THE DYNAMIC RELATIONSHIP BETWEEN MACROECONOMIC FACTORS AND THE JORDANIAN STOCK MARKET

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Abstract

Previous research has hypothesized the existence of a long-term equilibrium relationship between stock prices and certain macroeconomic variables. The vector error correction model (VECM) (Johansen (1991)) is utilized to determine the impact of selected macroeconomic variables on Amman Stock Exchange (ASE). The variables are the real economic activity, money supply, inflation, and interest rate. The empirical results show that the stock prices and macroeconomics variables have a long-term equilibrium relationship.

JEL classification: G15

Keywords: Jordan; Amman Stock Exchange; Johansen method

1. Introduction

Despite the unfavorable political and economic conditions in the region, the Amman Stock Exchange (ASE) managed, for the second consecutive year, to sustain an outstanding performance. This was evident in the encouraging financial results of most indices, excluding the general share price index, which dropped by a small percentage compared to the decline of most international financial markets. The bourse's better performance in 2002 was partly due to the government policies aimed at enhancing the investment climate in the Kingdom and spurring economic growth. The increase in the profitability of public shareholding companies, the bourse's qualitative technological advancements, and the boost in investors'

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confidence in the Jordanian capital market, also contributed to a better performance.

The trading volume in 2002 increased by 42.9 percent, to JD 946.7 million, a record level since 1993. The boom was triggered by a 37.1 percent increase in the number of traded shares, due to the listing of Jordan Telecom shares on the bourse. At the sector level, the industrial sector witnessed the highest increase in the trading volume, reaching JD 208.3 million. Thus, the relative importance of the trading volume of this sector vis-a-vis total trading rose by 10 percentage points, to reach 49.8 percent. In contrast, the relative importance of trading volume for "banks and financial companies", and services sectors decreased by 8.9 and 1.9 percentage points to reach 36.9 and 12.1 percent, respectively. As for the insurance sector, the relative importance of trading volume registered a minimal increase (0.2 percentage points) to reach 1.2 percent.

The general share price index, in light of the unfavorable regional circumstances, dropped by 1.6 percent, to 170 points, compared to a 29.8 percent increase during 2001. The drop was the outcome of a decline of 19.5 points (7.1 percent) in the "banks and financial companies" sector index, and a decline of 3.4 points (3.1 percent) in the services sector index. On the other hand, the indices of the insurance and industry sectors rose by 16.7 points (12.5 percent) and 9.9 points (10.8 percent) respectively. Worth mentioning here is that the market capitalization of listed stocks in the bourse also increased by 12.3 percent, to JD 5,029 million, in 2002 (around 76.4 percent of GDP). This rise is attributed to the listing of the Jordan Telecom shares in the bourse. Activity in the market for fixed income securities (bonds) remained relatively marginal; total value of bonds traded on the bourse during 2002 did not exceed JD 9.7 million.

As for non-Jordanian investments in the bourse, data revealed that non-Jordanian investors purchased JD 233.4 million worth of shares, double the amount bought in 2001. Meanwhile, they sold stocks worth JD 232.5 million. Consequently, net non-Jordanian investments in the ASE showed a positive balance of JD 0.9 million

last year, compared to a negative balance of JD 107.5 million in 2001.

A number of technical developments that took place at the bourse also allowed for increased transparency and efficiency, and for better services. These included refurbishing the manual trading hall and turning it into an investors' hall, where investors can monitor trading activity and prices. The bourse also completed the first and second stages of the management information system, set to streamline procedures at all ASE departments. Within the legislative context, the new temporary Securities Law No. 76 for the year 2002 entered into force. The Law includes key amendments that seek to boost the efficiency of the stock market and allow for the establishment of other bourses besides the ASE. It also allows for the creation of an independent fund to protect investors.

Despite the importance of previous studies, until now the majority of research considers developed countries financial markets, which are efficient enough and do not suffer from the inefficiency problems in less developed countries. Considering this matter, the subject of financial markets in developing countries still needs lengthy analysis and more research attention. Therefore, the importance of this study stems from it being an empirical attempt in this direction. I select five macroeconomic variables based on their hypothesized effect on either stock pricing or return. The ASE is also a well-established, small, emerging open equity market, thus, providing a showcase for other emerging markets in the world.

