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**TEMPORAL CAUSALITY BETWEEN ECONOMIC GROWTH AND STOCK
MARKET DEVELOPMENT IN TURKEY: AN ARDL BOUNDS TESTING
APPROACH**

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ABSTRACT

This paper aims to investigate the causal relationship between stock market development and per capita economic growth. Using the ARDL approach to cointegration, we find evidence of long-run bi-directional causality between per capita economic growth and stock market development.

Keywords: Stock Market, Economic Growth, Causality, Turkey

1. INTRODUCTION

Mishkin (2001) show that well-developed stock markets prompt savings and efficiently allocate capital to productive investments that lead to an increase in the rate of economic growth. Stock markets contribute to the mobilization of domestic savings (Caporale *et al.*, 2004: 33-50). Stock markets are best indicators to forecast future economic activity and describe actual casual effect between future economic growth and stock prices. The link between financial development and growth stems from the insights of endogenous growth models, in which growth is self-sustaining and influenced by initial conditions. In this framework, the stock market is shown to not only have level effects, but also rate effects (e.g. Levine, 1991: 1445-1465). Greenwood and Smith (1996) show that stock markets lower the cost of mobilizing savings, facilitating investments into the most productive technologies. Obstfeld (1994) shows that international risk sharing through internationally integrated stock markets improves resource allocation and accelerates growth. Bencivenga *et al.* (1996) and Levine (1991) have argued that stock market liquidity, i.e. the ability to trade equity easily, plays a key role in economic growth.

The aim of this paper is to use the Autoregressive Distributed Lag (ARDL) approach to cointegration and error correction models (ECM), to determine whether there is any evidence of causality between per capita economic growth and stock market development in the long and short run. Using Granger causality testing within a multivariate cointegration and error-correction framework we find evidence of bi-directional causality between economic growth and stock market development. Following the introduction we discuss the ARDL approach to cointegration, and then present some results, finishing with the conclusions and policy implications.

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2. ECONOMETRIC METHODOLOGY

The ARDL approach to cointegration (see Pesaran *et al.*, 2001: 289-326) involves estimating the conditional error correction version of the ARDL models for per capita GDP and stock market development:

$$\Delta \ln Y_t = \alpha_0 + \sum_{i=1}^p \alpha_i \Delta \ln Y_{t-i} + \sum_{i=1}^p \alpha_i \Delta \ln MC_{t-i} + \sigma_1 \ln Y_{t-1} + \sigma_2 \ln MC_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta \ln MC_t = \alpha_0 + \sum_{i=1}^p \alpha_i \Delta \ln MC_{t-i} + \sum_{i=1}^p \alpha_i \ln Y_{t-i} + \sigma_1 \ln MC_{t-1} + \sigma_2 \ln Y_{t-1} + \varepsilon_{2t} \quad (2)$$

where Δ is the first difference operator, $\ln Y$ is the log of per capita real GDP and $\ln MC$ is the log of market capitalization that is used as a proxy for stock market development. We then ‘bounds test’ for the presence of a long-run relationship between per capita GDP and stock market development using a bounds F -statistics. The F test is used to determine whether a long-run relationship exists between the variables through testing the significance of the lagged levels of variables. The F test has a non-standard distribution. Pesaran *et al.* (2001) report two sets of critical values, which provide critical value bounds for all classifications of the regressors into purely $I(1)$, purely $I(0)$ or mutually cointegrated. If the computed F -statistics falls outside the critical bounds, a conclusive decision can be made regarding cointegration without knowing the order of cointegration of the regressors. If the estimated F -statistic is higher than the upper bound of the critical values then the null hypothesis of no cointegration is rejected. Alternatively, if the estimated F statistic is lower than the lower bound of critical values, the null hypothesis of no cointegration cannot be rejected.

The conditional long-run model can then be produced from the reduced form solution of Eqs. (1) and (2), when the first-differenced variables jointly equal zero. The long-run coefficients and error correction model are estimated by the ARDL approach to cointegration, where the conditional ECM in Eqs. (1) and (2) are estimated using unrestricted vector error correction model (UECM) and then the Schwarz–Bayesian criteria (SBC) is used to select the optimal lag structure for the ARDL specification of the short-run dynamics. The UECM is then used to conduct standard Granger-type multivariate causality tests augmented with a lagged error-correction term where the series are cointegrated.

3. EMPIRICAL RESULTS

The data is annual and spans the time period 1986 to 2007. Since the Istanbul Stock Exchange (ISE) was established in 1986, estimation begins in 1986. Real (GDP) per capita (Y_t) is used as a proxy for economic growth (basis 1987). To maximize the use of information extracted from the data, we use a disaggregated measure of stock market development as opposed to a composite measure that is used in many recent empirical studies. Although theory does not provide us with a foundation for any unique indicator of stock market development, it does suggest that stock market size, liquidity, and integration with the world capital markets may affect economic growth (Demirguc-Kunt and Levine, 1996). Stock market development is measured by market capitalization over GDP. Market capitalization ratio (MC) equals the value of listed shares divided by GDP. The assumption behind this measure is that overall market size is positively correlated with the ability to mobilize capital and diversify risk on an economy-wide basis. Real per capita GDP was

obtained from *TURKSTAT, Statistical Indicators, 1923-2006*. The stock market data is from the website of ISE. All variables are in logarithms.

