ARDL model according to the Akaike Information Criteria (AIC) is (2, 1, 4, 4, 3).

3.3. ARDL cointegration, bound test and long-run form

The ARDL approach to cointegartion requires establishing the long-run relationship by testing the lagged variables in the error correction regression. Then the first lag of the levels of each variable is added to the equation to create the error correction mechanism equation using F-statistic to test the significance of all lagged variables. This process is needed for testing the null hypothesis of no long-run relationship or:

$$H0: \quad \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0.$$

If F-test is greater than the Pesaran's upper critical value, *H0* can be rejected, meaning that the variables are cointegrated, if it is lower than the lower critical value, H_o cannot be rejected implying no cointegration and if it is between the upper and lower critical values, the results are inconclusive. Table 3 shows the results of the bound cointegration test. Since F-statistic value of 24.21 is greater than the upper critical value of 3.49 at the 5 percent level of significance, that means that there exists a cointegration relationship.

Table 3. Bound test results

The model	Calculated F-statistic	Critical values		
LnGeneral		Value	I(0)	I(1)
LnRGDP		10%	2.2	3.09
LnCPI	24.21	5%	2.56	3.49
LnIDR		2.5%	2.88	3.87
LnDCGDP		1%	3.29	4.37

Table 4 reports the results of the long-run estimation, all the variables, except domestic credit in percent of GDP (*LnDCGDP*), are significant at the 1 percent level. A 1 percent increase in *RGDP*, *CPI*, *IDR* leads to a change in the stock price index (*General*) of 3.86 percent, –1.62 percent, and –5.33 percent, respectively.

Table 4. The long-run estimation model

Constant and Regressor	Coefficient	Std. error	T-stat	P-value
C	–11.15994	3.723345	–2.997290	0.0200
LnRGDP	3.861034	0.855590	4.512716	0.0028
LnCPI	–1.620421	0.319094	–5.078192	0.0014
LnIDR	–5.338057	1.083052	–4.928718	0.0017
LnDCGDP	–0.319218	0.487428	–0.654904	0.5335

These findings are consistent with those of the developed markets. Economic activity, in real terms, has a powerful impact, a 1 percent increase (decrease) leads to almost a 4 percent increase (decrease) in stock prices. This positive relationship should not be surprising but the

magnitude is very high. As the focus in this paper is consumer price index (CPI) and interest rate (IDR), they are both highly significant with the correct signs. An increase of 1 percent in CPI leads to a fall in stock prices by 1.6 percent, which is in line with the majority of studies. The elasticity of stock prices to the prices of goods and services is very high. Finally, interest rate is the most powerful factor, as a monetary policy instrument, whenever the CBJ lowers the discount rate by 1 percent the stock market goes up by more than 5 percent. This is a very important finding, especially for the CBJ; any increase in the rate of interest will have a detrimental effect on shareholders' wealth. To fight inflation or strengthen the currency value, the CBJ raises the level of interest rate, which is a standard monetary action, but the negative effect is clearly high on stock market performance. Central banks should add financial stability to price stability when formulating their policies. After confirming the existence of the cointegration relationship, this study examines the speed of adjustment to long-run equilibrium after a short-run deviation occurred. The short-run error correction representation of the estimated ARDL model is:

$$\begin{aligned}\Delta LnGeneral_t &= \beta_0 + \sum_{i=1}^{j}\beta_1\Delta(LnGeneral)_{t-i} + \\ &+\sum_{i=1}^{j}\beta_2\Delta(LnRGDP)_{t-i} + \sum_{i=1}^{j}\beta_3\Delta(LnCPI)_{t-i} + \\ &+\sum_{i=1}^{j}\beta_4\Delta(LnIDR)_{t-i} + \sum_{i=1}^{j}\beta_5\Delta(LnDCGDP)_{t-i} + \\ &+\theta\, ECT_{t-1} + \varepsilon_t,\end{aligned} \quad (4)$$

where θ is the speed of adjustment to long-run equilibrium, which is supposed to be negative and significant according to t-test. The term ECT_{t-i} is the lagged residuals obtained from estimating the following long-run model:

