

The Impact of Inflation and Financial Crisis on Stocks' Prices in Amman Stock Exchange: UVAR Model

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الملخص

تأثير التضخم والأزمة المالية العالمية على أسعار الأسهم في بورصة عمان: نموذج (UVAR)
تهدف هذه الدراسة بشكل أساسي إلى استقصاء أثر التضخم والأزمة المالية العالمية
٢٠٠٩/٢٠٠٨ على أسعار الأسهم في بورصة عمان (الأردن) خلال الفترة الزمنية (١٩٩٢-٢٠١٤).
ولتحقيق هذا الهدف فقد تم استخدام نموذج متجه الانحدار الذاتي غير المقيد (UVAR) بخمسة متغيرات
(أسعار الأسهم، والنواتج المحلي الإجمالي، والأزمة المالية العالمية، وسعر الفائدة، ومعدل التضخم).
وتبين من نتائج اختبارات جذر الوحدة بأن جميع المتغيرات مستقرة عند مستويات مختلفة.
كما وتم استخدام أداتين رئيسيتين للتحليل هما: تحليل مكونات التباين، ودالة الاستجابة لردة
الفعل، وتبين من النتائج أن الأزمة المالية العالمية كانت أكثر المتغيرات تأثيراً على أسعار الأسهم وبأثر
سلبياً، يليها أثر التضخم وبأثر سلبي أيضاً بالمقارنة مع تأثير كل من الناتج المحلي الإجمالي وسعر
الفائدة.
الكلمات الدالة: بورصة عمان، الأزمة المالية العالمية، معدل التضخم، نموذج متجه الانحدار
الذاتي غير المقيد.

Abstract

The Impact of Inflation and Financial Crisis on Stocks' Prices in Amman Stock Exchange: UVAR Model

This study aims at investigating the impact of inflation and the late financial crisis in 2008/2009 on stock prices in the Amman Stock Exchange (Jordan) over the period (1992-2014). An unrestricted vector autoregressive (UVAR) model with five variables has been used (the variables: stock prices, gross domestic product, financial crisis, interest rate, and inflation rate). The unit root tests have shown that all the variables are stationary in different orders.

Two major tools were used for analysis: variance decomposition and impulse response function. It is found that the late global financial crisis is the most influential

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factor in explaining the variation of stock prices with a negative impact, then inflation comes second with a negative impact compared to the other two variables; gross domestic product and interest rate.

Keywords: Amman Stock Exchange, Financial Crisis, Inflation rate, Unrestricted Vector Autoregressive (UVAR) Model.

1. Introduction:

The financial markets all over the world have been suffering from the late global financial crisis over the last a few years. Stock prices in Amman Stock Exchange (ASE) have deteriorated sharply in year 2008 with a negative growth rate (-17%) compared to year 2007. This negative growth rate has continued till 2014. Also, Jordan has witnessed higher inflation rates during the last seven years compared to the earlier years. So, this study tries to investigate the impact of the late global financial crisis in 2008/2009 and inflation on stock prices in Amman Stock Exchange over the period (1992-2014).

The rest of the paper is organized as follows: Section 2 explains the objective of the study. While section 3 shows the motivation and importance of the study. Section 4 reviews the theoretical and empirical literature. Section 5 addresses the hypotheses of the study. Section 6 provides an overview of the trends of stocks' prices and data description. The methodology is introduced in section 7. The empirical results are presented in Section 8. The final section summarizes the findings of the paper.

2. The Objective of the Study:

The main aim of this study is to explore the impact of inflation and the late global financial crisis in 2008/2009 on stock prices in Amman Stock Exchange during the period spanning from 1992 till 2014.

3. Motivation and Importance of Study:

The late recent studies about the impact of inflation on Amman Stock Exchange (Al-Zoubi and Al-Sharkas, 2011; Mousa et al., 2012) focused on inflation and ignored the effect of the late financial crisis in their models, so this study has come to expand the model via introducing the late global financial crisis as an important factor in explaining the reduction in stock prices since the last quarter of the year 2008.

4. Theoretical and Empirical Literature Review:

The stock price-inflation issue has had a lot of debate in the theoretical and empirical literature. However, no consensus has yet emerged on the theoretical nexus between inflation and stock prices (Pearce, 1982). In theory, stocks are assumed to be inflation neutral for unexpected inflation which should have a negative effect on stock prices (Olufisayo, 2013). Inflation raises the real tax burden on corporate capital because it raises taxable profits, which causes investors to underestimate the returns to shareholders (tax effect), but also inflation reduces real corporate debt (gains from debt) (Pearce, 1982).

