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The Relationship Between Macroeconomic Variables and ISE Industry Index

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ABSTRACT: In this study, the relationship between macroeconomic variables and Istanbul Stock Exchange (ISE) industry index is examined. Over the past years, numerous studies have analyzed these relationships and the different results obtained from these studies have motivated further research. The relationship between stock exchange index and macroeconomic variables has been well documented for the developed markets. However, there are few studies regarding the relationship between macroeconomic variables and stock exchange index for the developing markets. Thus, this paper seeks to address the question of whether macroeconomic variables have a significant relationship with ISE industry index using monthly data for the period from 2003 to 2010. The selected macroeconomic variables for the study include interest rates, consumer price index, money supply, exchange rate, gold prices, oil prices, current account deficit and export volume. The Johansen's cointegration test is utilized to determine the impact of selected macroeconomic variables on ISE industry index. The result of the Johansen's cointegration shows that macroeconomic variables exhibit a long run equilibrium relationship with the ISE industry index.

Keywords: Macroeconomic variables; ISE industry index; Johansen's Cointegration Analysis
JEL Classifications: G10; G21; E44

1. Introduction

The stock exchange plays a pivotal role in financial intermediation in both developed and developing market by transferring from surplus to deficit economic units. When the country economy grows up, more resources are needed to meet the demand coming from business organizations. Stock exchange provides businesses with the facility to raise capital by selling shares to the investor (Black and Gilson, 1998). Stock exchange serves a vital function for businesses considering going public. An economy that experiences sustainable growth is likely to have a very effective stock exchange. While developed countries fully usurp the benefits of the raising capital through the stock exchange, developing countries do not have effective stock exchange at the desired level. Being one of the most important pillars of the country economy, stock market is carefully observed by governmental bodies, companies and investors (Nazir et al., 2010).

The country economy is composed of the macro and micro variables. Economic variables play a critical role in the overall performance of stock market. The stock market can rapidly respond to all macro and microeconomic level information. It leads to conclusion that stock market has a significant relationship with real and financial sectors of the country economy. There are two main opinions about the relationship that exists between macroeconomic variables and stock market performances. Traditional opinion suggests that stock markets are created by industry and stock exchange markets can not directly influence the real economy. The latter opinion is financial opinion that suggests financial organizations have a huge impact on the economic development.

An accurate estimation of the relationship between macroeconomic variables and performances of the stock market can enable investors to make better investment decisions. At the same time, it might help policy makers to make effective decisions and encourage more capital inflows into the capital market of the country.

During the last two decades, the relationship that exists between macroeconomic variables and stock market performances has dominated the finance literature. Most of these studies were guided by the efficient market hypothesis developed by Fama (1970). The studies that support efficient market hypothesis state that the price of the shares cannot be predicted by historical data. In other words, earning above average is impossible by analyzing historical price of the shares. Some of the studies claim that no market is efficient. These studies state that past levels of economic activity are useful to predict future stock prices.

The main objective of this study is to complement the existing literature on the relationship between stock market and macroeconomic variables. First, is to determine whether macroeconomic factors have explanatory power for the performance of the ISE Industry index. It is generally thought that the operations of the companies listed on ISE industry index are heavily influenced by macroeconomic variables.

The rest of the paper is organized as follows. Section 2 provides a review of literature on the relationship between macroeconomic variables and stock market index. Section 3 presents the data as well as econometric methodology. Section 4 put forward the empirical results and discussions. Section 5 concludes the paper.

2. Literature Review

Numerous studies have been conducted in recent years to analyze the relationship between stock market index and macroeconomic variables. Studies reveal strong relationships between macroeconomic variables and stock returns.

Fama (1982) stated that expected inflation is negatively associated with the share price. Darrat (1990) found that budget deficits, long term bond rates, the amount of industrial production and the volatility of interest rate have an impact on the stock returns. Achsani and Strohe (2002) examined the relationship between inflation and the index of Jakarta stock exchange and concluded that inflation has a negative relationship with stock exchange index.

Nishat and Shaheen (2004) investigated the relationship between a set of macroeconomic variables and the index of Karachi stock market. The results showed that industrial production has a positive impact on the performance of the index and inflation has a negative relationship with stock exchange index. Aggarwal (1981) found that there is a positive relationship between US stock prices and exchange rate. A study conducted by Chen (1991) revealed that market excess returns can be predicted by using lagged production growth rate, treasury bill rate, and the term structure. Mukherjee and Naka (1995) investigated the role of macroeconomic variables on the index of Tokyo stock exchange. They found a long-term equilibrium relationship between the index of Tokyo stock exchange and macroeconomic variables such as money supply, exchange rate and long-term bond rate.