To determine the optimal number of lags to be included in the conditional ECM, we used the SBC, whilst ensuring there was no evidence of serial correlation, as emphasized by Pesaran *et al.* (2001). As we use annual data, all tests include a minimum of two lags and maximum of four to ensure lagged explanatory variables are present in the ECM, according to Gonzalo (1994), the costs of over-parameterization in terms of efficiency loss is marginal. We then obtained the relevant F -statistics as described above. The results are contained in Table 1. From these results, it is clear that there is a long-run relationship between the variables when Y and MC are the explanatory variables because the calculated F -statistics are higher than the upper bound critical values at the 10% and 1% significance level, respectively. Evidence of cointegration relationships between the variables in Eqs. (1) and (2) also rule out the possibility of estimated relationship being 'spurious'.

Table 1. F -statistics for cointegration relationship

| k | Critical value bounds of the F -statistic | | | | | |
|---|---|--------|-----------|--------|-----------|--------|
| | 90% level | | 95% level | | 99% level | |
| | $I(0)$ | $I(1)$ | $I(0)$ | $I(1)$ | $I(0)$ | $I(1)$ |
| I | 4.04 | 4.78 | 4.94 | 5.73 | 6.84 | 7.84 |
| Calculated F-statistics | | | | | | |
| $F_Y(Y_t/MC_t) = 5.5236^{**}$ | | | | | | |
| $F_{MC}(MC_t/Y_t) = 16.3884^*$ | | | | | | |

Notes: Critical values are obtained from Pesaran *et al.* (2001). k denotes the number of regressors.

* Significance at the 1% level.

** Significance at the 10% level.

Given that the bounds test suggest that $[Y_t, MC_t]$ are cointegrated in Eqs. (1) and (2), we augment the Granger-type causality test with lagged error-correction terms. Thus, the Granger causality test involves specifying a multivariate p th order VECM as follows:

$$\begin{bmatrix} \Delta \ln Y_t \\ \Delta \ln MC_t \end{bmatrix} = \begin{bmatrix} \sigma_1 \\ \sigma_2 \end{bmatrix} + \sum_{i=1}^p \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} \Delta \ln Y_{t-i} \\ \Delta \ln MC_{t-i} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} [ECT_{t-1}] + \begin{bmatrix} v_{1t} \\ v_{2t} \end{bmatrix} \quad (3)$$

In addition to the variables defined above, Δ is the lag operator, ECT_{t-1} is the lagged error-correction term derived from the long-run cointegrating relationships, and v_{1t} and v_{2t} are serially independent random errors with mean zero and finite covariance matrix. In each case the dependent variable is regressed against the past values of itself and other variables. The optimal lag length p is based on the SBC. The existence of a cointegrating relationship between $[Y_t, MC_t]$ suggests that there must be Granger causality in at least one direction, but it does not indicate the direction of temporal causality between the variables. We examine both short-run and long-run Granger causality. Table 2 summarizes the results of the long-run and short-run Granger causality. The short-run causal effects can be obtained by the F -statistics of the lagged explanatory variables in each of the two equations, while the t -statistics on the coefficients of the lagged error-correction terms indicate the significance of the long-run causal effect.

Table 2. Results of Granger Causality

| Dependent Variable | $\Delta \ln Y_t$ | $\Delta \ln MC_t$ | ECT_{t-1} [t-stat.] |
|--------------------|------------------|-------------------|-----------------------|
| $\Delta \ln Y_t$ | — | 2.3639 (.133) | -0.9363* [-3.3874] |
| $\Delta \ln MC_t$ | 0.5616 (.652) | — | -0.7059* [-3.2600] |

Notes: * refers statistical significance at 1% level and, ** refers statistical significance at 5% level. The probability values are in brackets. t -ratio of ECT_{t-1} is in square bracket.

For both of the equations the coefficients on the error correction terms are highly significant and measure the speed of adjustment to obtain equilibrium in the event of shock(s) to the system. The result suggests that changes in real per capita GDP and/or market capitalization are a function of disequilibrium in the cointegrating relationship. However, none of the lagged differences of the variables are significant, indicating no evidence of any short-run causality, this is not surprising given the usual assumption that economic growth interacts with other macroeconomic factors in the long run rather than the short run.

4. CONCLUSIONS

This paper has investigated the nature of the relationship between per capita economic growth and stock market development, finding evidence to support the long-run bi-directional causality running from per capita GDP to stock market development and vice versa. Evidently, stock market development is an important wheel for economic growth in Turkey. The results have certain policy implications for Turkey. The study has strongly contradicted the assumption that Istanbul Stock Exchange is not a vehicle of economic growth. Earlier, little attention has been made to understand the stock market link with the overall growth of the economy because of the shallow financial sector, in particular, the stock market in Turkey. The results have also shown the positive effect of financial liberalization on stock market development and hence the growth of economy. Since the outset of 1980s, the country has witnessed much needed financial liberalization that improves the efficiency of the financial system dramatically. The analysis of the results indicates that in the long-run economic growth in Turkey is strongly influenced from financial liberalization policies of respective governments. There exists significant and positive contribution of stock market in the overall growth of the economy for the period under consideration. The causality runs both ways for long-run relationship between stock market development and economic growth. Finally, the existence of causal nexus between stock market development and economic growth evidently proves the hypothesis that stock market development does matter for growth, in particular, in the early stages of economic development (Gregorio and Guidotti, 1995).

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