An Empirical Analysis of the Relationship Between Stock Market Indices and Macroeconomic Variables: Evidence from Jordan

Rasha Dayyat[1*]   Abdel Razaq Freihat[2]

1.King Talal School of Business Technology, Princess Sumaya University for Technology, P.O. Box 1438 Al-Jubeiha-Amman, 11941 Jordan
2.School of Business Administration, Al-Balqa Applied University, Al-Salt, Jordan

Abstract
The purpose of this study is to investigate the relationship between stock market index and macroeconomic variables in Jordan.The unit root tests and the Granger causality test have been applied between the Amman Stock Exchange Index (ASEI) and the macroeconomic variables, Discount rate (interest), Money Supply, Index of Industrial production (IIP), Foreign Exchange Reserve (FR), and Consumer Price Index (CPI) using monthly data for the period from 2002 to 2015. The findings show the ASE Index doesn't granger cause any of the variables except the interest rate. And shows that none of the macroeconomic variables granger causes ASEI except the CPI. Economists, policy makers and financial investors can use the findings to help them in exploring whether the movement of stock market indices is the result of some related macroeconomic variables or it is one of the causes of movement in those variables of the Jordanian economy.
Keywords: Stock Index, Macroeconomic Variables, Granger Causality, Jordan.

1. Introduction
Over the past few decades, the interaction of share returns and the macroeconomic variables has been a subject of interest among academics and practitioners (Kwon and Shin, 1999). It is often argued that stock prices are determined by some fundamental macroeconomic variables such as the interest rate, the exchange rate and the inflation. Many studies had been published about the relationships between stock returns and macroeconomic variables in well-developed countries such as the US, Japan and European countries (see for example, Fama and Schwert, 1977; Fama, 1990; Chen, 1991; Wei and Wong, 1992; Cheung and Ng, 1998.). However, regional stock markets such as Jordan have not been fully explored because of their small sizes and geographic locations. In this paper, we examined the relationships between the Amman Stock Exchange Index (ASEI) and a set of five macroeconomic variables from January 2002 to December 2015 using Granger Causality Test.

2. Significance of the Study
Result of this study help in exploring whether the movement of stock market indices is the result of some related macroeconomic variables or it is one of the causes of movement in those variables of the Jordanian economy. Such a study will benefit different groups: Economists, researchers, policy makers and financial investors. First, it helps policy makers understand the full effect of prevailing and upcoming policies and regulations. Second, if investors were aware of this relationship and fully understood it then they will make more informed investment decisions thus reducing their exposure to risk. And third, knowing which force leads the other can help in reducing the shock factor because the public will be somewhat aware of what might happen in the economy or the financial market and thus will be able to take protective measures.

3. Objectives
The purpose of this study is to investigate the effects of macroeconomic variables on stock performance in Jordan. The specific objectives of the study are:
1. To establish the existence of short-run relationship between macroeconomic variables and the Amman Stock Exchange Index.
2. To establish the existence of causality between macroeconomic variables and the Amman Stock Exchange Index.

4. Problem of the Study:
This study is underpinned by the following research questions:
1- Whether there is a significant short-run relationship between macroeconomic variables and the Amman Stock Exchange Index.
2- Whether there is a significant causality between macroeconomic variables and the Amman Stock Exchange Index.

5. Theoretical framework and previous studies
Under The arbitrage pricing theory (APT) all investments have expected return and affected by macroeconomic forces (Rjoub, Tursoy, & Gunsel, 2009). APT starts with the assumption that security returns are related to an

unknown number of unknown factors (Alexander, Sharpe, & Bailey, 2001). However, Roll and Ross (1980) stated four major factors; these are unanticipated change in the inflation, risk premiums, the term structure of interest rate and industrial production.

5.1 Research on U.S. stock market

Based on the above the arbitrage pricing theory (APT) has been applied to test the impact of macroeconomic forces on stock return worldwide. Initially, the APT was applied by Ross (1976) to explain stock return in U.S market through the examination of seven macroeconomic variables which were terms structure, industrial production, risk premium, inflation, market return, consumption and oil price (Chen, Roll and Ross, 1986). The findings revealed the significant association between the macroeconomic variables and stock return especially in terms of industrial production, changes in risk premium, and twist in the yield curve. Hence, APT has been applied to test the expected return of investment and the impact of macroeconomic factors on the investment.