The principal objective of this paper is to use the cointegration method of Johansen (1991) to analyze the long-term equilibrium relationship between stock returns and relevant macroeconomic variables for the Jordanian (Amman) stock market. Series of studies have been done to find the long-term equilibrium relationship between stock returns and macroeconomic variables for the USA, Japan, and other industrially developed countries. Furthermore, the paper addresses this question for the first time in the Jordanian stock market. In particular, it attempts to find whether there exists long-term equilibrium relationship between the Jordanian stock market

return and the level of real economic activity, money supply, inflation, and interest rates. The results indicate that a cointegration relationship indeed exists and that stock prices contribute to this relationship.

This paper's contributions are as follows. First, by employing Johansen's VECM, which has become a standard technique for examining cointegration among financial variables, the current paper provides a more appropriate framework than the standard vector autoregressive (VAR) technique.[1] The advantage of the cointegration technique stems from its ability to explore dynamic co-movements among variables examined. On the other hand, the VAR approach is deficient in its failure to incorporate potential long-term relations and, therefore, may suffer from a misspecification bias.

Second, studying the relationship between the macroeconomic indicators and the Jordanian stock market can shed some light on the stock market's response to macroeconomic factors for similar emerging and industrial markets as well. In Table 1, I report the market capitalization of the whole market, the size of new equity issues, and their respective proportions to GDP. When judged by the ratio of market capitalization to GDP, the mean proportion of 55% indicates the importance of the market in the Jordanian economy. Moreover, during the time period 1978-1999, the mean annual equity issues as a proportion of GDP was equal to 1.13%. During the time period 1991-1995, "this proportion was equal to 0.6% in Germany, 1.0% in Japan, 0.5% in Turkey, 0.4% in Greece and 0.5% in Portugal" (Aylward and Glen, 1999, p.35).

The paper proceeds along the following lines. Section 2 describes the recent macro variable trend in Jordan. Section 3 presents the literature review. Section 4 discusses the data and the methodology. Section 5 reports the empirical results, and Section 6 provides conclusions.

[1] Darrat (1990) applies a VAR model to examine the relation between stock returns and macroeconomic variables.

2. Recent Macro Variable Trends in Jordan

Macroeconomic indicators in the year 2002 have shown an improvement in the performance of the economic activity. Primary figures presented in the "Budget Address for the year 2003" expect that the GDP growth in fixed prices will be 5.0% for 2002, compared to 4.2% for the year 2001, whereby the GDP would reach JD 6,780 million in current prices.

As for the monetary policy, the Central Bank of Jordan (CBJ) pursued its policy which aims at maintaining monetary stability, a strong and stable Jordanian Dinar exchange rate, a low inflation rate, and low interest rates. This policy has helped to keep a comfortable level of foreign currency reserves at the CBJ, equaling JD 2,477.7 million by the end of 2002, which is the highest level since the Kingdom was established. As for interest rates, the discount rate dropped from 5.0% by the end of 2001 to 4.5% by the end of 2002, the weighted average of interest rates on loans and advances went down from 10.45% to 9.85%, interest rates on three months certificate of deposits (CDs) decreased from 3.9% to 3.0%, and the consumer price index went up by 1.8% during 2002.

On the public finance performance, re-estimated figures indicate a drop of 8.5% on the expected level of domestic revenues for the year 2002 and a decrease in general expenditures of 5.2%, thus the fiscal deficit would amount to JD 260 million, i.e. 3.8% of the GDP. Domestic debt figures indicate a rise in its outstanding balance by the end of 2002 to JD 1335 million, 19.7% of the GDP, against JD 1,124 million, or 18% of the GDP, by the end of 2001, namely an increase of 18.8%. This increase in the outstanding balance of public domestic debt is due mainly to treasury bonds and bills issued to finance part of the budget deficit. On another vein, the external debt outstanding increased to JD 5,123 million by the end of 2002, 75.6% of the estimated GDP for 2002, against JD 4,743 million or 75.8% of the GDP as of end the of 2001. Thus, registering an increase of 8%, as a result of the increase in the exchange rate of the Yen and the European currencies against the Jordanian Dinar.

