LONG RUN RELATIONSHIPS BETWEEN STOCK MARKET RETURNS AND MACROECONOMIC PERFORMANCE: Evidence from Turkey

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ABSTRACT

The purpose of this study is to investigate whether current economic activities in Turkey have explanatory power over stock returns, or not. The data used in this study are monthly stock price indexes of Istanbul Stock Exchange and a set of macroeconomic variables, including money supply, exchange rate of US Dollar, trade balance, and the industrial production index. Engel-Granger and Johansen-Juselius co-integration tests and Granger Causality test were used in the study to explain the long-run relations among variables questioned. Obtained results illustrate that stock returns is co-integrated with a set of macroeconomic variables by providing a direct long-run equilibrium relation. However, the macroeconomic variables are not the leading indicators for the stock returns, because any causal relation from macroeconomic variables to the stock returns can not determined in sample period. Contrarily, stock returns is the leading indicator for the macroeconomic performance for the Turkish case by supporting emerging market issues.

1. Introduction

In the financial literature, the price of a share is equal to the discounted sum of the share holders' future returns. That is,

$$P_0 = \sum_t E(c_t)/(1+k_t)^t \ . \qquad (1)$$

A possible change in expected returns [$E(c_t)$] and/or discount rate (k_t) would affect the share prices. That is why, the discount rate in the equation (1) depends on the risk free rate and the risk premium, stock market indexes in an economy is affected by the macroeconomic movements [Chen, et al., (1986)]. A number of studies suggest a relationship between macroeconomic variables and stock market returns have been documented for developed economies. However, these studies have not considered the emerging market case, generally. This paper extends this relation to the emerging markets by considering Turkish case.

A substantial number of study related US and Japanese stock markets [e.g. Kaneko and Lee (1995), Lee (1992), Fama (1981)] determined a positive relation between stock returns and real economic activity. An example of this type research due to Jones and Kaul (1996) obtained a significant importance of crude oil price and exchange rate on the share prices for the Japanese market. Another dimension of this type researches is to forecast the future stock returns [e.g. Mavrides (2000), Kothari and Shanken (1992), Rozeff (1984)]. These studies have generally focused on the relation between dividend returns and forecasting future returns. These studies have concluded that the dividend returns is a significant impact upon forecasting the future returns.

Some studies, however, could not improve the relation mentioned above for the European markets. Poon and Taylor (1991)'s study for the UK market, Martinez and Rubio (1989)'s study for the Spanish market, and Gjerde and Saettem (1999)'s study for the Norwegian market have not implied a significant relation between stock returns and macroeconomic variables. Mookerje and Yu (1997)'s study on forecasting share prices for the Singapore case obtained a result that money supply and exchange rate have an impact upon forecasting share prices.

As a consequence, a number of study investigated developed markets as US and Japanese markets have been concluded that share prices is affected by macroeconomic performance, while the same relation is not valid for the emerging markets as European and South Asian markets. This conclusion exposed the necessity of taking into consideration the Turkish stock market, which is an emerging one.

The purpose of this study is to determine whether the returns of the shares are related to the current economic activities for the Turkish case. This study has organized as follows: In the second chapter, the data and the econometric analysis used in this study have introduced, and in the third chapter, the obtained results have presented. The last chapter will draw comments and conclusions.

2. Methodology and Data

Hardouvelis (1987), Keim (1985), Litzenberger and Ramaswamy (1982) empirically investigated whether the main economic indicators (e.g., inflation, interest rates, treasury bond's returns, trade balance, dividend returns, exchange rates, money supply, and crude oil prices) are effective to explain the share returns. If there was a co-integration relation between macroeconomic indicators and share returns, there would be a causal relation between these variables, too. Otherwise, share returns can not be explained by main macroeconomic variables.

In this study, the relationships between share returns and selected macroeconomic variables have been examined for the Turkish case. Monthly data covers the period of 1990:01-2001:11[1]. Selected macroeconomic variables are Money Supply (M1), US Dollar Exchange Rate (DOL), Trade Balance (TB), and Industrial Production Index (IP).