McMillan (2001), using US data, undertook to investigate whether a cointegrating vector existed between variables such as industrial production, inflation, money supply, interest rate and stock market indices. The findings provided positive support of cointegration between both the US market index Dow Jones Industrial Average index (DJIA) and the S&P 500 and macroeconomic activity variables. The established relationship is positive and significant for industrial production and inflation, negative and significant for long term interest rates, and negative and insignificant for money supply and short term interest rates.

5.2 Research on Arab countries stock prices

Several researchers have attempted to establish the relationship between macro-economic variables and stock market indices or stock price using various models. There are a number of existing studies that attempt to determine the relationship between stock market and macroeconomic variables. Numerous studies have focused on developed countries, in more recent times, however, there has been an encouraging number emphasizing on developing economies specifically Arab Economies.

To test the existence of long-term relationships between share price indices in Kuwait, Bahrain, and Oman stock markets Hassan (2003) employed Johansen's (1988, 1991, 1992) and Johansen and Juselius' (1990) multivariate cointegration techniques and using a vector-error-correction model, he also investigated the short-term dynamics of prices by testing for the existence and direction of intertemporal Granger-causality. The researcher showed that: (1) share prices were cointegrated with one cointegrating vector and two common stochastic trends driving the series, which indicates the existence of a stable, long-term equilibrium relationship between them; and (2) prices were not affected by short-term changes but were moving along the trend values of each other. Therefore, information on the price levels would be helpful for predicting their changes.

To examine the impact of real interest rates as a key factor in the performance of the Egyptian stock market, both in terms of market activity and liquidity Omran (2003) employed cointegration analysis through error correction mechanisms (ECM). Omran indicated that there is a significant long-run and short-run relationships between the variables, implying that real interest rates had an impact upon stock market performance.

5.3 Research on foreign stock prices

In India Vuyyuri (2005) investigated the co-integrating relationship and the causality between the financial and the real sectors. The Granger test showed unidirectional Granger causality between the financial sector and real sector of the economy.

In New Zealand. Gan, Lee, Yong, and Zhang (2006) conducted a research to analyze the effect of a set of macroeconomics variables on the New Zealand Stock Index (NZSE40) return for the period of January 1990 until January 2003. They are using co integration test, with specifically employ Johansen Multivariate, Granger-causality Test, and innovation accounting in processing the data. In general, the result shows that the NZSE40 is consistently determined by the interest rate, money supply, and real GDP.

In the MENA region, Ben Naceur, Ghazouani, & Omran (2007) examined the macroeconomic determinants of stock market development and found that saving rate, credit to private sector, the ratio of value traded to GDP and inflation change are the important determinants of stock market development.

Uddin and Alam (2007) examined the linear relationship between share price and interest rate on Dhaka Stock Exchange (DSE) and found that Interest Rate has significant negative relationship with Share Price.

Coleman and Tettey (2008) studied the impact of macroeconomic indicators on the Ghana Stock Exchange (GSE) and concluded that lending rates from deposit money banks and inflation have an adverse impact on stock market performance.

Abdul Rahman, Noor, & Tarfi (2009) have studied mutual relationships between selected macroeconomic variables and stock prices in the stock exchange in Malaysia and showed that monetary policy variables have considerable long-term effects on the Malaysian stock exchange.

Mahmood and Dinniah (2009) examined the dynamics relationship between stock prices and economic

variables in six Asian Pacific selected countries of Malaysia, Korea, Thailand, Hong Kong, Japan and Australia. The monthly data on stock price indices, foreign exchange rates, consumer price index and industrial production index that spans from January 1993 to December 2002 are used. The focus of the analysis is on the long run equilibrium and short run multivariate causality between these variables. The results indicated the existence of a long run equilibrium relationship between and among variables in only four countries that is Japan, Korea, Hong Kong and Australia. As concerned short run relationships, all countries except for Hong Kong and Thailand showed some interactions. Hong Kong shows relationship only between exchange rate and stock price while Thailand reported significant interaction only between output and stock prices.