$$\begin{aligned}LnGENERAL_t &= \beta_0 + \beta_1 \ln RGDP_t + \\ &+\beta_2 \ln CPI_t + \beta_3 \ln IDR_t + \\ &+\beta_4 \ln DCGDP_t + \varepsilon_t,\end{aligned} \quad (5)$$

$$\begin{aligned}ECT_{t-1} &= \varepsilon_t = \ln General_{t-1} - \\ &-\left(\beta_0 + \beta_1 \ln RGDP_{t-i} + \beta_2 \ln CPI_{t-i} + \right. \\ &\left.+\beta_3 \ln IDR_{t-i} + \beta_4 \ln DCGDP_{t-i}\right).\end{aligned} \quad (6)$$

3.4. The error correction model

Table 5 presents the results of the error correction model (the short-run model) of the estimated ARDL model.

Table 5. ARDL error correction regression

Variable	Coefficient	Std. error	t-Statistic	Prob.
D(*LnGENERAL*(–1))	–0.219482	0.035756	–6.138422	0.0005
D(*LnRGDP*)	1.012180	0.408675	2.476736	0.0424
D(*LnIDR*)	0.109530	0.041623	2.631500	0.0338
D(*LnIDR*(–1))	1.359698	0.101635	13.37823	0.0000
D(*LnIDR*(–2))	0.637197	0.070787	9.001586	0.0000
D(*LnIDR*(–3))	0.784272	0.071804	10.92239	0.0000
D(*LnCPI*)	–0.085853	0.348368	–0.246443	0.8124
D(*LnCPI*(–1))	3.342406	0.582033	5.742635	0.0007
D(*LnCPI*(–2))	2.232055	0.334336	6.676094	0.0003
D(*LnCPI*(–3))	0.614066	0.330328	1.858959	0.1054
D(*LnDCGDP*)	0.058241	0.227697	0.255784	0.8055
D(*LnDCGDP*(–1))	–1.041608	0.334242	–3.116327	0.0169
D(*LnDCGDP*(–2))	–1.353931	0.378629	–3.575881	0.0090
CointEq(–1) = ECT(–1)	–0.838628	0.053136	–15.78274	0.0000

Note: Dependent variable: D(LnGENERAL), selected model: ARDL(2, 1, 4, 4, 3).

As for the short-run causality based on Wald test, Table 6 shows that all the independent variables jointly cause the Amman Stock Exchange Price Index meaning that there exists a short-run causality running from each explanatory variable to the dependent variable (based on F-test). All hypotheses are rejected at the 5 percent level of significance, and the error correction term ECT is very high and significant at the 1 percent level.

The system adjusts in the current year very quickly at a speed of 83.8 percent to any short-term shock from previous year, which confirms the evidence of the long-run relationship. The negative sign implies that if the system in the previous year is moving out of equilibrium in one direction, it is going to pull it back to long-run equilibrium at a speed of 83.8 percent.

Table 6. Short-run causality based on Wald test

Regressor	Hypothesis	F-test prob.	Result
LnRGDP	C(2) = 0	0.0351	Reject
LnIDR	C(3) = ... = C(6) = 0	0.0091	Reject
LnCPI	C(7) = ... = C(10) = 0	0.0004	Reject
LnDCGDP	C(11) = ... = C(13) = 0	0.0076	Reject

