

STOCK RETURNS, MACROECONOMIC FACTORS AND STRUCTURAL BREAKS: AN APPLICATION FOR THE TURKISH STOCK MARKET

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ABSTRACT

The goal of this paper is to explore the long-run relationship between stock returns and some macroeconomic factors in the presence of a structural break for the Turkish stock market. Since Turkey experienced severe financial crises, various stabilization programs and alternative macroeconomic policies in the past decade, we can expect that the relationship between stock returns and macroeconomic variables lacks stability during the period 1987-2004. To consider the stability of our model in relation to structural changes in the Turkish economy, we utilize recent methodological contributions which allow for the presence of a regime shift. The findings based on Gregory and Hansen's procedure suggest that there is a strong long-run relationship between stock returns and some macroeconomic factors in the emerging Turkish stock market. On the other hand, the evidence presented in this paper indicate that certain macroeconomic variables (i.e., exchange rate, money supply and real economic activity) play a significant role in explaining variations in stock returns for the case of Turkish stock market.

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1. INTRODUCTION

The relationship between macroeconomic factors and stock returns has been the subject of great interest in the finance literature. This paper attempts to investigate the relations between stock returns and some macroeconomic variables in the Turkish stock market by employing the recent methodological contributions which account for structural breaks in macroeconomic time series. The Turkish stock market provides a particularly good example for testing the effects of some macroeconomic factors on stock returns in the presence of structural breaks due to the changing economic policies in the 1990s. The Turkish economy went through financial crises, various stabilization programs and alternative policies in the past decade.

Earlier empirical studies attempted to test the validity of the two main theories related to asset pricing: the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT). Since most of the assumptions of the CAPM are not sufficiently realistic, Ross (1976, 1977) proposed an alternative theory for asset pricing (APT). The APT states that assets' expected returns are based on risk factors. However, there is no consensus about the number of risk factors in the finance literature.

The APT does not provide sufficient information either to specify the macroeconomic risk factors or to determine the effect of these factors on stock returns. In fact, there seems to be no generally accepted asset pricing models that clearly include certain macroeconomic variables. Hence, the selection of a specific macroeconomic variable as a risk factor should be based on economic theory.

The earlier empirical tests of the APT employed factor analysis technique to determine systematic factors affecting stock returns. Chen, et al. (1986) attempted to specify and use certain macroeconomic factors as proxies for the theoretically undefined state variables in the APT. They concluded that sources of risk from three important macroeconomic factors appeared to be priced in the stock market. Several other empirical studies analyzed the relations between stock returns and macroeconomic variables by interpreting macroeconomic variables as the known risk factors that affect the expected returns.

In finance, the present value of the future cash flows is the main determinant of the firm values. The variables representing real economic activity are likely to change preferences of investors over time and consequently affect the expected rate of asset returns. Since the asset prices reflect expectations of future earnings, the

relationship between real economic activity and stock returns is expected positive (Fama 1981; Geske and Roll 1983; Chen, et al. 1986; Asprem 1989). The relationship between the money supply and stock returns can be examined by the discounted cash-flow model of stock valuation. In that approach, the money supply is positively associated with the level of and growth rate of dividends. On the other hand, the money supply is negatively related to the riskless rate of interest and the risk premium. The money supply influences dividends mainly through the firm's current and expected earnings. A decrease in the money supply causes a rise in interest rates and thus a decrease in capital investments. Therefore, the decrease in expenditures will lead to a reduction in the firm's sales and thereby a decrease in its earnings. As a result, we expect a positive relationship between money supply and stock returns (Homa and Jaffee 1971; Muradoglu et al. 2001; Sorensen 1982).

The fundamental macroeconomic factors generating changes in exchange rates may also influence the stock returns (Asprem, 1989). The depreciation of domestic currency will have a negative effect on the local stock market when a deteriorating domestic economy leads to a change in the exchange rate. On the other hand, the local stock market will benefit from an exchange rate overshooting, resulting in higher stock returns. In this case, international or export oriented firms will benefit directly from the depreciation of domestic currency because the competitive position of these firms will improve. In Turkey, investors consider foreign currencies as one of the main investment alternatives to equities. Thus, we may expect a negative relationship between exchange rate and stock returns due to substitution effects in the specific case of Turkey (Özçam, 1997).

At the empirical level, the relations between stock prices and macroeconomic variables have been analyzed by a large number of studies. Most of the earlier studies attempted to examine these relations within the framework of traditional econometric methods (Fama and Schwert 1977; Fama 1981; Geske and Roll 1983; Chen, et al. 1986). On the other hand, recent studies focused on dynamic models by employing modern time series procedures such as cointegration, Generalized Autoregressive Conditional Heteroscedasticity (GARCH) and Vector Autoregression (VAR) (Bahmani-Oskooee and Sohrabian 1992; Lee 1992; Cochran and Defina 1993; Serletis 1993; Graham 1996; Ajayi and Mougoue 1996; Mukherjee and Naka 1997).