Cohn and Lessard (1980) examined the relationship between stock prices and inflation for the US and found that inflation has a negative significant impact on the stock prices.

Pearce (1982) analyzed the possible connections between stock prices and infaltion for the USA, and concluded that while inflation cannot account for all of the decrease in real stock prices, it has been a significant factor in the decline.

Geyser and Lowies (2001) found that the South African experience shows that the companies listed in the mining sector are negatively correlated against inflation, whereas the selected companies in other sectors (financial services, information technology and food and beverage sectors) shows a slightly positive correlation between stock price and inflation. But for the selected companies in Namibia (except Alex Forbes) shows a strong positive correlation between stock price changes and inflation.

Al-Zoubi and Al-Sharkas (2011) investigated monthly stock prices indexes and good price indexes for Jordan, Saudi Arabia, Morocco, and Kuwait for 2000-2009 using cointegration methods. Their findings support the long-run relationship between stock prices and goods prices.

Mousa et al. (2012) examined the impact of inflation on stock prices at the Amman Stock Exchange by taking a random sample from the companies that are listed in the market. Their results show a negative correlation against inflation for some companies, and a slightly positive correlation between stock price changes and inflation for some other countries.

On the other hand, Olufisayo (2013) examined the relationship between stock prices and inflation in Nigeria over the period 1986-2010 using an error correction model, and his results seem to contradict the findings of some previous studies, where he found that a one standard deviation shock applied to inflation produces a positive impact on stock prices both in the short and long run.

Regarding the impact of the late global financial crisis on stock prices, Dianat-e-Jahromi et al. (2013) found from their study that the stock price before global financial crisis was more than that one after the global

financial crisis in firms accepted in Tehran Stock Exchange during the years 2004 and 2011.

Ali and Afzal (2012) found that the recent global financial crisis made mild negative impact on stock returns and enhanced volatility in Pakistani and Indian Stock Exchanges but this impact is found to be stronger on Indian stock market compared to Pakistani stock market.

Rachdi (2013) investigated the impact of the recent international financial crisis on the yield in the Tunisian Stock Exchange. His results indicate that the returns of Tunindex were not directly affected by the international financial crisis because there is volatility of return before and after the crisis.

5. The Hypotheses of the Study:

The two major hypotheses of this study will:

- H_{01} : Inflation has a negative impact on stock prices.
- H_{02} : Financial crisis has a negative impact on stock prices.

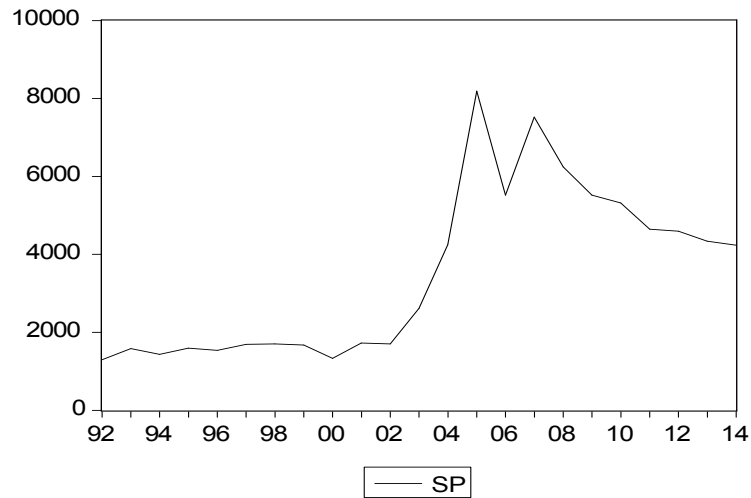
6. Overview of Trend of Stocks' Prices and Descriptive Statistics of the Data:

Jordan has experienced a progress towards economic openness, encouraging foreign investment, accession to the World Trade Organization (WTO) in year 2000, and privatization. Figure 1 caricatures the trend of the index of stocks' prices for Jordan over the period (1992-2014). This index had approximately an upward trend till year 2005, it started to fluctuate between the years 2005 and 2008. After that, this index

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deteriorated sharply with a downward trend as figure 1 reveals. This sharp decrease of the index could be explained by the late global financial crisis.

Figure 1: Plot of Stocks' Prices 1992-2014



Analysis of this paper uses annual time series data about Jordan including 23 observations, namely, for the period 1992 to 2014. Data on the model's variables are gathered from various sources like the Central Bank of Jordan, Department of Statistics in Jordan, and Amman Stock Exchange (ASE).