In Mookerjee (1987), Pearce and Roley (1983), and Davidson and Froyen (1982)'s studies, M1 and M2 were found to be as significant explanatory variables on explaining share returns. In this respect, M1 was selected as the first candidate explanatory variable in this study. Bahmani-Oskooee and Sohrabian (1992)'s study implied that exchange rate has a significant explanatory power on share returns. In this study, US Dollar Exchange Rate was used as one of the explanatory variables[2]. The other explanatory macroeconomic variables used in this study are trade balance and industrial production. The effects of these variables on explaining share returns are expected as significant, because a lot of stabilization program applied by Turkish governments in order to support the increasing in industrial production and export.

[1] Istanbul Stock Exchange (hereafter ISE) has been established in 1986. That is why, the transaction volume of ISE was very low in early years, starting year of the sample was chosen as 1990.
[2] Because the US Dollar is the most using foreign money in Turkish economy.

All variables are in the logarithm and data come from the "Electronic Data Delivery System" of the "Central Bank of the Republic of Turkey" and "Istanbul Stock Exchange" web sites.

As indicated in Granger and Newbold (1974), using non-stationary macroeconomic variables in time series analysis causes superiority problems in regressions. To eliminate this problem, stationarity tests must be performed for each of the variables. There have been a variety of proposed methods for implementing stationarity tests (for example, Dickey and Fuller, 1979; Sargan and Bhargava, 1983; Phillips and Perron, 1988 among the others) and each has been widely used in the applied economics literature. However, there is now a growing consensus that the stationarity test procedure due to Dickey and Fuller (1979) (hereafter ADF) has superior small sample properties compared to its alternatives. Therefore, in this study, ADF test procedure was employed for implementing stationarity tests. The ADF test procedure requires to run the following regression for both level and the first difference of each variable, separately. If necessary, the ADF regression can be run for the higher levels of the variables.

$$DLX_t = \alpha + \gamma t + \Phi LX_{t-1} + \sum_{i=1}^{m} \delta_i DLX_{t-i} + w_i \qquad (2)$$

where LX is the logarithmic form of the variable in question, α and t are a constant term and a time trend, respectively, "D" is the first difference operator, w is the white noise residual and m is the lagged values of DLX_t that are included to allow for serial correlation in the residuals. In the context of the ADF test, a test for nonstationarity of the series, LX, amounts to a t-test of $\Phi=0$. The alternative hypothesis of stationarity requires that Φ be significant negative. If the absolute value of the computed t-statistic for Φ exceeds the absolute critical value given in McKinnon (1990), then the null hypothesis that the log level of X series is not stationary must be rejected against its alternative. If, on the other hand, it is less than the critical value, it is concluded that the logarithmic level of X, LX, is nonstationary. In this case, the same regression must be repeated for the first difference of the logarithmic value of the series. In estimating ADF regressions, the number of own lags (m) was chosen by using the "Akaike Information Criterion" (AIC) due to Akaike (1969).

If the series under consideration turn out to be integrated of the same order, it is possible to proceed by testing for cointegration relationships between the integrated variables. In this paper, cointegration tests were carried by means of the methods developed by Johansen and Juselius (1990) and Engle and Granger (1987).

The Engle-Granger cointegration method [Equation (4)] determines whether the residual terms obtained from the regression, which contain two non-stationary series [Equation (3)], are stationary, or not. If the residuals are stationary in their levels, two non-stationary series in question are cointegrated, and vice versa.

$$\log Y_t = \alpha + \beta \log X_t + RES_t \qquad (3)$$

$$DRES_t = \eta + \lambda RES_{t-1} + \sum_{i=1}^{k} \gamma_i DRES_{t-i} + w_t \qquad (4)$$

The Johansen method applies the maximum likelihood procedure to determine the presence of cointegrating vectors in nonstationary time series as a vector autoregressive (VAR):

$$\Delta Z_t = C + \sum_{i=1}^{K} \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-1} + \eta_t \qquad (5)$$

where Z_t is a vector of nonstationary (in log levels) variables and C is the constant term. The information on the coefficient matrix between the levels of the series Π is decomposed as $\Pi = \alpha\beta'$ where the relevant elements of the α matrix are adjustment coefficients and the β matrix contains the cointegrating vectors. Johansen and Juselius (1990) specify two likelihood ratio test statistics to test for the number of cointegrating vectors. The first likelihood ratio statistics for the null of exactly r cointegrating vectors against the alternative of r+1 vectors is the maximum *eigenvalue statistic*. The second statistic for the hypothesis of at most r cointegrating vectors against the alternative is the *trace statistic*. Critical values for both test statistics are tabulated in Johansen and Juselius (1990). The number of lags applied in the cointegration tests are based on the information provided by the multivariate generalization of the AIC[3].