2. THE DEVELOPMENTS IN THE TURKISH STOCK MARKET AND THE OUTLOOK OF THE TURKISH ECONOMY

There are serious problems facing the Turkish stock market. One of the fundamental problems is the absence of institutional and long term investors. Since insurance companies and mutual funds do not invest in the stock market, the activities of speculators cause large price fluctuations. The speculative activities and highly volatile stock prices have led to a widespread mistrust among small savers. In addition, a few big insiders tend to manipulate the stock market. Although the Capital Market Law prohibits insider trading, the law does not clearly specify the activities of insider trading. On the other hand, the stock market has a limited function as a source of financing firms because the family companies are generally unwilling to lose the control of management in their firms (Yüce, 1996).

Before embarking upon an empirical analysis, it may be useful to review the major structural changes in the economic policies of Turkey during the period 1987-2004. The traditional industrialization strategy based on import-substitution and protectionist policies ended with the introduction of an orthodox program of stabilization and structural adjustment in 1980. The program included radical measures to liberalize foreign trade and realize structural reforms in monetary and fiscal policies. The liberalization of the international capital flows and the foreign exchange regime were completed in the early 1990. On the other hand, the policy of continual real depreciation until 1989 encouraged the currency substitution. From the late 1980s onwards, increased public sector borrowing requirements raised the domestic interest rates above foreign rates and attracted capital inflows, which in turn exerted upward pressure on the real exchange rate (Aşıkoğlu and Uçtüm, 1992). However, the liberalization of the capital account without achieving stabilization led to the speculative capital inflows due to high real interest rates.

The Turkish economy experienced large fluctuations in the rate of growth during the 1990s as inflation rates fluctuated at around 65-70 percent during the first part of the decade, and at around 80-90 percent during the second half. On the other hand, the nominal rates of interest reached to the levels of more than 100 percent over the past decade. The Central Bank implemented a controlled peg regime together with a contractionary monetary policy to control inflation. Furthermore, the fragile Turkish financial system with a poorly supervised, weak banking structure suffered from the problems of low capital adequacy and uncovered short-term positions of banks against exchange rate risk (Yeldan, 2001).

With the new policy regime of post-1980, several measures were taken to reduce the role of central bank as the basic source of the deficit finance. Moreover, Turkish government reformed the monetary system in 1986 and 1990 by changing the reserve requirement system and restructuring the balance sheet of the central bank. Since the government's access to the Central Bank resources has been heavily restricted during the post-1980 period, the debt finance has become the major source for financing fiscal deficits. The main motivation behind the shift from monetization to internal debt finance may be explained by the government's desire to avoid the acceleration of inflation through the monetary growth. However, an increasing reliance on domestic debt finance has generated an interest payments explosion due to a large internal debt stock and very short debt maturities (Özmen and Koğar, 1998).

The Turkish economy underwent a severe currency crisis in early 1994. Shortly prior to crisis, there was a sizeable real appreciation of the Turkish Lira. The two alternative views have been expressed by economists in Turkey about the fundamental causes of Turkish currency crisis in 1994. First, some authors suggest that 1994 currency crisis of Turkey resulted from problems related to public debt mismanagement (Özatay, 1996). The alternative view stresses the role of policy mistakes in sequencing of economic liberalization. The external financial liberalization without achieving stabilization limited the ability of policy authorities to use monetary policy instruments such as interest rate and exchange rate, leading to a severe currency crisis (Yeldan, 1996).

On the other hand, the customs union formed between Turkey and the European Union in 1996 further liberalized Turkish foreign trade by removing all trade barriers between the two parties. Thus, 1996 marks a new period in the foreign trade relations of Turkey. After the failure of a series of stabilization attempts through the decade, the Turkish government started a disinflation program in July 1998 under the auspices of the International Monetary Fund (IMF). The main objective of the disinflation program was to reduce fiscal deficits and control the inflation. However, the IMF-supported program failed to accomplish its objectives in the wake of the general elections and two earthquakes.

In December 1999, the Turkish government started to implement an exchange rate-based disinflation program with the supervision and technical support of the IMF. The program entailed exchange rate based disinflation and monetary control by setting the liquidity generation mechanism to the net foreign asset position of the Central Bank. Since the Central Bank practiced a policy of no sterilization, it

acted as a semi-currency board (Yeldan, 2001). In addition, the disinflation program set specific targets for non-interest fiscal surpluses. However, the first post-stabilization crisis came quickly in November 2000. The banks with highly-leveraged positions started to sell government securities, creating a severe liquidity shortage in the domestic economy. International speculative capital fled the country and interest rates reached to very high levels. Only after the IMF granted additional support in December 2000 and the technical limits of the monetary program were revised, the continued implementation of the disinflation program have been secured. However, shortly after this rearrangement with the IMF, the exchange rate-based disinflation program ended in February 2001 as a result of a severe financial crisis.