3. Literature Review

Chen, Roll and Ross (1986) contribute to the fact that a long-term equilibrium relationship exists between stock prices and relevant macroeconomic variables.[2] They find that asset prices react sensitively to economic news, especially to unanticipated news. Hamao (1988) replicated the Chen, Roll and Ross (1986) study in the multi-factor APT framework. He shows that the Japanese stock returns are significantly influenced by the changes in expected inflation, and the unexpected changes in both the risk premium and the slope of the term structure of interest rates. The volatilities in real economic activity in Japan are weakly priced compared to the U.S.A.

Lee (1992) investigates the causal relationship and dynamic interaction among asset return, interest rates, real activity and inflation, using a multivariate VAR model with postwar U.S. data. He shows that prior stock returns Granger-causes real stock returns. Darrat (1990) tests the joint hypothesis that the stock market of Canada is efficient and the expected returns are constant over time using the multivariate Granger-causality technique. He finds that the Canadian stock prices fully reflect all available information on monetary policy moves.

Darrat and Mukherjee (1987) use a Vector Autoregression (VAR) model along with Akaike's final prediction-error on the Indian data over 1948-84, and show that a significant causal relationship exists between stock returns and certain macroeconomic variables. Brown and Otsuki (1990) find that money supply, production index, crude oil price, exchange rate, call money rate and a residual market error are associated with risk premia and affect the Japanese stock market. Mukherjee and Naka (1995) test the dynamic relationship between six macroeconomic variables and the Japanese stock market, by employing a vector error correction to a model of seven equations. They find that a long-term equilibrium relationship exists between the Japanese stock market and the six macroeconomic variables such

[2] Granger (1986) provides the foundation of the validity of this fact by using a cointegration analysis.

as exchange rate, money supply, inflation, industrial production, long-term government bond rate and call money rate. More recently, Sadorsky (1999) finds that industrial production responds positively to the shocks in stock return and that oil prices play in affecting real stock return. On the other hand, other studies left this matter as an open question as to whether there exists a significant reliable statistical relationship (Homa and Jaffee, 1971;Fama, 1981;and Gultekin, 1983).

4. Data and Methodology

4. a Summary Statistics

The data used in this study were obtained from various issues of the monthly statistical bulletins from the Central Bank of Jordan. The stock data were collected from the Amman Security Market statistical data. The sample period consists of 92 quarterly observations for each variable, from March 1980 to December 2003.

The variables used to represent Jordanian stock market, inflation, money stock, output (real activity), and interest rate are respectively the Amman Stock Exchange Index (ASE), Consumer Price Index (CPI), Money supply (M2), Industrial Production Index (IP), and Treasury bill (TB) rates. The choice of variables is almost similar to Chen, Roll and Ross (1986), Darrat and Mukherjee (1987), Hamao (1988), Brown and Otsuki (1988), Darrat (1990), Lee (1992) and Mukherjee and Naka (1995). The definition of the variables is provided in Table 2.

Table 3 provides the summary statistics on the levels of the variables in Panel A and their first differences in Panel B. The table shows that ASE (stock prices) increases by 0.3% per quarter but the money supply, industrial production increase by 2.6%, and 1.1% respectively. Treasury bill rate and inflation rate grew at low rates. As expected, the maximum value of TB exceeds that of CPI, indicating that debt holders earn real returns. However, the standard deviations of the differences in these variables indicate that interest rates are more variable than inflation, apparently because they sometimes change drastically.

4.b Test of Cointegration

Advancement in time series methodology allows researchers to test for the presence of equilibrium relationships among economic variables. Recent time series analysis require data to be covariance stationary that led academicians to take first-difference time series before estimating economic models to remove much of the long-run characteristics of the data. Engle and Granger (1987) find that specific economic variables obey specific equilibrium constraints even though an economic series may fluctuate over time. It implies that over time there may exist some linear combination of the variables that converges to equilibrium. If the separate economic series are stationary only after differencing, but a linear combination of their levels is stationary, then the series said are to be cointegrated (Hafer and Jansen, 1991).

