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THE STOCK MARKET RELATIONSHIP BETWEEN TURKEY AND THE UNITED STATES UNDER UNIONISATION

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ABSTRACT

The main aim of this paper is to investigate the dynamic relationship and volatility spillover between the stock markets in Turkey and the United States under the conditions for Turkey's accession to the European Union. This study uses bivariate cointegration, ECM, CGARCH and threshold cointegration for daily data spanning from 1988 to 2008. The presence of nonlinear error correction terms is evaluated using threshold cointegration. Our empirical findings indicate that (a) there were strong dynamic linkages between the Istanbul Stock Exchange and National Association of Securities Dealers Automated Quotation (NASDAQ) after the Custom Union Agreement between Turkey and the European Union was signed, (b) threshold and negative error correction effects exist during the full sample period and (c) significant volatility spillovers exist from NASDAQ to the Istanbul Stock Exchange for the full sample period.

Keywords: Istanbul stock exchange, NASDAQ, cointegration, CGARCH, threshold cointegration

INTRODUCTION

The process of liberalisation and deregulation in Turkey's financial markets began in 1980. As a result, beginning in mid-1989, Turkey became a financially open economy with a fully exchangeable currency. In terms of capital flow, the Turkish market is more open than that of other European countries. However, attempts to make it accessible and financially liberalised have not yielded significant results. Turkey's financial markets remain extremely volatile and fragile. This may be as a result of political instability and liberalisation efforts that fail to materialise. This unfortunate predicament creates serious challenges for the liberalisation of the financial markets given the unfavourable condition in the global market.

The initial goal of the plans to liberalise Turkey's markets was to develop its markets until they reached the level of developed countries. The Turkish government believed that the most direct and efficient way of achieving economic competitiveness was for Turkey to become a member of the European Union (EU).

The relationship between Turkey and the EU has improved over the past 15 years despite frustrations on both sides, and the beginning of negotiations regarding Turkey's accession into the EU constitutes a new reality. It is expected that this move will have a positive effect on the Turkish financial systems and will encourage democracy. The EU's expectations regarding Turkey in the economic, political and educational sense are instrumental to its goals. The relationship between Turkey and the EU is simultaneously unilateral and multilateral. It is not difficult to estimate that Turkey's membership will influence not only Turkey and the EU member countries but also the Muslim countries and neighbouring countries as well as central Asia.

Turkey, as a Muslim country (99% of the population is Muslim), creates a bridge between Asia, the Middle East, Russia and Europe, and as a result of its historical affluence, it enjoys good relations with a large number of countries from every continent. Hence, Turkey's accession into the EU will have a great deal of importance. It is the view of many that Turkey's accession into the EU will have a positive impact on the world economy and hopefully foster peace in the region.

This study investigates the co-movements between the Turkish and American stock markets in the context of the EU accession period for Turkey. We explore these co-movements because the findings are important for Turkish policy-makers and international portfolio investors. Portfolio investors often shift their investments from one country to another based on the available information. To minimise risk, they always search for diversified markets. Risk minimisation can be achieved through these shifts. If there are significant linkages or co-movements between two markets during certain periods of time, the investors seek other diversified markets. Turkish policy-makers should also use the findings of this study to obtain benefits from these linkages. They are responsible for taking the necessary precautions that will allow Turkish financial markets to develop healthily, especially in an era of global financial crises.

We choose National Association of Securities Dealers Automated Quotation (NASDAQ) system as a proxy for the US stock market and the Istanbul Stock Exchange (ISE) as a proxy for the Turkey stock market. To minimise the effect of US financial crises on our model, we chose the NASDAQ-100 index, which include one hundred stocks from the largest American and international non-financial companies based on market capitalisation.[1] Based on strict listing criteria for NASDAQ-100, there is excellent liquidity between stocks. Since its establishment in 1986, the ISE has seen fast growth in trading volume, market capitalisation, the number of listed corporations and foreign investments. It has surpassed several European stock exchanges in terms of monthly turnover velocity.

