THE IMPACT OF MACROECONOMIC VARIABLES ON STOCK RETURNS IN TURKEY: AN ARDL BOUNDS TESTING APPROACH

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ÖZET

Bu makalenin amacı hisse senedi getirileri ile geniş para arzı , endüstriyel üretim , reel efektif döviz kuru oranları,uzun dönem yerel faiz oranları ve yabancı faiz oranları arasındaki uzun ve kısa dönemli ilişkileri araştırmaktır. Eş bütünleşme için ARDL yönetimi kullanılmıştır. Birçok makro değişken ile hisse senedi getirileri arasında uzun dönemli eş bütünleşme kanıtı bulunmuştur.

ABSTRACT

This paper aims to investigate both the long-run and short-run relationships between stock returns and broad money supply, industrial production, real effective exchange rates, long term domestic interest rates, and foreign interest rates. Using the ARDL approach to cointegration, we find evidence of long-run cointegrating relationship between stock return and various macro variables. Results of the parameter stability tests indicate that the structure of the parameters has not diverged abnormally over the period of the analysis.

KEYWORDS: Stock market, cointegration, error-correction modelling, Turkey.

JEL CLASSİFİCATİON CODES: C12, C32, O16

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INTRODUCTİON

The effect of macroeconomic variables on the stock market behaviour is a well-established theory in the financial economics literature. However, more studies are focused on the developed countries such as the US, UK and Japan [see e.g. Fama (1981) and Chen (1991) for the US; Hamao (1988) for Japan; and Poon and Taylor (1992) for the UK]. Emerging markets tend to have distinguished features from those of the developed markets. Risks and returns in the emerging stock markets appear to be higher relative to the developed stock markets (Errunza, 1983; Claessens et al., 1993; Harvey, 1995). There is an empirical evidence to suggest that emerging markets are segmented from the developed markets (Goetzmann and Jorion, 1999; Bilson et al., 2001).

According to the 'intuitive financial theory', various macroeconomic variables affect stock market behaviour (Maysami and Koh, 2000; Gjerde and Sættem, 1999). The 'stock valuation model' is generally concerned with the factors, which affect the average stock price of all firms. According to 'monetary portfolio model' (Rozeff, 1974), an increase in the interest rates raises the opportunity cost of holding cash and is likely to lead to a substitution effect between stock and other interest bearing securities. According to 'simple discounted present value model', stock prices are determined by the future cash flows to the firm and discount rates (Liljeblom and Stenius, 1997; Ibrahim, 2002; Ibrahim and Jusoh 2001). The stock market-output nexus has also been extensively studied [e.g. Rousseau and Wachtel (2000); Khan et al. (2007); Shahbaz et al. (2008)]. Geske and Roll (1983), Chen et al. (1986), and Wongbangpo and Sharma (2002) suggest a positive relationship between stock prices and industrial production index (IPI), which is used as a proxy for the levels of economic activity, will influence stock prices through its impact on corporate profitability. Accordingly, stock returns-macro variables analysis investigates the interrelationship among the three markets, i.e. the goods market, the money market, and the security market. IPI is used as a proxy for the goods market variable. The money market variables consist of the broad money supply, domestic and foreign interest rates. The security market variable is represented by stock exchange price index. Exchange rates are used to capture external competitiveness. Hence, the selected macroeconomic variables cover a wide range of macroeconomic aspects of the economy.

The objective of this article is to employ cointegration and error-correction modelling to estimate both the short-run and long-run elasticities of stock returns and various macroeconomic variables. The article makes two contributions to the existing literature on the relationship between stock returns and broad money supply, industrial production, real exchange rates, the long-term domestic interest rates and foreign interest rates. First, it is the first study to examine the relationship between stock returns and macroeconomic variables in Turkey, using a relatively new, and yet little used, estimation technique, which is the bounds testing approach to cointegration, within an autoregressive distributive lag (ARDL) framework, developed by Pesaran and others (Pesaran et al., 1996; Pesaran and Pesaran, 1997; Pesaran et al., 2001). Second, in contrast to existing studies, which find cointegration, we also examine whether the parameter estimates are stable over time. To test for parameter stability we use a test developed by Pesaran and Pesaran (1997). The remainder of this paper is organized as follows. Following this introduction, we discuss the ARDL approach to cointegration and present some results, finishing with the conclusions.