3. DATA, EMPIRICAL METHODOLOGY AND RESULTS

The data used in this study are comprised of quarterly observations and taken from the Central Bank of Turkey. It includes 3 macroeconomic variables of the Turkish economy and stock returns at the Istanbul Stock Exchange for the period 1987(1)-2004(1). We employed a set of macroeconomic variables such as the \$US/TL exchange rate, real economic activity and money supply.

The Istanbul Stock Exchange index is utilized as a proxy for the stock returns (SR) variable. The exchange rate (E) is represented by \$US/Turkish Lira exchange rate. The money supply (M) is measured by the broad money supply, M2. For the real economic activity (Y), gross national product of Turkey is used.

We have checked the variables for seasonal fluctuations. ISE index, exchange rate and money supply series include no seasonal variations. However, these series contain a trend. It is observed that both seasonal fluctuations and a trend exist in GNP variable. Thus, a seasonally adjusted GNP variable was employed in our empirical estimation. Furthermore, we used the natural logarithms of all the variables in this paper.

The long-run relationship between stock returns and macroeconomic variables selected (exchange rate, money supply and real economic activity) may be written as

$$SP_t = \beta_0 + \beta_1 E_t + \beta_2 M_t + \beta_3 Y_t + u_t \quad (1)$$

where all the variables are in the logarithmic form and u_t is a disturbance term.

In this paper, we employ residual-based cointegration models with regime shifts to examine the relations between stock returns and macroeconomic variables for the case of Turkey. As a prelude to cointegration analysis with regime shifts, we first employed the procedure developed by Perron (1997) to test for endogenously determined structural breaks in the stock returns and macroeconomic time series. Perron (1997) emphasized that the date of the break point should be endogenously estimated. The null hypothesis of a unit-root without an exogenous structural break is tested against the alternative that the series is trend-stationary with a one-time break. The structural break tests developed by Perron (1997) involve the following regression:

$$y_t = \mu + \theta DU_t + \beta t + \alpha y_{t-1} + \Gamma D(TB)_t + \sum_{i=1}^k c_i \Delta y_{t-i} + \varepsilon_t \quad (2)$$

where $DU_t = 1$ if $t > T_B$, 0 otherwise, $D(TB)_t = 1, t = T_B + 1, \dots, T$, 0 otherwise. This model describes Perron's 'Model A' which allows a shift in the mean.

There are two methods to determine the date of structural break endogenously. First, the time of break is selected as the value which minimizes the t-statistic for testing the null hypothesis of a unit-root ($\alpha = 1$). Secondly, the date of structural break is chosen such that the value of $|t_\theta|$ is maximized. We employed the selection procedure suggested by Perron (1989) in determining the value of the lag truncation parameter k . Perron (1997) has tabulated critical values according to asymptotic distribution of the t-statistic.

The standard tests for cointegration are not appropriate in the case of an economic regime change. Hence, Gregory and Hansen (1996) have developed residual-based tests for cointegration which allow for the possibility of structural change. They propose extensions of ADF*, Z_α and Z_t tests for cointegration and derive the asymptotic distributions of these test statistics. The level shift model of Gregory and Hansen (1996) takes the form:

$$Y_{1t} = \mu_1 + \mu_2 \phi_t + \alpha Y_{2t} + e_t \quad t=1, 2, \dots, n \quad (3)$$

where $\phi_t = 1$ ($t > [\tau n]$), $\tau \in (0, 1)$ is an unknown parameter denoting the relative timing of the change point, $1(\cdot)$ is the indicator function, and $[\cdot]$ denotes integer part. The ADF statistic to test the nonstationarity of the residuals in (3) at τ yields Gregory and Hansen's ADF* test:

$$\text{ADF}^* = \inf_{\tau \in T} \text{ADF}(\tau) \quad (4)$$

For each τ , the test statistics for cointegration are calculated. Following the procedure by Gregory and Hansen (1996), we compute the test statistic for each break point in the interval ($[0.15n]$, $[0.85n]$). The test statistic described in (4) provides a tool for analyzing cointegration regressions with a regime shift. We search for the smallest value of the $\text{ADF}(\tau)$ across all possible break points because small values of the test statistic provide evidence against the null hypothesis of no cointegration.