Apergis and Eleftherio (2002) investigated that the relationship among the index of Athens stock exchange, interest rate and inflation and concluded that inflation has greater impact on the performance of the index of Athens stock exchange than interest rate. Rapach (2001) analyzed the long run relationship between inflation and the stock prices. Using macroeconomic data from sixteen developed countries, it is concluded that there is a weak relationship between inflation and stock prices. Liu ve Shrestha (2008) examined the relationship between a set of macroeconomic variables and the index of Chinese stock market. By employing heteroscedastic cointegration, they found that a significant relationship exists between the index of the Chinese stock market and macroeconomic variables. They concluded that inflation, exchange rate and interest rate have a negative relationship with the index of Chinese stock market. Hashemzadeh and Taylor (1988) tested the casual relationship among the prices of US common stock, money supply and interest rate. They found that there is a two-way causation between the price of US common stock and money supply and interest rate leads US stock price.

Durukan (1999) studied the link between macroeconomic variables and the stock prices in Istanbul stock exchange. The empirical results showed that interest rate is negatively associated with the stock price and there is no statistically significant relationship between inflation and stock price. Aydemir and Demirhan (2009) investigated the relationship between exchange rate and the index of Istanbul stock exchange. By employing Toda-Yamamoto causality test, they found that there exists a two-way causation between stock exchange index and exchange rate. Erdem et al., (2005) analyzed the relationship between macroeconomic variables and the index of Istanbul stock exchange. They

concluded that there is a negative relationship between inflation and the stock price, and real economic activity proxied by industrial production has a positive effect on the stock price.

3. Data and Methodology

This paper focuses on the Istanbul stock exchange and investigates the performance of ISE industry index using monthly data from 2003M1 to 2010M12. The ISE industry index is obtained from the official web site of the ISE. The selected macroeconomic variables for this study are gold price, exchange rate, oil price, interest rate, consumer price index, export volume, money supply, and current account deficit. This study selects macroeconomic variables closely related to Turkish economy, and global economy. The macroeconomic variables employed in this study are monthly data for the same time period as the ISE industry index data (2003M1-2010M12), and obtained from various source including Central Bank of the Republic of Turkey, and online database of International Financial Statistics (IFS). Stata 11 is used for the empirical analysis. There are two stages to each part of the empirical analysis: (i) testing for a unit root, (ii) testing for cointegration.

Before analyzing the relationship between macroeconomic variables and the index of ISE industry, it is critically important to carry out a univariate analysis. Generally speaking financial time series are integrated which means that variance, mean, and covariance of the time series data are time variant. If time series data are non- stationary, regression equation might be spurious or unreliable. Thus, financial time series used in the study have to be stationary or be converted to stationary.

3.1. Unit Root Test

Augmented Dickey-Fuller (ADF) is employed to determine whether each macroeconomic time series is stationary or not. The test of the unit root hypothesis was introduced by Dickey and Fuller (1979, 1981). To test the unit root hypothesis, the following form of ADF test is employed;

$$\Delta\pi_t: \mu + \alpha\pi_{t-1} + \sum_{i:1}^{k} \lambda_i \Delta\pi_{t-i} + e_t$$

where π_t is macroeconomic time series

t is time trend

e_t is residual term.

The null and alternative hypothesis of the ADF test is followed as;

H_0: $\theta = 0$ (Unit root exists, time series need to be differenced to make it stationary)

H_1: $\theta < 0$ (Unit root does not exist, time series does not need to be differenced)

3.2. Johansen's Cointegration Test

In this part of the study, on the basis of ADF unit root test, Johansen's cointegration test is employed to determine whether any combinations of the variables included in the study in the long-run. The maximum likelihood that determines the number of cointegrating vectors in non-stationary time series is applied in Johansen's cointegration method. Johansen's cointegration model is as follows;

$$\Delta X_t - u + \sum_{i=1}^{p} \Gamma_i \Delta X_{t-i} + \alpha\beta^I X_{t-p} + \varepsilon_t$$

where X_t is an (nx1) vector of non-stationary variables

Γ_i is (nxn) matrix of matrix of coefficients

α is (nxr) matrix of error correction coefficients in which r is the cointegrating vectors in the variables.

β is (nxr) matrix of r cointegrating vectors.

The number of the cointegrating vectors that exist in non-stationary time series can be found by employing trace test and maximum eigenvalue test. Both tests can be used to find the number of cointegrating vectors; though these tests can indicate different number of cointegrating vectors.

The hypotheses of Trace test;

H_0: The number of cointegrating vector is equal to or less than r.

H_1: The number of cointegrating vector is more than r.

The hypotheses of Maximum Eigenvalue test;

H_0: There are at most r cointegrating vectors.

H_1: There are r+1 cointegrating vectors.

$$\lambda_{trace}\,(\mathrm{r}) = -T \sum_{\mathrm{i=r+1}}^{\mathrm{g}} \ln(1-\hat{\lambda}_{\mathrm{i}})$$

and

$$\lambda_{max}\,(\mathrm{r},\mathrm{r}+1) = -\mathrm{T}\ln(1-\hat{\lambda}_{\mathrm{r+1}})$$

where r is the number of cointegrating vectors under the H_0, and $\hat{\lambda}_{\mathrm{i}}$ is the estimated ith ordered eigenvalue from $\alpha\beta'$ matrices (Brooks, 2008).