In Pakistan Ahmad, Rehman, Raoof (2010) observed the impact of interest rate and exchange rate to the Stock Return. The dependent variable used in their research is the stock return of KSE-100, where the independent variables used are interest rate and exchange rate (Rs/USD). As a result of multiple regression model analysis, it shows that the change in interest rate and exchange rate has a significant impact on stock returns. The change in interest rate giving negative impact, while change in exchange rate giving positive to the stock returns.

In Turkey Büyükşalvarcı (2010) analyzed the effect of seven variables of macroeconomics in the Turkish Stock Exchange Market using the Arbitrage Pricing Theory framework. The method used in processing the data is Multiple Regression with seven variables macroeconomic (variables consumer price index, money market interest rate, gold price, industrial production index, oil price, foreign exchange rate and money supply) as independent variables and Turkish stock market Index (Istanbul Stock Exchange Index-100) as dependent variable. The data used are monthly basis over the period of January 2003 to March 2010. As a result, interest rate, industrial production index, oil price, foreign exchange rate has a negative effect while money supply has positive impact on ISE-100 Index returns. Moreover, inflation rate and gold price do not have any significant effect on ISE-100 Index returns.

In China Xiufang (2010) try to find some evidence on the relationship between stock price and macroeconomic variables (Real GDP, CPI, short term interest rate) in China Stock Market. The research is aim to estimate the volatility of each variable using Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) and determine the causal relationship between the stock price volatility and macroeconomic variables by using Lag-Augmented VAR (LA-VAR) models. The first finding of this research is there is no causal relationship between stock price and real GDP volatility. Bilateral causal relationship is found between inflation and stock price volatility. Xiufang (2010) also found that there is a unidirectional causal relationship between stock market volatility and interest rate volatility, with the direction from stock prices to the interest rate.

Pal and Mittal (2011) examined the long-run relationship between the Indian capital markets and key macroeconomic variables such as interest rates, inflation rate, exchange rates and gross domestic savings (GDS) of Indian and their study reveals that the changes in stock markets are affected not only by change in few selected macroeconomic variables.

On the Ghanaian stock market Again, Kuwornu (2012) using the Vector Error Correction approach did find that in the long-run stock returns are positively affected by inflation, exchange rate and treasury bill rate and negatively by crude oil prices. But in the short-run, they attribute variations in stock returns to inflation (negative effect), and treasury bill rate (positive effect).

In India Naik and Padhi (2012) used Johansen's co-integration and vector error correction model to explore the long-run equilibrium relationship between stock market index and macroeconomic variables and analyzed that macroeconomic variables and the stock market index are co-integrated and, hence, a long-run equilibrium relationship exists between them.

Hsing, Budden & Phillips (2012) applied the exponential GARCH model and found that the Argentine stock market index is positively associated with real GDP, the ratio of M2 money supply to GDP, the peso/USD exchange rate and the U.S. stock market index.

On the Ghanaian stock market, a gain (Prempeh, 2016) empirically examined the impact of some macroeconomic variables on stock price volatility in the Ghana Stock Exchange (GSE) using annual time series data over the period of 1990-2014. The macroeconomic variables used in this study are inflation rate, real gross domestic product growth rate and interest rate. The Granger causality test was employed to determine the causal link between stock prices and macroeconomic variables in Ghana. The results of the Granger causality test showed that at 10% significance level, real domestic product rate granger causes stock price but stock price does not granger cause real domestic product rate. However, the other variables: inflation rate and interest rate do not granger cause stock prices.

6. The Emergence of the Amman Financial Market

Prior to 1978 unregulated share trading of the public share holding companies was undertaken through unregistered offices in Jordan. The Amman Financial Market commenced its operations officially in January 1978 as a public financial institution with legal, administrative, and financial independence, operating under the auspices of the

Minister of Finance.