The preliminary step in our empirical analysis is concerned with examining the time series properties of the series. The results of augmented Dickey-Fuller (ADF) tests portrayed in Table 1 indicate that all series are integrated of first order $I(1)$ at the 1% significance level. Table 1 reports the results of Perron (1997) sequential unit-root tests. The evidence based on Table 1 suggest that the unit-root null hypothesis cannot be rejected for any of the variables at the conventional levels. The test statistics for structural break analysis are presented in Table 1 as well. The date of structural break for the Istanbul Stock Exchange index is 2001:1. The break point suggested by $t_\alpha(\text{ADF})$ and $|t_0|$ test statistics is the third quarter of 1993 for the \$US/TL exchange rate. Moreover, the evidence presented in Table 1 suggest that the estimated date of structural break is 2001:3 for the money supply. For the real economic activity variable, the estimated break point is the third quarter of 1994.

Table 1. ADF and sequential unit root tests based on Perron (1997), $k=1$ *

	(1) ADF tests		(2) Sequential unit root tests		
	Levels	First Differences	$T_B^{\S}$	t_{θ}	T_{α} (ADF)
SR	-0.71	-5.22 ^a	2001:1	-3.504	-4.017
E	-0.30	-4.77 ^a	1993:3	-3.090	-3.070
M	-2.95	-10.35 ^a	2001:3	-2.290	-0.690
Y	-1.03	-6.12 ^a	1994:3	-4.056	-4.593

Notes: * k denotes the lag length; ^a: Rejection of the unit root hypothesis at the 1% level; [§] T_B denotes the break date suggested by t_{α} (ADF) and t_{θ} ; The critical values for the 1, 5 and 10 percent significance levels of the t_{α} (ADF) statistic are -5.77, -5.09, and -4.84.

The following estimated static equation gives the result for Engle and Granger (1987) residual-based cointegration test under the assumption of no structural change:

$$SR_t = -2.679 - 0.055 E_t + 0.933 M_t + 0.0263 Y_t \quad (5)$$

$$(-7.57) \quad (-2.05) \quad (4.109) \quad (1.968)$$

$$R^2 = 0.982 \quad ADF = -4.39 \text{ (p: 0.0044)}$$

where the t-statistics are given in parantheses. The ADF test result indicates that the residuals from the cointegration regression are stationary at the 5% significance level, indicating that series in question are cointegrated.

Since the results presented in Table 1 establishes the possibility of regime shifts, the standard tests for cointegration are not appropriate in our case. In fact, the power of the conventional ADF test falls significantly in the presence of a structural change (Gregory and Hansen, 1996). We now proceed to test for cointegration between stock returns and some macroeconomic variables (i.e., exchange rate, money supply, and real economic activity) in the presence of a regime shift by employing Gregory and Hansen's procedure. The results of the sequential ADF* tests reveal that the estimated test statistic is minimum at the first

quarter of 2001 and statistically significant at the 1% level, suggesting a breakpoint. The estimated cointegrating regression in the presence of a structural shift is given by:

$$SR_t = -3.426 - 0.106 E_t + 1.038 M_t + 0.0365 Y_t - 0.789 DU_{2001:1} \quad (6)$$

$$(-10.27) \quad (-2.11) \quad (7.24) \quad (1.999) \quad (-5.12)$$

$$R^2 = 0.987 \quad ADF^* = -4.57 \quad (p: 0.004)$$

where $DU = 1$ ($t > 2001:1$) and t-statistics are given in parantheses.

The null hypothesis of a unit root for the residuals from cointegrating regression can be rejected at the 1% significance level. The residual-based tests for cointegration in the presence of a structural break provide stronger evidence in favor of a cointegration between stock returns and some macroeconomic variables (i.e., exchange rate, money supply and real economic activity) for the specific case of Turkey.

4. CONCLUSION

In this article, we investigated the long-run relationship between stock returns and some macroeconomic factors in the presence of a structural break for the case of the emerging Turkish stock market. In the Turkish economy with significant structural changes in its economic policies and institutions, it is expected that the relationship between stock returns and macroeconomic variables lacks stability in the period under investigation. To consider the stability of our model in relation to structural changes in the Turkish economy, we employed empirical methodologies which allow for the presence of a regime shift. The procedures developed by Gregory and Hansen (1996) and Perron (1997) are employed to test for cointegration and to estimate structural break points.

The empirical analysis based on the data for Turkey indicates that the evidence of cointegration is substantially strong for the variables in our model. More specifically, the empirical findings reveal the existence of a strong long-run relationship between stock returns and some macroeconomic factors (exchange rate, money supply, and real economic activity) for the Turkish stock market during the period 1987-2004. Although all of the macroeconomic factors included

in our model may be considered to be domestic, the inclusion of the exchange rate variable at least partially reflects the effects of foreign risk factors.

The macroeconomic risk factors (i.e., exchange rate, money supply and real economic activity) included in our model play a significant role in determining the stock returns in Turkey. The outcome of cointegration regression suggests that the \$US exchange rate are negatively associated with stock returns as expected. On the other hand, the empirical results indicate that the real economic activity and money supply are positively correlated with the ISE index as economic theory predicts.

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