The causality relationships among the variables in this study determined by using the methodology based on Granger (1988). The Granger tests involve the estimation of the following equations.

$$DX_t = \alpha_0 + \sum_{s=1}^{k} \alpha_{1s} DX_{t-s} + \sum_{i=1}^{m} \alpha_{2m} DY_{t-m} + \varepsilon_{1t} \qquad (6)$$

$$DY_t = \beta_0 + \sum_{j=1}^{n} \beta_{1j} DX_{t-j} + \sum_{h=1}^{p} \beta_{2h} DY_{t-h} + \varepsilon_{2t} \qquad (7)$$

If α_{2m} in the equation (6) was found to be equal to zero as a group, the null hypothesis which proposed that Y is the "Cause Variable" for X could not be rejected. Similarly, β_{1j} in the equation (7) was found to be equal to zero as a group, it could not be said that X is the "Cause Variable" for Y.

3. Empirical Results

Table-1 summarizes the ADF test results. While the numbers in parenthesis shows the lag lengths, the numbers in brackets shows the 5% critical values due to McKinnon (1990). The second and third columns of Table-1 summarize the ADF-t statistics of the variables questioned in their own levels. Any of these values is not greater than related critical value, except DOL with trend. This result can be interpreted as any variable is not stationary in its own level. On the other hand, the fourth and fifth columns of Table-1 show the ADF-t statistics of variables questioned in the first difference. These statistics show that all variables in the analysis are stationary in the first difference, that is all variables are I(1).

The first method used in this study is the Engle-Granger Co-integration Test in order to determine whether the variables in analysis share the same long-run trend with ISE. As indicated in Engle and Granger (1987), performing this method requires that all variables should be stationary in the same level and at least first difference. Any variable in this analysis carries out these conditions.

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[3] The multivariate generalization of the AIC is AIC = $T\log|\Sigma|+2N$. Where $|\Sigma|$ is determinant of the covariance matrix of the residuals and N is total number of parameters estimated in all equations.

Table 1: Unit Root Test Results

	ADF-t statistics (log levels)		ADF-t statistics (the first difference)	
Variables*	**Without Trend**	**With Trend**	**Without Trend**	**With Trend**
ISE (1) (1)	-0.2414 [-2.8837]	-3.1836 [-3.4447]	-7.4929 [-2.8838]	-7.4520 [-3.4450]
M1 (12) (7)	-0.5263 [-2.8757]	-2.8826 [-3.4478]	-5.7854 [-2.8849]	-5.9336 [-3.4466]
TB (1) (1)	-2.5071 [-2.8837]	-3.2397 [-3.4447]	-10.8807 [-2.8838]	-10.8412 [-3.4450]
DOL (1) (7)	-0.6340 [-2.8837]	-6.6246 [-3.4447]	-6.7872 [-2.8849]	-6.7729 [-3.4466]
IP (12) (11)	-1.2383 [-2.8857]	-2.1559 [-3.4478]	-4.2075 [-2.8857]	-4.2212 [-3.4478]

* There are two numbers in parenthesis nearby the variables. The former one is about log levels and the latter one is about the first difference of the variables.

Table-2 presents the Engle-Granger cointegration test results. This test is based on whether the residuals, which were obtained from related regressions, are stationary or not. If the residual series is stationary, then two variables used in the former regression are cointegrated. The results in Table-2 show that there are cointegration relations among the related variable pairs. This result proves that any explanatory variable in this study shares the same long-run trend with ISE.