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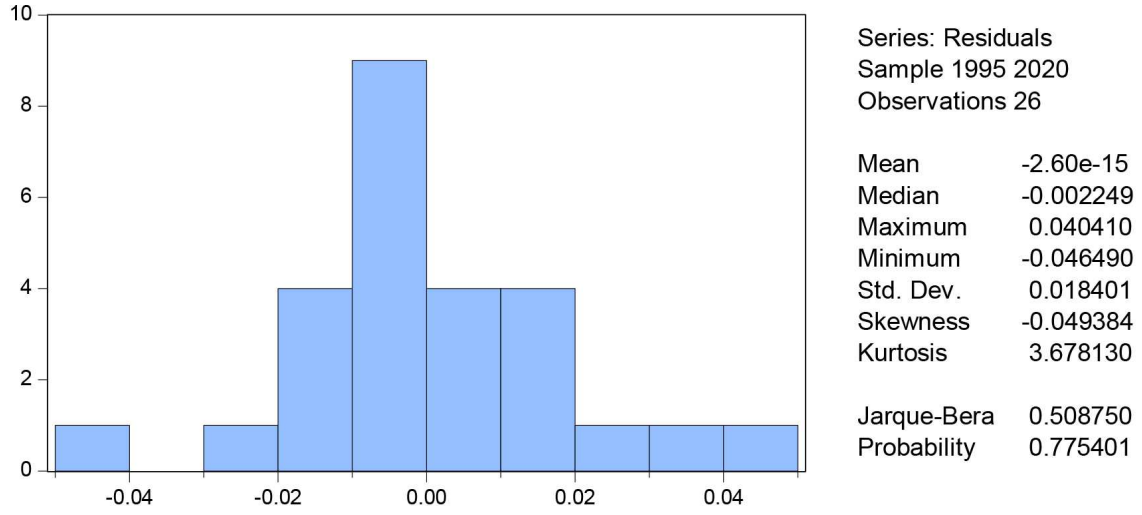

Figure 2. Normality test

3.5. Residual diagnostics

Robustness is important to ensure that the estimated results are reliable and are not spurious. The following tests are used for diagnostics: For serial correlation, Breusch-Godfrey Serial Correlation LM test; for normality, Jarque-Bera test; for Heteroscedasticity, Breusch-Pagan-Godfrey. The diagnostic tests show that the ARDL (2, 1, 4, 4, 3) model has the proper econometric properties. The functional form is correct, the residuals are not serially correlated, normally distributed and homoscedastic.

3.5.1. Serial correlation LM test

Based on Breusch-Godfrey serial correlation LM test, the residuals are free from serial correlation. Table 7 shows that the F-statistics probability value is 0.1105, not significant at the 5 percent level. Therefore, the null hypothesis (*H0:* no serial correlation) cannot be rejected.

Table 7. Breusch-Godfrey serial correlation LM test

F-statistic	Prob. (2,5)
3.5346	0.1105

3.5.2. Normality test

Based on the Jarque-Bera test, Figure 2 shows that the probability value is 0.775, implying that the null hypothesis at 5 percent cannot be rejected (*H0:* the residuals are normally distributed), and it can be concluded that the residuals are normally distributed.

3.5.3. Heteroscedasticity test

Based on Breusch-Pagan-Godfrey, the residuals are free from heteroscedasticity. Table 8 shows that the R-squared probability value is 0.262, not significant at a 5 percent level. Therefore, the null hypothesis (*H0:* no heteroscedasticity) cannot be rejected.

Table 8. Heteroscedasticity test: Breusch-Pagan-Godfrey

F-statistic	1.786372	Prob. F(18,7)	0.2216
Obs-R-squared	21.35177	Prob. Chi-Square(18)	0.2620
Scaled explained SS	2.072454	Prob. Chi-Square(18)	1.0000

3.6. Stability test

In order to investigate the stability of long-run and short-run parameters of the selected error correction ARDL model, the cumulative sum CUSUM and cumulative sum of squares CUSUMsq are employed as suggested by Pesaran and Shin (1999). The results of both CUSUM and CUSUMsq are presented in Figure 3 and Figure 4, respectively. The plots of the two figures are between critical bounds of the 5% level of significance, meaning that the null hypothesis cannot be rejected (Ho: all parameters are stable), which means that the model is stable.