EMPİRİCAL RESULTS

The ARDL approach to cointegration involves estimating the conditional error correction version of the ARDL models for stock market returns and macroeconomic variables:

$$\Delta ISE_t = \lambda_0 + \sum_{i=1}^{p} \lambda_1 \Delta ISE_{t-i} + \sum_{i=0}^{p} \lambda_2 \Delta L0_{t-i} + \sum_{i=0}^{p} \lambda_3 \Delta IPI_{t-i} + \sum_{i=0}^{p} \lambda_4 \Delta RER_{t-i} + \sum_{i=0}^{p} \lambda_5 \Delta FFR_{t-i} + \delta_1 ISE_{t-1} + \delta_2 L0_{t-1} + \delta_3 IPI_{t-1} + \delta_4 RER_{t-1} + \delta_5 FFR_{t-1} + v_t \quad (1)$$

$$\Delta ISE_t = \lambda_0 + \sum_{i=1}^{p} \lambda_1 \Delta ISE_{t-i} + \sum_{i=0}^{p} \lambda_2 \Delta R_{t-i} + \sum_{i=0}^{p} \lambda_3 \Delta IPI_{t-i} + \sum_{i=0}^{p} \lambda_4 \Delta RER_{t-i} + \sum_{i=0}^{p} \lambda_5 \Delta FFR_{t-i} + \delta_1 ISE_{t-1} + \delta_2 R_{t-1} + \delta_3 IPI_{t-1} + \delta_4 RER_{t-1} + \delta_5 FFR_{t-1} + u_t \quad (2)$$

where ISE is Istanbul Stock Exchange-100 index, L0 is the broad money supply, IPI is the industrial production index, RER is the real effective exchange rate index, R is the long-term domestic interest rates, and FFR is the US Federal funds rates. Except for R and FFR, all variables in logarithms. The quarterly data series was obtained from the Central Bank of the Turkish Republic electronic data delivery system and spans the time period 1986:1 to 2008:3. FFR is taken from the Federal Reserve's electronic data delivery system. Before conducting the cointegration tests, the conventional ADF tests were carried out to determine the order of integration of the variables. All of the series appear to contain a unit root in their levels but stationary in their first-differences, indicating that they are integrated at I(1), which necessitated the use of the ARDL approach to cointegration rather than one of the alternative methods. For brevity of presentation they are not reported here. Eqs. (1) and (2) were estimated in two stages. Firstly, the order of lags on the first-differenced variables for Eqs. (1) and (2) were obtained from unrestricted VAR by means of Schwarz Bayesian Criterion (SBC), whilst ensuring there was no evidence of serial correlation, as emphasized by Pesaran et al. (2001). Secondly, the bound F-test was applied to Eqs. (1) and (2) in order to establish a long-run relationship between the variables. As we use quarterly data, all tests include a minimum of two lags and maximum of 8 to ensure lagged explanatory variables are present in the ECM. The results are contained in Table 1. The F-tests indicate that there exist cointegrating relationships for both of the models. Evidence of cointegration relationship between variables also rules out the possibility of estimated relationship being spurious.

Table 1. F-statistics for cointegration relationships

Critical value bounds of the F-statistic						
k	90% level		95% level		99% level	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
4	2.20	3.09	2.56	3.49	3.29	4.37
Calculated F-statistics						
FISE (ISE|L0, IPI, RER, FFR) = 4.0714 (Eq. 1)						
FISE (ISE|R, IPI, RER, FFR) = 3.6441 (Eq. 2)						

Notes: Critical values obtained from Pesaran et al. (2001). k refers for the number of regressors.

In the next step the ARDL cointegration procedure was implemented to estimate the parameters of Eqs. (1) and (2) with maximum order of lag set to 8 to minimize the loss of degrees of freedom. This stage involves estimating the long-run and short-run coefficients of Eqs. (1) and (2). The long-run results of Eqs. (1) and (2) based on SBC are reported in Table 2. The cointegration test results indicate that a set of macroeconomic variables namely, L0, IPI, RER, and FFR (Eq. 1) and R, IPI, RER and FFR (Eq. 2) are cointegrated with the Istanbul Stock Market-100 index in Turkey over the period of analysis. Individually, only IPI and R appear insignificant in Eqs. (1) and (2) respectively. L0 is positively related to the changes in stock prices. The negative coefficient of exchange rate lends support to the view that when a currency depreciates, imports are cheaper and this in turn causes an increase in the firm's profitability and therefore the value of the stock. IPI has positive effect on the stock returns, suggesting stock prices should serve as barometer of future economic growth.