The descriptive statistics of the data utilized for this paper are shown in table 1.

Table 1: Descriptive Statistics of the Data

	SP	INF	R	GDP	FC
Mean	3489.49	3.73	9.92	6038.28	0.30
Median	2614.50	3.09	9.48	5476.50	0.00
Maximum	8191.50	13.96	12.89	9392.50	1.00
Minimum	1299.00	- 0.66	7.59	3392.60	0.00
Std. Dev.	2168.46	2.87	1.49	2038.79	0.47
Skewness	0.63	1.86	0.63	0.29	0.85
Kurtosis	2.18	8.13	2.43	1.58	1.72
Jarque-Bera	2.15	38.55	1.85	2.26	4.33
Probability	0.34	0.00	0.40	0.32	0.11
Observations	23	23	23	23	23

SP: Stock Price Index. INF: Inflation rate. R: weighted average interest rates on loans and advances. GDP: Real Gross Domestic Product. FC: a dummy variable denotes for the late global financial crisis.

The probability of the Jarque-Bera (above 5%) indicates that four variables (Stock prices, interest rate, gross domestic product, and financial crisis) are normally distributed. On the other hand, the value of the standard deviation of the stock prices is found to be the largest (2168.46) amongst the other variables, which indicates that stock prices have the largest fluctuations. The results indicate positive skewness meaning that the variables are asymmetrical, which imply that most of the values are concentrated on the left of the mean with extreme values to the right. Kurtosis less than 3 for all the variables (except inflation) means the variables have a platykurtic distribution, i.e. flatter than a normal distribution with a wider peak.

7. Methodology:

The purpose of this paper is to examine the impact of inflation and the late global financial crisis on stocks' prices in Amman Stock Exchange over the period 1992-2014.

In this study, the reduced form of an unrestricted vector autoregressive (UVAR) model has been utilized for several reasons. Firstly; this study shows the effect of one variable on another; this effect may appear with lags. In the OLS method, it is not always easy to interpret each coefficient, especially if the signs of the coefficients alternate. For this reason the impulse response functions in the UVAR model would be more appropriate. Secondly; there is no single econometric method that will suit all situations (Gujarati, 1995). Basically, an UVAR is a system of reduced form equations which expresses each set of endogenous variables as a function of lagged values of itself and lagged values of all the other variables in the system (Al-Tayeb and Malawi, 2002). This approach was adopted by Sims (1980). Two useful tools were suggested for analyzing the relationships among the variables in the system; variance decomposition and impulse response functions.

The Functional form of an UVAR is

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_n Y_{t-n} + U_t$$

Where;

$$Y_t = [SP \quad GDP \quad R \quad INF \quad FC]'$$

SP: Stock Price Index, weighted by market capitalization.

GDP: Real Gross Domestic Product

R: weighted average interest rates on loans and advances.

INF: Inflation rate; calculated based on the Consumer Price Index (CPI).

FC: a dummy variable denotes for the late global financial crisis; it takes

1 for the years 2008-2014, and 0 otherwise.

U_t : is a (5x1) column vector of error terms normally distributed with 0 means and constant variances.

UVAR models have several advantages. Firstly, this kind of models shows the effect of one variable on another with lags, which is not always easy in the usual OLS method. Secondly, the usual econometric problems such as multicollinearity and autocorrelation are not considered to be serious problems in this method since the estimated parameters are not important. Thirdly, this method requires the minimum number of theoretical demands on the structure of the model. On the other hand, it is very difficult in UVAR models to talk about elasticities. This means that these models are usually very helpful for forecasting (Malawi and Tarawneh, 2004). This model has been used in several studies such as Bai (2014) and Mahmood et al. (2014).

8. Empirical Investigation:

Much empirical research has been carried out over the past few years on the effects of the late financial crisis or inflation on stock prices in different countries. But unfortunately, to the knowledge of researchers, none of them combined between the two effects jointly on stock prices.

Our investigation aims at providing a thorough analysis of the impact of global financial crisis and inflation on stock prices in Amman Stock

Exchange over the period 1992-2014. The annual data is obtained from the websites of Central Bank of Jordan and the Amman Stock Exchange.

The results of several tests are reported as follows:

7.1 Unit Root Test for Stationarity:

Prior to multivariate analysis with any technique, the order of integration of the variables involved should be tested. This is to ensure avoiding spurious results. The traditional Augmented Dickey-Fuller (ADF) is widely used for determining the stationarity status. The fact that the unit root is the null hypothesis to be tested.