The sample period is divided into four sub-periods according to Turkey-EU relations. We can thereby explore possible changes in the linkages resulting from Turkey's attempt at accession and show evidence that Turkey's accession period and pending EU membership does not affect Turkey-US stock market relationships.

The remainder of this paper is organised as follows. The next section discusses the previous studies, followed by sample data and the methodology used in the study. Empirical analyses and findings are presented in the subsequent section. The papers ends with concluding remarks and a summary of the findings.

LITERATURE REVIEW

Most of the studies in the literature emphasise the leading role of the US in the world stock market. Among them, Eun and Shim (1989), Arshanapali, Doukas and Lang (1995), Hassan and Naka (1996), Wu and Su (1998), Bessler and Yang (2003), Cumperayot, Keijzer and Kouwenberg (2006), Ozdemir and Cakan (2007), and, Abu Hassan and Ergun (2009) all find results indicating the leading role of US in the dynamic linkages of the world stock markets, but Janor, Ali, and Shaharudin (2007) report the increasing influence of Japan relative to US on the ASEAN market. Ibrahim (2006) on the other hand finds no cointegration between Indonesia and other ASEAN markets (Malaysia, the Philippines, Singapore and Thailand) and two advanced markets, the US and Japan.

In the European region, the linkages between developed European stock markets are strong, but the connections among emerging markets are weak. Verchenko (2000) proves that the lack of cointegration among the Eastern

[1] www.nasdaq.com

European stock markets creates significant opportunities for diversification. Brada and Kutan (2001) find that real cointegration for the candidates is much lower than it was for recent EU member countries. Syriopoulos (2004) presents evidence that the Czech Republic, Hungary, Poland, Slovakia, Germany and US stock markets are co-integrated. Floros (2005) presents evidence that Central European markets are co-integrated. Syriopoulos (2007) finds evidence of one cointegration vector in both a pre- and s post-EMU sub-period, which indicates market co-movement towards a stationary long-term equilibrium between major emerging Central European (Poland, Czech Republic, Hungary, Slovakia) and developed (Germany, US) stock markets.

Emerging Central European states have recently joined the EU, and this move may cause the local stock markets to become less immunised to external shocks. Fratzscher (2002) finds that the European equity markets have become highly integrated since 1996 and that the integration of European equity markets can be largely explained by the drive towards EMU. Bartram, Taylor and Wang (2007) study market linkages and the impact of the introduction of the Euro on the relationship of dependence between 17 stock markets; they find that market dependence increased only for large equity markets. Structural break tests indicate that the increase in financial market dependence began around the beginning of 1998, when Euro membership was determined and the relevant information was announced.

According to Alper and Yilmaz (2004), there is a clear evidence of volatility contagion from the financial centres to the ISE. This was a special issue in the aftermath of the Asian crisis. Darrat and Benkato (2003) find that there exists a significant cointegrating relationship binding the ISE with the four matured markets (US, UK, Japan and Germany). The US and UK stock markets are particular sources of volatility spillovers for the ISE. Erdal and Gunduz (2001) investigate to what extent the ISE is integrated regionally and globally. They find that there is no cointegration among the equity markets in Turkey, Egypt, Israel, Jordan and Morocco. However, there exists a strong cointegration relationship binding the ISE with seven matured markets. Furthermore, it is found that the US and Japanese markets have a greater influence on Turkey than on the other emerging markets. There is no lead-lag relationship between the ISE and other developed and emerging markets. Onay (2006) finds the long-term financial integration of second-round acceding and candidate countries with the European Union and the US stock markets during the Accession Process. Ogawa and Shimizu (2004) find linkages between Turkish lira and both the EURO and the US dollar existed since the 4th quarter of 2003.

Berumen and Ince's (2005) assesses the effect of S&P 500 returns on the ISE for the period between 1987 and 2004 and find that the Turkish stock exchange is affected by both its own dynamics and the US stock exchange. In summary, based on the very limited studies available, we can conclude that Turkey's stock market has a close relationship with developed international stock markets, especially the US stock market. In addition to that, there is also significant volatility spillover between them.