Cointegration analysis examines the long-term equilibrium relationship between time series variables. Furthermore, econometric analysis does not hold in the presence of non-stationary time series data. The most important approach to analyze the non-stationary time series data is VAR (vector autoregression) and cointegration. To analyze the long-term equilibrium relationship between stock returns and macrovariables, cointegration analysis is more appropriately compared to the VAR model because the cointegration method can explore the dynamic co-movements among the variables (Mukherjee and Naka, 1995). Cointegration refers to a linear combination of nonstationary time series that results in a stationary time series in the presence of cointegration among the variables. In the presence of such a linear combination, conventionality indicates the long-term equilibrium relationship among the cointegrating variables (Granger, 1986). Cointegration is a method of defining the long-term relationship amongst a group of time series variables. It uses the idea of an integrated time series in describing the long run interaction and arose in the context of the spurious regression problem. To be related to one another statistically in the long run, variables must be of the same order of integration. The presence of cointegration among relevant variables implies that a linear combination of nonstationary time series variables is stationary. For example, if a two variable regression model is specified as $y_t = \beta x_t + u_t$, then u_t will only be

I(0), integrated of order zero, and therefore having the property of stationarity, if y_t and x_t are both of same order of integration I(d). The simplest and most common case is where x_t and y_t are both I(1). Then if u_t is I(0), the series x_t and y_t are said to be cointegrated. But for non-stationary time series data the traditional econometric analysis does not work. The most important approach to analyze the non-stationary time series data is Vector Autoregression (VAR). However, cointegration analysis is more appropriate than the VAR technique to explain the long-term equilibrium relationship between stock returns and relevant macroeconomic variables. The existence of cointegration among time series variables indicates that there exists a long-term equilibrium relation between those variables. Cointegration is closely linked to error correction models.

Johansen (1991) developed the vector error correction model as:

$$\Delta Y_t = \mu + \sum_{j=1}^{k-1} \Gamma_j \Delta Y_{t-j} + \alpha \beta' Y_{t-k} + \varepsilon_t$$

where,

Δ = First difference notation

Y_t == px1 vector integrated of order one

μ = px1 constant vector representing a linear trend in a system

k = Lag structure

ε_t = px1 Gaussian white noise residual vector

Γ_j = pxp matrix indicating short-term adjustments among variables across p equations at the j^{th} lag.

α = pxr speed of adjustment

β = pxr cointegrating vectors.

A long-term equilibrium relationship (stationary linear combinations of $\beta' Y_t$) is found when variables are cointegrated even if Y_t is nonstationary.[3] . The vector error correction model of Johansen (1991) uses the full information maximum likelihood method and the model aims to:

1. Test whether all variables are integrated of the same order by using unit root tests.

[3] See (Mukherjee and Naka, 1995).

2. Find the truncated lag (k) such that the residuals from each equation of the vector error correction model are uncorrelated.
3. Regress ΔY_t against the lagged differences of ΔY_t and $\Delta Y_{t-k.}$ Then estimate the cointegrating vectors from the canonical correlations of the set of residuals from the regression equation using the set of variables in the model.
4. Determine the order of cointegration using the λ_{trace} and λ_{max} test.
5. Test for the presence of a linear trend, test for linear restrictions on the cointegrating vectors.
6. By using the appropriate cointegrating vector, it determines the long run equilibrium relationship.

Testing for cointegration using the method of Engle and Granger (1987) is concerned with a single-equation while the Johansen (1991) method uses a system of equations and provides more efficient estimators of cointegrating vectors, as it does not require a specific variable to be normalized (Phillips, 1991). The cointegration testing procedure of Engle and Granger (1987) has some undesirable features as described by Enders (1995).

5. Empirical Result

5. a Unit Root Test

The Augmented Dickey Fuller (1981) test and the Phillips and Perron (1988) test are employed to determine the presence of a unit root. Table 3 reports the results of the unit root tests. The appropriate lag length is selected using the Akaike Information Criterion (AIC). All tested equations include a drift (constant) and a deterministic trend term. Using the Augmented Dickey Fuller test conflicting results for the unit root test is found for Jordanian data. All the variables indicate that the variables are non-stationary, but M2, IP, and TB variables are difference stationary while, CPI is difference non-stationary. The Phillips and Perron test shows that all the variables are non-stationary in level form and difference stationary. We get the similar kind of results using different lag lengths. However the unit root tests are not conclusive. The variables are non-

stationary and are integrated of order one that is consistent with the existing literature for other countries including the U.S.A.