Results of the unit root test with constant and without constant and trend for all series are reported in Table 2. So; the null hypothesis of unit root test for the levels of the four variables is not rejected at 5% significance level. The results of the test show that the GDP variable is integrated of order 2; i.e. $I(2)$. Whereas the inflation (INF) variable is integrated of order one; i.e. $I(1)$. On the other hand, the interest rate (R) and stock price (SP) variables are $I(1)$ without intercept and trend and $I(2)$ with intercept. This implies that there is a possibility of the variables to be integrated of different orders, i.e. order one; $I(1)$, or of order two; $I(2)$, or a mix of both.

Since there is some degree of uncertainty concerning the integration order of the variables in question, the use of the Unrestricted Vector Autoregressive (UVAR) model is an appropriate technique for some reasons. First, it doesn't require the assumption that the variables are integrated of the same order. Second, none of the variables in the model is considered to be exogenous. Third, this model doesn't impose any prior restriction on the estimates. Fourth; this model allows us to avoid some econometric problems such as multicollinearity and autocorrelation. And

finally; this model utilizes two analytical tools: variance decomposition and impulse response function.

Table 2:Unit Root Test (Augmented Dickey-Fuller Test)

Variable	With Intercept		Without Intercept and Trend	
	ADF (calculated)	5% level	ADF (calculated)	5% level
GDP: level	0.2170	-3.0114	1.6905	-1.9583
GDP: first difference	-1.5895	-3.0199	-0.3317	-1.9592
GDP: second difference	-3.5259	-3.0294	-3.6333	-1.9602
INF: level	-2.4374	-3.0114	-1.0932	-1.9583
INF: first difference	-4.9534	-3.0199	-5.0944	-1.9592
R: level	-1.7901	-3.0114	-0.5493	-1.9583
R: first difference	-2.2222	-3.0199	-2.2509	-1.9592
R: second difference	-3.3649	-3.0294	-3.4671	-1.9602
SP: level	-1.1784	-3.0114	-0.0740	-1.9583
SP: first difference	-2.6014	-3.0199	-2.6214	-1.9592
SP: second difference	-5.3966	-3.0294	-5.5612	-1.9602

8.2 Selecion the Lag Length:

Before estimating the model, the optimal lag length should be selected. Different criteria are utilized such as Sequential Modified LR test statistic (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC),Schwarz Criterion (SC), Hannan-Quinn Information Criterion (HQ). The results of these statistics are reported in table 3.

Table 3: Selection Lag Length

Lag	LR	FPE	AIC	SC	HQ
0	NA	1.86e+0.8	33.18	34.42	33.42
1	42.36	50794701	31.44	33.93	31.92
2	40.98*	968176.9*	25.74*	29.48*	26.47*

*: indicates lag order selection by criterion at 5% level.

All of the above criteria have chosen the optimal number of lag length to be two, which is used in the analysis.

7.3 UVAR Model:

Two tools are utilized: variance decomposition and impulse response functions as follows;

First: variance decomposition

Table 4 reports variance decomposition for one to ten periods of time ahead. The results indicate that the impact of the financial crisis (FC) is greater than the effects of the other three variables (INF, R, GDP) in influencing the movements in stocks' prices (SP) starting from the second period of time to the tenth period of time. This impact starts to be 16.93% in the second period and increases gradually until it reaches 36.13% in the tenth period. Whereas the effect of the inflation rate (INF) on SP starts to be around 2.27% in the second period and increases to reach around 25.02% in the tenth period. The effects of the interest rate (R) and GDP in explaining the variation of the SP seem to be very small and don't reach 6% for each of both in the tenth period. Starting from the fifth period, the effect of both FC and INF on SP gets higher than 50% and reaches around 61% in the tenth period.