Since 1997, the Jordanian Government adopted a comprehensive restructural reform policy for the capital market of Jordan built upon what had been accomplished during the previous twenty-one years, aiming to bring the Jordanian securities industry up to international standards. The main features of the restructural and reform policy according to the provisions of the Securities Law (No. 23/1997) were the institutional changes in the capital market, the introduction of the automation of the trading and clearing and settlement operation, removal of obstacles restricting investment, strengthening the monitoring and surveillance of the capital market, introducing new financial services and new financial instruments to achieve the highest level possible of transparency and to provide the right environment to achieve the orderly dealing in securities.

The reform program contemplated the establishment of three new Institutions: The Jordan Securities Commission to regulate and monitor Jordan's capital market, a Stock Exchange, and a Securities Depository Center to initiate the registration and transfer of ownership of securities traded and the settlement of prices of such securities among financial brokers.

Based on the above, there is an increasing importance of the stock market from aggregate economy point of view. Currently stock market has become a main driver of modern market based economy and is one of the major sources of raising resources for Jordanian corporation, thereby enabling financial development and economic growth.

7. Hypotheses

This study is underpinned by the following research questions:

1- There is no significant short-run relationship between macroeconomic variables and the Amman Stock Exchange Index.

2- There is no significant causality between macroeconomic variables and the Amman Stock Exchange Index.

8. Data set and Methodology

8.1 Data and Sources

The study makes use of time series monthly data spanning from January 2002 to the last month of 2015, thus making use of 168 data points enough for effective regression analysis. The variables used in the study are the Amman Stock Exchange Index (ASEI) and the macroeconomic variables, discount rate (interest), Money Supply (M1), Index of Industrial production (IIP), Foreign Exchange Reserve (FER), and Consumer Price Index (REER) and the period of study is January 2002 to December 2015. Monthly data of all the variables will be collected from different sources such as the handbook of statistics on the Jordanian Economy published by Ministry of finance, the annual reports published by the Central Bank of Jordan, the monthly statistical bulletins issued by the Amman Stock Exchange, and the handbook of statistics published by Jordanian department of statics.

8.2 Variable description and justification

8.2.1 ASE Index

This variable captures the overall performance of the market and it is the dependent variable in our study. This variable measures the general level of share prices for companies listed in the Amman Stock Exchange (ASE). This index represents the share price index weighted by market capitalization

8.2.2 Discount Rate

This variable provides the annualized interest rate a country's central bank charges commercial, depository banks for loans to meet temporary shortages of funds.

8.2.3 Industrial Production

This variable measures the monthly developments of real activity in the industrial sector, comprising 'Mining and Quarrying', Manufacturing, and Electricity (around 20% of real gross domestic product). It is calculated according to actual production of a sample representing most domestic industries, and weighted by the value added for each industry in the base year.

8.2.4 Money Supply

This variable equals currency with the public plus demand deposits in Jordan dinar with the banking system of the private sector (resident), public entities, and non-banking financial institutions, plus demand deposits of other banking institutions in Jordan dinar with the CBJ only

8.2.5 Foreign Reserves

This variable equals cash, balances and deposits in convertible foreign currencies, plus foreign currency bills and bonds, plus balances and deposits in non-convertible foreign currencies, minus deposits of licensed banks and non-residents in foreign currencies with the CBJ

8.2.6 Consumer Price Index

This variable measures the general price level of a fixed basket of goods and services consumed by the Jordanian family (844 commodities and services), including those imported from abroad. It is prepared by the Department

of Statistics and weighted by the average family expenditure on goods and services, acquired from the results of Household Expenditure and Income Survey carried out in 2002.

9. Statistical Analysis
The researcher will use the following techniques in analyzing the data and to test the study hypotheses:
9.1 Unit Root Test
The stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis and to enhance the accuracy and reliability of the models constructed. The following, Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF), and KPSS unit root tests are performed to know whether the process governing the concerned variables is stationary or not.

9.2 Granger Causality Test
The Granger causality test as proposed by C. J. Granger in 1969 is used to establish the existence and direction of causality between macroeconomic variables and stock performance

10. Analysis
By applying the above mentioned tests, the researchers found the following
10.1 Model selection criteria:
According to Akaike Information Criteria (AIC), which is based on the residual variance, we have to get the model that has the smallest residual variance. Then we'll choose the lag length in the model with the smallest residual variance (Vogelvang, 2005, P.344) (Eviews User's Guide, 2004, P.513). However, for running this test, a rule of thumb can be used regarding choosing the lag length which is if we have annual data we can use 4 lag lengths, but for monthly data 8 lag lengths can be used.