Table 2. Estimated long-run coefficients using the ARDL approach

Regressors	Eq. 1 (2, 0, 1, 1, 0)	Eq. 2 (2, 1, 1, 0, 0)
L0	1.45 (3.07)*	—
R	—	-0.01 (-0.63)
IPI	0.86 (0.67)	1.03 (4.62)**
RER	-0.45 (-2.75)*	-0.51 (-2.86)*
FFR	0.07 (2.63)**	0.02 (3.26)*
Intercept	-1.25 (-2.55)**	-3.08 (-3.71)*

Notes: * refers statistical significance at 1% level, and ** refers statistical significance at 5% level. Values in brackets are estimated t-statistics.

In search of finding the short-run dynamics of the above equations, their error-correction representations were estimated as auxiliary models. The results indicate that the estimates possess expected signs and plausible magnitudes and are statistically significant (see Table 3). The error-correction terms are statistically significant with plausible magnitude in both of the equations. The feedback coefficients are −0.67 in Eq. (1) and −0.45 in Eq. (2) with the expected signs. Thus, for both of the models, the speed of adjustment appears considerably fast in the case of any stochastic shock to stock market.

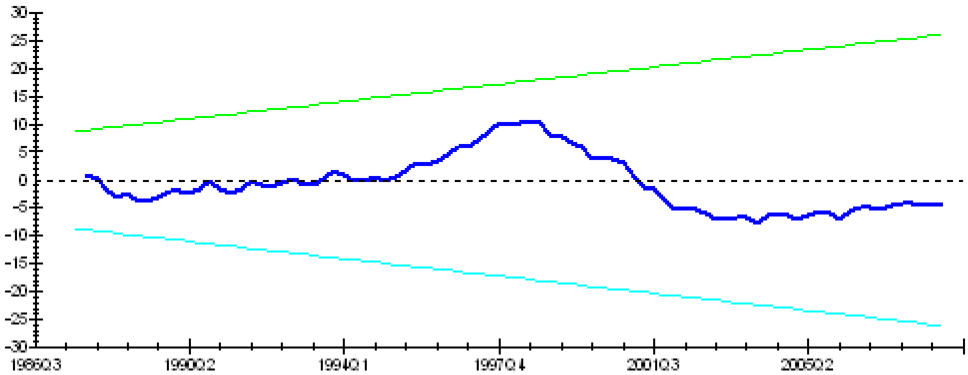
Table 3. Error correction representation for the selected ARDL models

Regressors	Eq. 1 (2, 0, 1, 1, 0)	Eq. 2 (2, 1, 1, 0, 0)
ΔlnISEt-1	0.29 (3.71)*	0.24 (2.44)**
ΔlnL0t	1.96 (2.70)*	—
ΔlnRt	—	-0.80 (-3.94)*
ΔlnIPIt	0.48 (3.29)*	0.50 (2.34)**
ΔlnRERt	-0.97 (-2.47)**	-1.33 (-3.64)*
ΔlnFFRt	0.03 (3.74)*	0.01 (3.29)*
Intercept	-2.51 (-2.64)**	-1.87 (-3.89)*
ECTt-1	-0.67 (-3.06)*	-0.45 (-2.91)*

Notes: * refers statistical significance at 1% level, and ** refers statistical significance at 5% level. Values in brackets are estimated t-statistics.

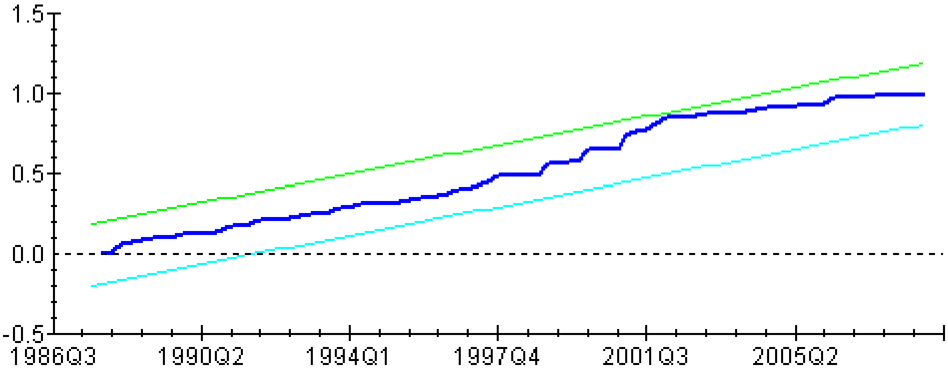
Pesaran et al. (1997) suggest applying the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests proposed by Brown et al. (1975) to assess the parameter constancy. The models were estimated by OLS and the residuals subjected to the CUSUMSQ test. Figures 1 and 2 plot the CUSUMS and CUSUMSQ statistics for Eqs. (1). Figures 3 and 4 plot the CUSUMS and CUSUMSQ statistics for Eqs. (2). Overall, the results indicate no instability in the coefficients as the plots of the CUSUM and CUSUMSQ statistics are confined within the 5% critical bounds of parameter stability.