DATA AND METHODOLOGY

Data

Our data, which is obtained from Datastream, includes daily observations for the stock market indices for the Istanbul Stock Exchange and NASDAQ. We divide the sample period into four sub-periods as follows: 4 January 1988 to 1 January 1996 (a custom union entered into force at the Luxembourg summit); 1 January 1996 to 1 December 1999 (the EU leaders decided to grant Turkey candidate country status in Helsinki); 1 December 1999 to 3 October 2005 (Official entry talks were launched); 3 October 2005 to 1 June 2008.

Stationarity Test

Unit root tests from Augmented Dickey Fuller (ADF) (Dickey & Fuller, 1981) and Phillips-Perron (PP) (Phillips & Perron, 1988) techniques are applied to each series to determine their order of integration.

Cointegration Tests

Bivariate cointegration analysis

The Engle-Granger bivariate cointegration test is performed on the time series that are found to be nonstationary and integrated of the same order. The long-run equilibrium relationship is estimated via ordinary least squares. Then the unit root test is applied to the residual obtained from the regression.

To obtain the residual, the following regression models are estimated:

$$x_t = \beta_0 + \beta_1 y_t + e_{x,t} \tag{1}$$

$$y_t = \beta_0 + \beta_1 x_t + e_{y,t} \tag{2}$$

The unit root test applied to the residual using the ADF test is as follows;

$$\Delta\hat{e}_t = a_1\hat{e}_{t-1} + \sum_{i=1}^{k} a_{i+1}\Delta\hat{e}_{t-1} + \varepsilon_t \tag{3}$$

The null hypothesis of $H_{0:}$ $a_1 = 0$ is used to test the stationary of the estimated residuals from both equations (1) and (2). The value of optimal lag length k is selected using the Akaike Information Criterion (AIC). Because the residual series is calculated using a long-run equilibrium equation, an intercept or time trend is omitted from the equation (Enders, 1995). The test statistics obtained are then compared against the table generated by MacKinnon (1991).

Error correction model

Once it is established that the series are cointegrated, their dynamic structure can be exploited for further investigation. Engle and Granger (1987) show that cointegration implies and is implied by the existence of an error correction representation of the indices involved. An error correction model (ECM) abstracts the short- and long-run information in the modelling process. The ECM to be estimated is given by

$$\Delta x_t = \beta_1 + \sum_{i=1}^{n_1} \beta_{11}(i)\Delta x_{t-i} + \sum_{j=1}^{n_2} \beta_{12}(j)\Delta y_{t-j} + \beta_s(\varepsilon_{t-1}) + \eta_t \tag{4}$$

$$\Delta y_t = \beta_2 + \sum_{i=1}^{n_3} \beta_{21}(i)\Delta x_{t-i} + \sum_{j=1}^{n_4} \beta_{22}(j)\Delta x_{t-j} + \beta_f(\varepsilon_{t-1}) + \eta_t \tag{5}$$

$\varepsilon_{t-1} = n \times t$ vectors of error correction terms representing the previous period's disequilibrium ($y_{t-1} - a_1 x_{t-1}$) and $\eta_t = n \times t$ vectors of residuals.

Engle and Granger (1987) propose a two-step estimation procedure for estimating the parameters of the model. The parameters in equations (4) and (5) are estimated using OLS. The error correction model is expected to provide better forecasts than can be obtained from a native model.

We use AIC to determine the optimal lag length. The traditional test statistics (t-test and F-test) for the VAR analysis are employed to test all of the parameters. The short-run dynamics relationship between the stock prices is captured by the coefficients of β_{12} and β_{21}. The existence of a long-run relationship between the two financial variables is established based on statistically significant figures for one or both of the speed of adjustment coefficients: i.e. β_s and β_f.

Threshold cointegration

We use the rolling threshold cointegration technique introduced by Balke and Fomby (1997). This procedure enables us to estimate the dynamics of estimated thresholds and provides an idea of how the long-term relationships among the financial markets converge over time.