Perron (1989) shows that a major shock like the great depression of 1929 and the oil price shock of 1973 have a permanent effect on macroeconomic variables. Most macroeconomic data, according to Perron (1989), do not contain a unit root. However, the test statistics are biased towards accepting the null hypothesis of a unit root if we disregard the structural breaks, although the series is stationary with each sub period. Schwert (1987) finds that the unit root test critically depends on the assumption of the process that generates the data. As a consequence, the correct specification of the process is extremely important to interpret the unit root tests. Misspecification of the data generating process may lead to an incorrect interpretation about the stationarity of any series. Perhaps, the above-mentioned reasons produce the conflicting results of the unit root tests in this research. Higher frequency of data usually yields better results for the unit root tests, but here we use less frequent (quarterly) data although Kasa (1992) finds stronger evidence of cointegration using quarterly data rather than using monthly data.

5.b Cointegration Test for Long-run Equilibrium Relationship

Table 5 represents the λ_{Trace} and λ_{Max} tests. Both the tests show that there exists only one cointegrating relation. The λ_{Trace} test rejects the null hypothesis of r=0 in favor of r>0 and the λ_{Max} test rejects the null hypothesis of r=0 in favor of r=1 at a 1% level of significance.

Following Johansen and Juselius (1990), I base my analysis on the cointegtrating vector represented by the largest eigenvalue.[4] The long-run equilibrium relationship among the tested variables is based on the following cointegrating vector:

$$\beta_1' = [1.00, -0.184, -0.809, 0.335, -0.787, 10.7].$$

[4] The long-term equilibrium relation with the second-largest is similar to the one associated with the highest eigenvalue.

These values represent the coefficient for ASE (normalized to one), M2, TB, CPI and IP. So the long-run equilibrium relationship can be expressed as:

$$TSE = 0.184M2 + 0.809TB - 0.335CPI + 0.787IP - 10.7$$

The likelihood ratio test shows that ASE contributes to the above cointegrating relation. The test statistic is 20.11 and is significant at the 1 percent level, with 2 degrees of freedom. It appears that there is reliable negative relationship between stock prices and inflation. This is consistent with Chen, Roll and Ross (1986) for US data, and Mukherjee and Naka (1995) for Japanese data. The level of real economic activity (output), represented by IP, affects stock prices positively. A similar relation is found in the United States (Fama (1990), Cheske and Roll (1983)). Money supply has either a positive or negative effect on stock prices as explained by theory, although most studies find a positive relationship.[5] The results show that money supply (M2) has a positive effect on ASE. These results support those of Friedman and Schwartz (1963) and Bulmash and Trivoli (1991). Interest rates (TB) have a negative relationship with stock prices. Mukherjee and Naka (1995) also find a positive relationship between share prices and short-term interest rates. Industrial production is one of the positive determinant factors of Jordanian stock prices and this is consistent with the findings of Chen, Roll and Ross (1986), Mukherjee and Naka (1995) and Naka, Mukherjee and Tufte (1998).

6. Conclusions

This paper analyzes long-term equilibrium relationships between a group of macroeconomic variables and the Amman Stock Exchange index. The macroeconomic variables are represented by the industrial production index, the consumer price index, money supply,

[5] However, Fama (1980) left the question opened regarding the effect of money supply justifying that by the fact that the rate of inflation has a positive relationship with money growth rates, other effect could be attributed to the corporate earnings effect.

and treasury bill rate. Johansen's (1991) vector error correction model is employed to avoid potential misspecification biases that might result from the use of a more conventional vector autoregression modeling technique. All of the new research in this area has focused on industrial countries, with relatively little attention paid to developing countries. Accordingly, I believe that this paper will add to our understanding as to whether similar empirical results are observed in developing countries. In addition, these findings may have important policy implications because they could be crucial in areas such as the design of stabilization and adjustment programs.