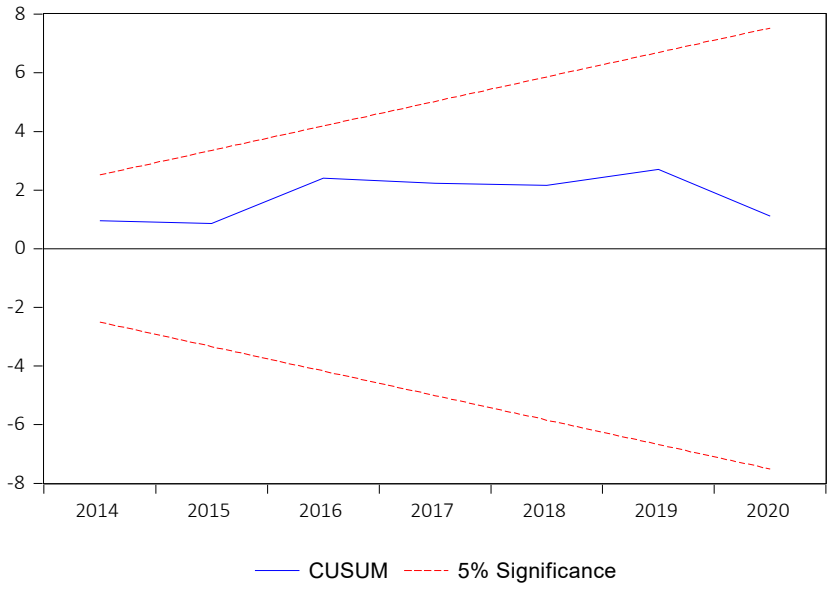

Figure 3. CUSUM test

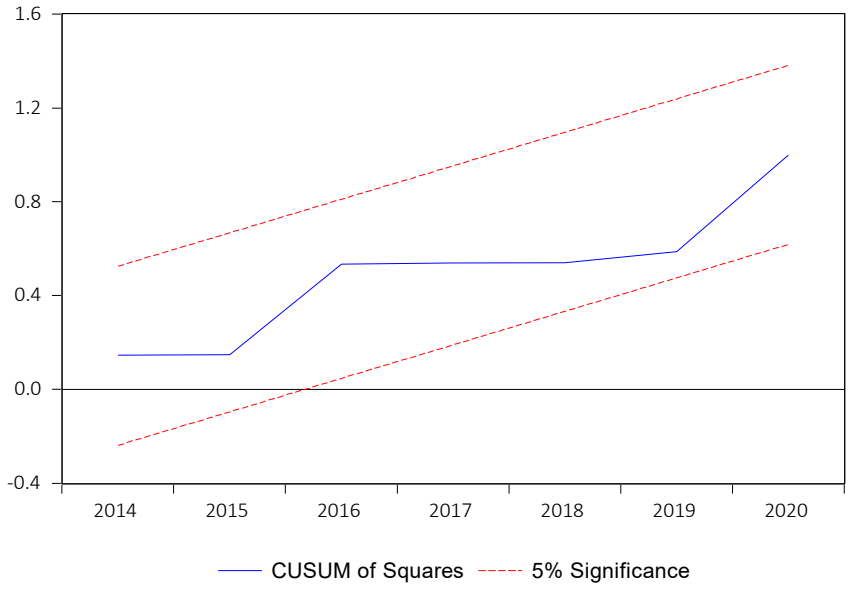

Figure 4. CUSUMsq. Test

CONCLUSION

The purpose of this paper is to examine the impact of changes in both inflation and interest rates on stock prices. The long-run results reveal that all the variables, except domestic credit in percent of GDP, are significant. Consumer price index (CPI) and interest rate (IDR) are both highly significant with the correct signs; their coefficients are –1.6 percent and –5 percent, respectively. Higher levels of CPI and IDR have negative effects on stockholder wealth. Stock market performance is highly elastic to real economic activity; a 1 percent increase (decrease) leads to almost 4 percent increase (decrease) in stock prices. While the central bank of Jordan is targeting price stability by raising interest rates at times of high inflation, its actions reflect negatively on the stock market. The central bank should be cautious before raising the interest rate because of its strong negative association with the stock market. It is true that

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the CBJ fights inflation, but this is coming at the expense of the financial stability. Any shift in interest rate will have a huge impact on stock market wealth. Therefore, the CBJ should target financial stability in addition to price stability.

The ARDL model has the proper econometric properties, the residuals are not serially correlated, normally distributed and homoscedastic. The results are reliable and not spurious.

AUTHOR CONTRIBUTIONS

Conceptualization: Marwan Alzoubi.
Data curation: Marwan Alzoubi.
Formal analysis: Marwan Alzoubi.
Investigation: Marwan Alzoubi.
Methodology: Marwan Alzoubi.
Project administration: Marwan Alzoubi.
Writing – original draft: Marwan Alzoubi.
Writing – reviewing & editing: Marwan Alzoubi.

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