The adjustment towards the long-run equilibrium is said to be asymmetrical if it depends on the sign of the shocks. Consequently, the test for cointegration using the standard procedure is misspecified (Balke & Fomby, 1997). To overcome this problem, Enders and Granger (1998) replace the standard ADF auxiliary regression with the following threshold autoregression (TAR) process:

$$\Delta\hat{\varepsilon}_t = I_t r_1 \hat{\varepsilon}_{t-1} + (1 - I_t) r_2 \hat{\varepsilon}_{t-1} + \nu_t \tag{6}$$

where $\hat{\varepsilon}_t$ are the residuals obtained from the long-run regression using equations (1) and (2) and r_1 and r_2 are the speeds of adjustment. The indicator function I_t depends on the lagged values of the residuals according to the following scheme:

$$I_t = \begin{Bmatrix} 1 & if & \hat{\varepsilon}_{t-1} > 0 \\ 0 & if & \hat{\varepsilon}_{t-1} \le 0 \end{Bmatrix} \tag{7}$$

or on the lagged changes in $\hat{\varepsilon}_t$:

$$I_t = \begin{Bmatrix} 1 & if & \Delta\hat{\varepsilon}_{t-1} > 0 \\ 0 & if & \Delta\hat{\varepsilon}_{t-1} \le 0 \end{Bmatrix} \tag{8}$$

The TAR model in equation (6) is referred to as TAR cointegration, whereas the indicator functions in (7) and (8) are called "momentum" TAR (or M-TAR) cointegration. The TAR model is designed to capture potential asymmetric "deep" movements in the residuals, whereas the M-TAR model helps us to take into account the sharp or "steep" variations in $\hat{\varepsilon}_t$ (Enders & Granger, 1998).

The test used to determine the presence of a threshold in the error correction mechanism is termed the threshold cointegration test. If the coefficients r_1 and r_2 in equation (6) are equal, then the adjustment is symmetric; thus, the Engle-Granger approach emerges as a special manifestation of equations (6) and (7). If the errors are serially correlated, equation (6) can be supplemented with the lagged differences for $\hat{\varepsilon}_t$ as in the standard ADF test:

$$\Delta\hat{\varepsilon}_t = I_t r_1 \hat{\varepsilon}_{t-1} + (1 - I_t) r_2 \hat{\varepsilon}_{t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta\hat{\varepsilon}_{t-1} + \nu_t \quad (9)$$

Therefore, the hypothesis for symmetric adjustment (i.e., $r_1 = r_2$) can be tested using the standard F-test. The corresponding asymmetric error correction can be written as follows:

$$\Delta x_{1t} = \alpha_{up} \hat{\varepsilon}_{t-1}^{up} + \alpha_{down} \hat{\varepsilon}_{t-1}^{down} + \sum_{1=0}^{p} \gamma_i \Delta x_{2t-i} + \ldots + \sum_{1=0}^{p} \delta_i \Delta x_{mt-i} + \sum_{i=1}^{p} \lambda_i \Delta x_{1t-i} + \xi_t \quad (10)$$

where $\hat{\varepsilon}_{t-1}^{up} = I_t \hat{\varepsilon}_{t-1}$ and $\hat{\varepsilon}_{t-1}^{down} = (1 - I_t)\hat{\varepsilon}_{t-1}$.

CGARCH

We estimate conditional volatility using the component GARCH (CGARCH) model of Engle and Lee (1999). The mean and variance equations are given by equations (11) and (12), respectively.

$$\Delta S_t = \varphi_1 + \sum_{i=1}^{m} \varphi_{5,i} \Delta S_{t-i} + \varepsilon_t \quad (11)$$

where S_t is return, and

$$\sigma_t^2 - q_t = \bar{\omega} + \alpha.(\varepsilon_{t-1}^2 - \bar{\omega}) + \beta(\sigma_{t-1}^2 - \bar{\omega}) \quad (12)$$