4. Empirical Results

In this part of the study, the empirical results of the ADF unit root test and Johansen's cointegration estimation are presented respectively. In the ADF test, the rejection of the null hypothesis means that time series is stationary. If the calculated ADF test statistics is greater than MacKinnon's critical value, then the null hypothesis is rejected.

Table 1. ADF Unit Root Tests

Macroeconomic Variable	Level	First Differences
Gold Price	1.868	-4.829
Oil Price	-1.476	-4.204
Interest Rate	-1.86	-12.603
Export Volume	-2.21	-14.918
Money Supply	-2.138	-3.84
CPI	-1.79	-11.582
Current Account Deficit	-2.433	-10.63
Exchange Rate	-2.495	-7.017
ISE Industry Index	-0.462	-5.167

*Test critical values for ADF are -3.517(1%), -2.894 (5%), and -2.582 (10%).

Null hypothesis of ADF test is rejected at 1%, 5% and 10% levels for each macroeconomic variable. The critical values for the ADF statistics are from the Mackinnon (1991) table. All of the series are accepted to be stationary at one level difference (see Table 1).

Johansen cointegration test is very sensitive to the lag length specified. Different lags may yield different cointegration test results. An Akaike information criterion indicates an optimal lag length of 2. The cointegration results along with test statistics are presented in Table 2.

As can be seen the null of no cointegration, r =0 is rejected for each macroeconomic variable and ISE Industry index. This is because both of the statistics (maximum eigenvalue and trace) is greater than the critical value at the 5% significance level. Thus there exists at least one cointegrating vector in each case. Further inspection of the trace and maximum eigenvalue test indicate that except export volume, there are two cointegrating vectors. The result of the Johansen's cointegration test shows high association between ISE Industry index and macroeconomic variables. In other words, a long-run stable relationship between ISE industry index and selected macroeconomic variables exists. That means ISE industry index and macroeconomic variables move together in the long-run.

Table 2. Johansen's Cointegration Estimation Results

Trace Test				Maximum Eigenvalue Test			
H_o	H_1	Statistic	5% Critical Value	Ho	H1	Statistic	5% Critical Value
Gold Price							
r=0	r=1	46.3342	15.41	r=0	r=1	37.1826	14.07
r≤1	r=2	9.1516	3.76	r≤1	r=2	9.1516	3.76
Exchange Rate							
r=0	r=1	58.3203	15.41	r=0	r=1	49.6851	14.07
r≤1	r=2	8.6352	3.76	r≤1	r=2	8.6352	3.76
Oil Price							
r=0	r=1	43.3832	15.41	r=0	r=1	31.0909	14.07
r≤1	r=2	12.2923	3.76	r≤1	r=2	12.2923	3.76
Interest Rate							
r=0	r=1	102.82	15.41	r=0	r=1	75.2975	14.07
r≤1	r=2	27.5225	3.76	r≤1	r=2	27.5225	3.76
CPI							
r=0	r=1	63.7915	15.41	r=0	r=1	58.4034	14.07
r≤1	r=2	5.3881	3.76	r≤1	r=2	5.3881	3.76
Money Supply							
r=0	r=1	42.873	15.41	r=0	r=1	32.7012	14.07
r≤1	r=2	10.1718	3.76	r≤1	r=2	10.1718	3.76
Current Account Deficit							
r=0	r=1	32.0872	15.41	r=0	r=1	31.6967	14.07
r≤1	r=2	0.3905*	3.76	r≤1	r=2	0.3905*	3.76
Export Volume							
r=0	r=1	24.9221	15.41	r=0	r=1	16.9482	14.07
r≤1	r=2	7.974	3.76	r≤1	r=2	7.974	3.76

5. Concluding Remarks

This paper aims to contribute to the existing literature by investigating the interconnections between macroeconomic variables and ISE industry index. Some of the macroeconomic variables employed in the study such as oil price, gold price, and exchange rate are closely related to global economy. The paper analyzes empirically the relationship between a set of macroeconomic variables and ISE industry index. Before seeking the long-run relation between ISE industry index and macroeconomic variables, ADF unit root test is employed. The null hypothesis of unit root is rejected for the first differences. It means that variable levels are not stationary but the first differences of variables are. This implies that the ISE industry index and macroeconomic time series are integrated of order one or I(1).

Since the variables in this paper are non-stationary, the Johansen's cointegration technique has been employed to estimate long run results. The relationship between ISE industry index and macroeconomic time series such as gold price, exchange rate, oil price, interest rate, money supply, current account deficit, and export volume are evaluated individually. This study has found that a set of macroeconomic variables, gold price, exchange rate, oil price, interest rate, money supply, current account deficit, and export volume exhibit a long run equilibrium relationship with the ISE industry index.

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