Table 2: Engle-Granger Cointegration Test Results

Models	ADF-t Statistics	
	Without Trend	**With Trend**
Model 1: IMKB – M1	-3.1843 [-2.8837]	-3.1785 [-3.4447]
Model 2: IMKB – DTD	-3.0737 [-2.8837]	-3.0825 [-3.4447]
Model 3: IMKB – DOLAR	-3.1753 [-2.8837]	-3.1785 [-3.4447]
Model 4: IMKB – SUE	-3.1642 [-2.8837]	-3.1673 [-3.4447]

Note: The values in brackets show the 5% critical value due to McKinnon.

In Engle-Granger cointegration test, the cointegration relations between ISE and the other variables are determined separately. The complete long-run relation between explanatory variables set and ISE was determined by using Johansen-Juselius technique. Because all of the variables are I(1) and the model is not an “Error Correction”, all variables imposed in the model as nonstationary. The optimal lag length of the VAR representation has been determined as 2 (two) by using “Akaike Information Criterion” (AIC). Table-3 reports the “Trace” and “Maximum Eigenvalue Test” statistics. Both of these tests indicate that there are two cointegration vectors (r=2). This finding exposes that there are two cointegration relations between ISE and the variables set, and both of these vectors are in use and can be interpreted.

Table 3: Johansen-Juselius Cointegration Test Results

	Maximum Eigenvalue Statistics	Trace Statistics
r=0	46.3450 [33.3190]	111.7841 [70.5980]
r≤1	42.3202 [27.1360]	65.4391 [48.2800]
r≤2	11.9507 [21.0740]	23.1189 [31.5250]
r≤3	11.1554 [14.9000]	11.1682 [17.9530]

Note: The values in brackets show the 5% critical value.

Two cointegration vectors obtained from Johansen-Juselius cointegration test are as seen in (7) and (8).

$$ISE = 4.8636M1 - 6.5151DOL - 1.5126TB + 14.6456IP \quad (7)$$

$$ISE = -6.72306M1 + 4.2911DOL - 0.9070TB + 22.4365IP \quad (8)$$

It has occurred two different relations between ISE and M1 in equation (7) and (8). A similar result is valid for the ISE-DOL relation. Therefore, it can be said that the relations between ISE-M1 and ISE-DOL are uncertain. The relations between ISE-TB and ISE-IP, however, are very clear in both of the equations. According these results, the relation between ISE and IP is positive and the relation between ISE and TB is negative. So, we can say that greater IP causes greater ISE, and smaller TB causes greater ISE.

Equations (7) and (8) determine the long-run relations between ISE and the set of explanatory variables. The causal relations among these variables are reported in Table-4. As seen from the "Granger Causality Test" results, ISE is not the result variable of any macroeconomic variable. So, any macroeconomic variable questioned in this study is not the indicator for the share returns for the Turkish case. Moreover, it is clear that the future share returns can not be estimated by using the time paths of the macroeconomic variables questioned for the Turkish case.

Table 4: Granger Causality Test Results

Direction of Causality			F-Test Statistics	P values
M1(2)	→	ISE (1)	2.1572	0.1441
ISE (1)	→	M1 (2)	3.2049	0.0439
DOL (2)	→	ISE (1)	0.1024	0.7494
ISE (7)	→	DOL (1)	0.1312	0.7178
IP (2)	→	ISE (1)	0.9478	0.3321
ISE (1)	→	IP (12)	0.9731	0.4791
TB (2)	→	ISE (1)	0.0406	0.8406
ISE (1)	→	TB (2)	1.2955	0.2774

Note: The numbers in parenthesis show that the lag lengths of relevant variable.

4. Conclusions

The purpose of this study is to clarify whether share returns can be explained by the changing macroeconomic performance. Obtained VAR results indicate that there are cointegration relations between ISE and the other economical variables; M1, DOL, IP and TB. The causality test results, however, show that ISE is not the result variable of current economic activities. Controversially, ISE is cause variable for M1. While the studies made for developed markets [Fama (1991), Geske and Roll (1983), etc.] determine a relation directed from macroeconomic performance to share returns, the same relation could not be determined for the Turkish case. As indicated in Kwon and Shin (1999), however, share returns can not be affected by macroeconomic fluctuations in emerging markets as Europe and South Asia. In this respect, the Turkish case can be included in the second group, namely "emerging market". Additionally, it can be said that the share holders in ISE have completely different investment patterns from the share holders in developed markets.

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