The CGARCH model distinguishes between short-term (transitory) and long-term (permanent) conditional volatility. Unlike in standard GARCH model with only one component of conditional volatility, long-term volatility (q_t) is allowed to vary over time, to which the short-term volatility or the transitory component of long-term volatility $(\sigma_t^2 - q_t)$ is mean-reverts as shown in equation (13) below.

$$q_t = \omega + \rho.(q_{t-1} - \omega) + \delta(\varepsilon_{t-1}^2 - \sigma_{t-1}^2) \quad (13)$$

The CGARCH model makes it possible to model separately the effect of spillovers on stock return volatility in the short and long run. We select the optimal lag length of the mean equation using the Schwarz Information Criterion (SIC).

EMPIRICAL RESULTS

Stationarity Test

In the first step, ADF and PP stationary tests are used to determine the order of integration of the variables. The test results based on the four sub-periods and the full sample analysis are reported in Table 1. The series of ISE and NASDAQ are nonstationary in level but stationary in first differences at the 1% level of significance in all periods under study.

Table 1
Unit Root Test

	Levels		First Differences	
	ADF	PP	ADF	PP
First Sub-Period				
Turkey	–1.5418	–1.5574	–9.6861*	–41.8153*
US	–1.4607	–1.7477	–9.8046*	–43.2838*
Second Sub-Period				
Turkey	–0.5687	–0.3605	–15.1855*	–29.5951*
US	–0.3798	–0.5146	–7.2738*	–34.8835*
Third Sub-Period				
Turkey	–0.6121	–0.5969	–38.1833*	–38.1741*
US	–1.3399	–1.2091	–8.4716*	–42.5742*
Forth Sub-Period				
Turkey	–1.9933	–2.0463	–21.5723*	–21.5708*
US	–2.0722	–2.0435	–16.6942*	–21.9062*
Whole Period				
Turkey	–0.5081	–0.6822	–13.2862*	–69.9508*
US	–1.9879	–1.7463	–10.2757*	–76.8414*

Note: *t*-values are reported in the table.
* indicates significant at 1%.

Cointegration Tests

In this section, we use the Engle-Granger bivariate cointegration test, the error correction model (ECM) and the threshold cointegration test for the return series for the Istanbul Stock Exchange and NASDAQ.

Engle-Granger bivariate cointegration

The empirical results of the Engle-Granger bivariate cointegration test are summarised in Table 2. The results indicate that the Istanbul Stock Exchange has a significant long-term relationship with NASDAQ in the first, second and fourth sub-periods.

Error correction model

The deviations from the long-term equilibrium are detected using ECM methodology. When the coefficient of the lagged residual term is negative, then the system is converging to long run equilibrium. The second step in the Engle-Granger procedure shows the existence of an error correction mechanism given that the coefficient of the lagged residual terms is negative. The coefficient of the NASDAQ stock indices has a positive impact on the ISE indices. The impact is strong at the 1% level of significance. The ECM test results, as summarised in Table 2, indicate that the ISE has strong dynamic linkages with NASDAQ in all periods studied except for the first sub-period.

Table 2
Engle-Granger Cointegration Test and ECM

	Significance Levels				
	Sub Period 1 %	Sub Period 2 %	Sub Period 3 %	Sub Period 4 %	Whole period (%)
Cointegration	5	5		1	
EMC		1	1	1	1

Note: Percentages in table show significance levels

Threshold cointegration test result

The threshold cointegration test results are further illustrated in Figure 1. The results show the error-correction for both long-term regression [ISE=f(NASDAQ) and NASDAQ=f(ISE)] relationships. The findings of the threshold cointegration test show the existence of a threshold in the long-term relationship of the former. The results indicate that there is strong positive error correction effect for the ISE and a weak error correction effect for NASDAQ on the left-hand side of the estimated threshold point. Furthermore, an error correction effect of almost zero for NASDAQ and a strong negative error correction effect for the ISE on the right-hand side of the threshold point are detected.