The empirical evidence shows that these macroeconomic variables are cointegrated i.e. there exists a cointegrating relation among the variables. Analysis of the results indicates that this cointegration relationship is consistent with the earlier findings, and the signs of the variables are also consistent with the earlier studies.

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Table 1:The relative size of Amman securities market

Year	Market Capitalization ($ billion)	Market Capitalization as a % of GDP	Size of New Equity Issues as a % of GDP
1978	0.408	36.7	0.78
1980	0.707	41.9	2.56
1982	1.411	58.1	3.38
1984	1.266	44.7	0.03
1986	1.253	40.5	0.50
1988	1.550	47.9	0.05
1990	1.830	48.0	0.10
1992	3.243	64.9	0.17
1994	4.618	76.1	3.34
1996	4.614	68.5	1.64
1998	5.478	74.0	0.83
1999	4.041	53.4	0.13
Mean		54.5	1.13

Source: Various ASM Annual Reports and Central Bank of Jordan

Table 2: Definition of variables used to proxy the Jordanian stock market and the five macroeconomic variables.

Variable	Definition
Share Price (ASE)	Index of market-value-weighted average of closing prices for shares listed on the Amman Stock Exchange
Money Supply (M2)	It equals money supply (M1) plus quasi-money. On the asset side it equals net domestic assets plus net foreign assets of the banking system.
Inflation (CPI)	Consumer price index
Industrial Production (IP)	Seasonally adjusted industrial price index as a proxy for current economic activity
Treasury Bill Rate (TB)	End-of-period mean yield of 3 month Jordanian treasury bill

Table 3: Descriptive statistics of all variables from March 1980 to December 2003.

	Summary Statistics				
	ASE	M2	TB	CPI	IP
Panel A: Level Specifications					
Observations	95	95	95	95	95
Mean	5.065	8.256	7.016	4.410	4.541
Std Error	0.235	0.655	3.550	0.347	0.246
Minimum	4.591	6.731	1.540	3.780	5.067
Maximum	5.629	9.136	20.150	4.849	112.030
Panel B: First Difference					
Observation	94	94	94	94	94
Mean	0.003	0.026	0.001	0.001	0.011
Std Error	0.090	0.024	0.152	0.036	0.100
Minimum	-0.370	-0.043	-0.550	-0.186	-0.267
Maximum	0.181	0.112	0.690	0.102	0.265

* ASE, M2, CPI, IP, and TB denote the Amman Stock Exchange, money supply, consumer price index, industrial production, and treasury bill rate. They are transformed into natural logs.

Table 4: Unit root test

Series	Augmented Dickey Fuller Test	Phillips-Perron Test
ASE	0.52	-0.41
DASE	-4.84*	-10.41*
M2	0.87	1.32
DM2	-4.00*	-18.34*
TB	-1.55	-2.01
DTB	-7.70*	-9.97*
CPI	-2.41	-2.75
DCPI	-1.74	-4.03
IP	-3.27	-2.71
DIP	-6.85*	-8.81*

Notes: The appropriate lags are automatically selected employing AIC through RATS program. All tested equations include a drift and a trend term. D represents the first difference in natural logarithm.
*Significance at 1% level.

Table 5: Test for the number of Cointegrated vectors.

λ_{Trace} Test				λ_{Max} Test			
(H_0)	(H_A)	λ_{Trace} Value	99% Critical Value	(H_0)	(H_A)	λ_{Max} Value	99% Critical Value
r = 0	r > 0	175.82*	143.09	r = 0	r = 1	73.56*	51.91
r ≤ 1	r > 1	102.47*	111.01	r = 1	r = 2	42.42*	46.82
r ≤ 2	r > 2	60.05*	84.45	r = 2	r = 3	33.99	39.79
r ≤ 3	r > 3	26.06	60.16	r = 3	r = 4	15.37	33.24
r ≤ 4	r > 4	10.69	41.07	r = 4	r = 5	8.80	26.81
r ≤ 5	r > 5	1.92	24.60	r = 5	r = 6	1.92	20.20

Notes: The λ_{Trace} and λ_{Max} test statistics are based without a linear trend. The critical values at 1% level are taken from Osterwald-Lenum. The null hypothesis, H_0, refers at most r cointegrating vectors when r is the order of cointegraion.