10.2 Unit Root Test:
Table (1) lists the variables and shows if these variables are stationary throughout the study years for all sectors. All variables are stationary

Table 1. Unit Root test

Variable	ADF T-Statistic	Probability	H_0: variable has a unit root	Is It stationary?
CPI	-0.557821	0.8753	Accept	No
D(CPI)	-10.15672	0.0000	Reject	Yes
IP	-2.323262	0.1660	Accept	No
D(IP)	-5.162417	0.0000	Reject	Yes
ASE	-2.167432	0.2191	Accept	No
D(ASE)	-6.280928	0.0000	Reject	Yes
M1	0.417195	0.9832	Accept	No
D(M1)	-14.08582	0.0000	Reject	Yes
FR	-0.688396	0.8456	Accept	No
D(FR)	-10.12992	0.0000	Reject	Yes
INTEREST	-1.457960	0.5525	Accept	No
D(INTEREST)	-5.615840	0.0000	Reject	Yes

The table shows that none of the variables are stationary from their levels. They are stationary from their first difference. Therefore, the researchers will use the first level difference of the variable in the analysis to test the causality between the variables.

10.3 Granger Causality Test:
To determine the direction of causality and prediction between variables, granger causality test has been applied to measure if one event happens before another event to help predict it.

Table (2) examines the relationship between the stock market index the economic variables.

Table 2. Granger Causality test

Null Hypothesis	F-Statistic	Probability
D(ASE) does not Granger Cause D(CPI)	1.95858	0.0559
D(CPI) does not Granger Cause D(ASE)	3.26120	0.0019
D(ASE) does not Granger Cause D(IP)	1.06518	0.3909
D(IP) does not Granger Cause D(ASE)	1.21169	0.2963
D(ASE) does not Granger Cause D(M1)	0.77934	0.6216
D(M1) does not Granger Cause D(ASE)	0.94134	0.4847
D(ASE) does not Granger Cause D(FR)	0.77474	0.6256
D(FR) does not Granger Cause D(ASE)	1.24262	0.2787
D(ASE) does not Granger Cause D(INTEREST)	2.76523	0.0072
D(INTEREST) does not Granger Cause D(ASE)	0.47295	0.8736

The table shows different results. Regarding the effect of ASE Index on macroeconomic variables, it shows that the ASE Index doesn't granger cause any of the variables except the interest rate, it granger cause the interest rate of probability less than 1%, which means it can't predict the movement of any variables except the interest rate. And that is consistent with some of the studies like Kwon and Shin (1999) that concluded that the stock price indices are not a leading indicator for economic variables. Also, Vuyyuri (2005) found by applying the Granger that unidirectional Granger causality between the financial sector and real sector of the economy.

However, the effect of the macroeconomic variables on ASEI, shows that none of the macroeconomic variables granger causes ASEI except the CPI. It granger causes the ASE of probability less than 1%. Again, none of the variables can predict the movement of the index except the CPI, which is reasonable as the CPI depends on the income, as the income rises, there could be some kind of investments.

Therefore, the results are not consistent with the Arbitrage Pricing Theory that says that all investments have expected return and affected by macroeconomic forces. And this is consistent with one of the studies which is Hamao (1988) that found that the industrial production which appeared insignificant in asset pricing.

According to the above, the researchers found that the ASE Index is related with the consumer price index and the demand and supply in the market, which means that people will invest in the stock market upon their income and their priorities.

11. Conclusion

The results of this study show that the ASE Index doesn't granger cause any of the variables except the interest rate. And shows that none of the macroeconomic variables granger causes ASEI except the CPI. And that the ASE Index is related with the consumer price index and the demand and supply in the market, which means that people will invest in the stock market upon their income and their priorities.

Therefore, we accept the second hypothesis that states that there is no significant short-run relationship between macroeconomic variables and the Amman Stock Exchange Index.

Also, we accept the third hypothesis that states that there is no significant causality between macroeconomic variables and the Amman Stock Exchange Index.

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