Hence, this study shows that using the threshold cointegration test, we obtain better results regarding the dynamic linkages between the Turkish and US stock markets. The empirical results indicate that the signing of the agreement with the EU has had a great impact on the US-Turkey relationship.

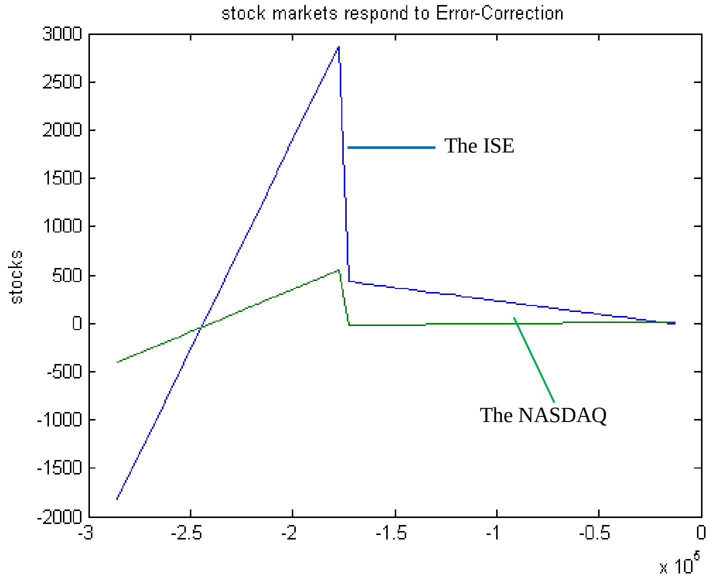

Figure 1. Response of the ISE and NASDAQ to Error Correction.

Volatility Spillover

The bivariate Engle-Granger causality test is used in the framework of vector autoregressive (VAR) model to process the estimated volatility obtained from the CGARCH (1,1) model. The empirical results shown in Table 3 indicate the presence of significant volatility spillover from US to Turkey in the second sub-period, fourth sub-period and full sample period. Moreover, there is bidirectional (feedback) spillover in the second and fourth sub-periods. In general, there is volatility spillover from the US stock market to the Turkish stock market in the period under study.

Table 3
Volatility Spillover for US-TURKEY Stock Markets Using VAR(2)

	F values				
	Sub Period 1	Sub Period 2	Sub Period 3	Sub Period 4	Whole period
US → Turkey	2.80213	9.04382*	0.40523	22.8698*	6.02021*
Turkey → US	22.5103*	5.71353*	0.57339	6.0924*	0.31373

Note: The reported *F*-statistics are the Wald statistics for the joint hypothesis; $\beta_1 = \beta_2 = \ldots = \beta_l = 0$.
* denotes the statistical significance of causal links at the 0.05 level or smaller.

CONCLUSION

The dynamic relationship and volatility spillover between the Turkish and American stock markets in the context of Turkey's accession into the European Union are investigated using bivariate cointegration, ECM, CGARCH and threshold cointegration. The empirical results indicate that (a) there have been strong dynamic linkages between the ISE and NASDAQ since the Custom Union Agreement was signed between Turkey and the European Union, (b) threshold and negative error correction effects are detected for the full sample period and (c) significant volatility spillovers are observed from NASDAQ to the ISE for the full sample period. Policy-makers and portfolio investors could benefit from these findings in making short-term and long-term investment decisions. Turkey's stock market had a strong relationship with the US stock market in the full sample period. The sub-period analyses show that this relationship has remained consistent and has not been irresponsive to the accession negotiations with EU. The lack of dynamic linkages and volatility spillovers in the third sub-period is probably linked to some extent with the September 11th attack.

This study provides a significant contribution to the literature by elucidating on some of the major concerns regarding the Turkey-US stock market relationship under unionisation and during the period of EU accession. It is hoped that the findings from this study can provide input to policy-makers and portfolio investors hoping to achieve healthy economic development. On the global market, Turkey is neither fully integrated nor fully isolated. The ISE is one of the less risky places for international portfolio investors who have suffered financial turmoil in the EU member countries in recent years.

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