Figure 1. Plot of Cumulative Sum of Recursive Residuals of Eq. (1)



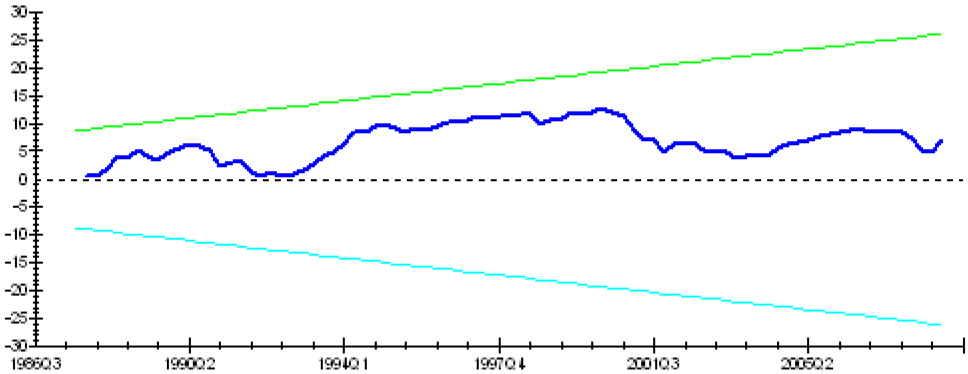
The straight lines represent critical bounds at 5% significance level

Figure 2. Plot of Cumulative Sum of Squares of Recursive Residuals of Eq. (1)



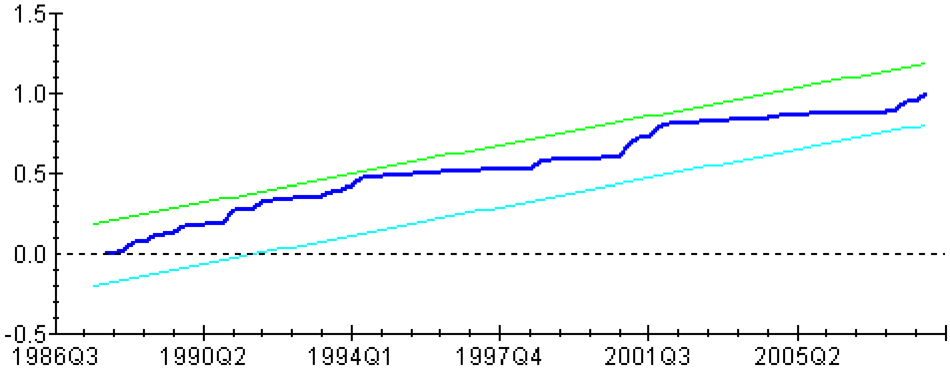
The straight lines represent critical bounds at 5% significance level

Figure 3. Plot of Cumulative Sum of Recursive Residuals of Eq. (2)



The straight lines represent critical bounds at 5% significance level

Figure 4. Plot of Cumulative Sum of Squares of Recursive Residuals of Eq. (2)



The straight lines represent critical bounds at 5% significance level

CONCLUSİONS

This article analyses the nature of the relationship between stock market behavior and the macroeconomic variables. The inclusion of L0, IPI, R, RER and FFR enhance the predictability measure of the Turkish stock market. L0, IPI, and RER seem to be suitable targets for the government to focus on so as to stabilize the stock market and to encourage more capital flows in to the capital market. As a small open economy, Turkey remains susceptible to external influence. Changes in the US monetary policy tend to also have a significant impact on the Turkish stock market behaviour during the period of analysis. This may be perceived as a channel of which the stock market shocks of more developed markets being transmitted to the Turkish stock market. Further analysis may be enhanced by incorporating different macroeconomic variables that may potentially affect the Turkish stock market.

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