Table 4: Variance Decomposition of the Stock Prices (SP)

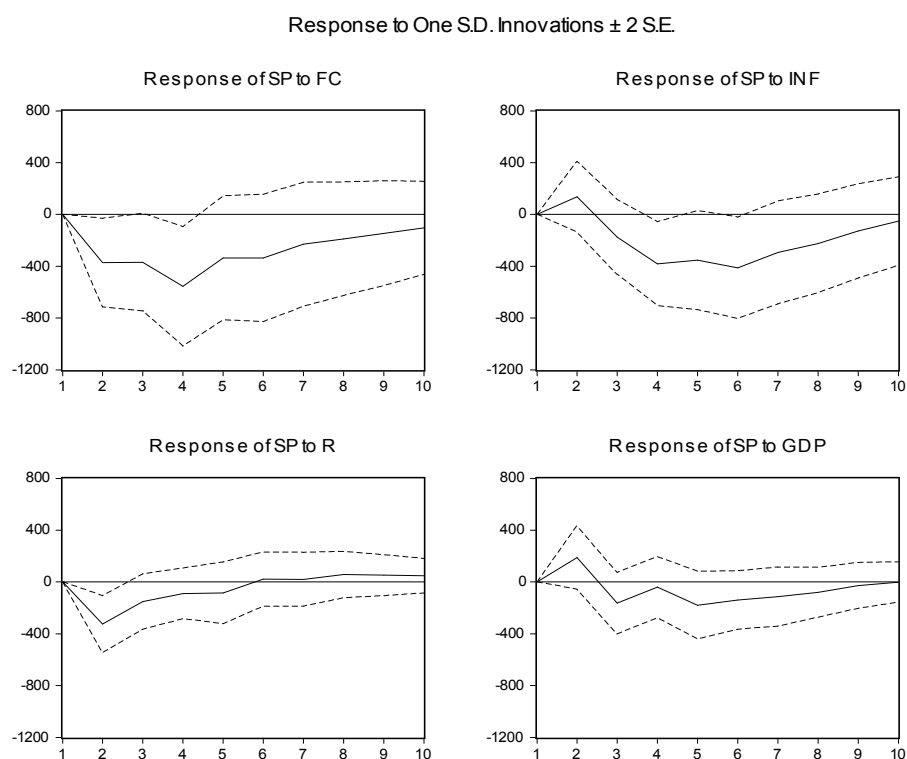
Period	SP	FC	INF	R	GDP
1	100.00	0.00	0.00	0.00	0.00
2	63.56	16.93	2.27	12.94	4.30
3	55.24	23.88	4.26	11.21	5.40
4	41.69	34.76	11.57	8.17	3.81
5	36.01	35.47	16.28	7.35	4.90
6	31.31	55.67	21.55	6.37	5.10
7	29.35	35.61	23.74	5.99	5.31
8	28.24	35.67	24.84	5.89	5.36
9	27.80	35.93	25.07	5.90	5.31
10	27.63	36.13	25.02	5.95	5.27

Ordering: SP FC INF R GDP

Second: Impulse Respose Function;

The second tool for estimating the dynamic response of each variable in the model to an unexpected change in another variable in the same model is the impulse response function. Figure 2 shows the impulse responses with upper and lower two standard error bands of SP to the other four variables in the UVAR model (FC, INF, R, and GDP).

Figure 2: Impulse Response Function of Stock Prices (SP)



As figure 2 shows, the impact of the financial crisis (FC) on Stocks Prices (SP) starts immediately to be significantly negative, and this impact lasts for about four years, which is consistent with results of Ali & Afzal (2012). The impact of INF on SP starts to be significantly negative after three years and lasts until the eighth year, which is consistent with the results of Pearce (1982), Bai (2014), Cohn & Lessard (1980), and Geyser & Lowies (2001), but this impact is not in line with the results of Olufisayo (2013) for Nigeria. The impact of R on SP starts to be significantly negative and lasts for about four years. On the other hand, the impact of GDP on SP starts to be significantly positive and lasts for about two years.

9. Summary and Conclusions:

This study has employed the Unrestricted Vector Autoregressive (UVAR) approach to examine the impact of the late global financial crisis in 2008/2009 and inflation on stocks' prices with annual data over the period 1992-2014.

In this research paper, the late financial crisis is found to have a negative impact and comes first in explaining the variation of stocks' prices, where its explanation power started to be 16.93% in the second period and ended to be 36.13% in the tenth period. Whereas, inflation rate has also a negative impact and comes second in affecting stock prices compared to the other two variables (interest rate and GDP). The explanation power of inflation is started to be 2.27% in the second period and reached 25.02% in the tenth period. The results are found to be consistent with most of previous studies.

The results of the impulse response functions have demonstrated the two hypotheses of the study.

The major policy implication that should be addressed here is that: Jordan should choose a good mix or combination of monetary policy and fiscal policy in order to reduce the direct impact of the late global financial crisis and inflation on stocks' prices, which in turn might encourage foreign investors to increase their investments in Amman Stock Exchange.

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