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International Journal of Economic Perspectives

Volume 4 Issue 4 2010 ISSN:1307-1637

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2010 4

www.econ-society.org

ISSN: 1307 – 1637

Volume **4** Issue **4** 2010

International Journal
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ECONOMIC PERSPECTIVES

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International Journal of Economic Perspectives

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ISSN: 1307 – 1637

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Ural Sokak, No: 7, Çanakkale Mahallesi,
Famagusta / North Cyprus
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International Journal of
Economic Perspectives

ISSN: 1307 – 1637

Volume **4** Issue **4**
2010

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International Economic Society Publishing Group

http://www.econ-society.org

International Journal of Economic Perspectives, 2010, Volume 4, Issue 4, 601-610.

The Causal Relationship between Stock Prices and Macroeconomic Variables: A Case Study for Turkey

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ABSTRACT

This study examines the causal relationships between stock prices and macroeconomic variables in Turkey, by applying the techniques of the long-run Granger non-causality test recently proposed by Toda and Yamamoto (1995). We test the causal relationships between the ISE-100 Index (Istanbul Stock Exchange-100) and the five macroeconomic variables: foreign exchange rate, gold price, broad money supply, industrial production index and consumer price index using monthly data for the period March 2001 to June 2010. The results suggest that there is a unidirectional long-run causality from stock price to macro variables for Turkey. This implies that the stock market can be used as a leading indicator for future growth in foreign exchange rate, gold price, money supply, index of industrial production and rate of inflation in Turkey.

JEL Classification: C32; F41; F43.

Key Words: Stock Prices; Macroeconomic Variables; Granger Causality; ISE-100.

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1. INTRODUCTION

The key function of stock market is to act as a mediator between savers and borrowers. It mobilizes savings from a large pool of small savers and canalizes these funds into fruitful investments. The preferences of the lenders and borrowers are harmonized through stock market operation. The stock market also supports reallocation of funds among corporations and sectors. It also provides liquidity for domestic expansion and credit growth (Sohail and Hussain, 2009: 183). The stock market has been historically viewed as a reliable instrument to indicate economic processes (Plinkus, 2009: 884). Therefore stock market determinants are vital.

The Istanbul Stock Exchange (ISE henceforth) was established on December 26, 1985 for the purpose of ensuring that securities are traded in a secure and stable environment, and commenced to operate on January 3, 1986. The ISE has contributed to the development of Turkish capital markets and Turkish economy since the date of its establishment. The ISE is a public legal entity which independently uses the powers independently under its own responsibility and is supervised and monitored by the Capital Markets Board (http://www.ise.org, 01.05.2010). Stock exchange markets in emerging countries are generally characterized as unstable and shallow. These two features lead to the fact that macroeconomic dynamics still have the potential to play a very important role on stock market performances. The ISE is no exception in this context. (Erdoğan and Özlale, 2005: 69). Also the movements in the stock prices are an important indicator of the economy. In financial economics, a number of studies have focused on relations among stock returns and macroeconomic variables. The stock market is taken as endogenous, and an important objective has been to reveal which systematic forces are

most important (Gjerde and Sættem, 1999: 61). Stock market plays an important role in the economic development of a country. A number of studies have been investigated on the causal relationship between macro-economic variables and stock prices. The focus in now being extended towards the analysis of stock markets of developing economies, due to their enormous profit potentials. This study provides similar evidence for Turkey.

Efficient market hypothesis states that stock exchange prices always reflect the fundamental macroeconomic indicators (Fama, 1990). Economic theory suggests that stock prices should reflect expectations about future corporate performance, and corporate profits generally reflect the level of economic activities. If stock prices accurately reflect the underlying fundamentals, then the stock prices should be employed as leading indicators of future economic activities, and not the other way around. Therefore, the causal relations and dynamic interactions among macroeconomic variables and stock prices are important in the formulation of the nation's macroeconomic policy (Maysami, 2004: 48). Risk management is the process of measuring, or assessing risk and then developing strategies to manage the risk while attempting to maximize prices. For this reason, causal relationships between financial elements should be determined by holistic risk management practices. The search for the causal relationships and interactions among macroeconomic variables and stock prices are important to the implementation of risk management systemically. Determination of both causal relationships and the interactions among them are useful to the minimization of the financial market risks (Imran et al., 2010: 313).

Which macroeconomic factor is more responsible for stock price has remained an issue of debate? The primary objective of this study is to estimate the long run relationship between macroeconomic factor and stock prices in Turkey for the period from March 2001 to June 2010. Also there was a need to study the behavior of stock market and determine the economic factors for policy recommendations that could safeguard the investors of stock markets. To achieve this objectives the paper is structured as follows; following this brief introduction is section two which is concerned with review of related literature, section three deals with data and methodology of the study, section four is concerned with empirical results while section five concludes the study.

2. LITERATURE REVIEW

The relationship between stock markets and macroeconomic forces has been widely debated in the finance and macroeconomic literature. Therefore a vast literature exists on stock price determination. Over the past few decades, determining the effects of macroeconomic variables on stock prices and investment decisions has preoccupied the minds of economists since they both they both play important roles in influencing the development of a country's economy. So that numerous empirical studies have been undertaken to determine what the main factors that drive stock prices are.

Hamburger and Kochin (1972) found that past increases in money lead to increases in equity prices. Aggarwal (1981) examines the influence of exchange rate changes on U.S. stock prices using monthly data for the floating rate period from 1974 to 1978. He finds that stock prices and exchange rates are positively correlated. Fama (1981) claimed that it is merely a proxy for a more fundamental relationship between anticipated real activity and stock returns. Fama gave an explanation for this negative relationship with two propositions that links real stock return and inflation through real output. First, there is a negative relationship between inflation and real output. Second there is a positive relationship between real output and real stock return. Also Fama showed that there was strong relationship between stock prices and gross national product. Schwert (1981) reports a slow adjustment of share prices to new information on inflation measured by the monthly Consumer Price Index. Geske and Roll (1983) find conflicting views of the relation between stock prices and inflation. Soenen and Hennigar (1988) find negative correlation between exchange rates and stock prices. Famma (1990) suggests that macroeconomic variables have projecting power for the stock exchange performance, although they do not consent to the anticipating authority of stock performance for the economy. Boyle (1990) proposed that changes in uncertainty of money supply will affect prices of financial instruments. Changes in uncertainty of money supply will affect prices of financial instruments. Fung and Lie (1990) argued that macroeconomic factors

cannot be reliable indicators for stock market price movements in the Asian markets because of the inability of stock markets to fully capture information about the change in macroeconomic fundamentals.

Mukherjee and Naka (1995) analyzed the relationship between stock market and exchange rate, inflation, money supply, real economic activity, long-term government bond rate, and call money rate in Japan. They concluded that a cointegration relation indeed existed and the stock prices contributed to this relation. They found positive relationship between industrial production and stock exchange prices. Abdalla and Murinde (1997) investigate stock prices-exchange rate relationships in the emerging financial markets of India, Korea, Pakistan and the Philippines using monthly data from 1985 to 1994. The empirical results show unidirectional causality from exchange rates to stock prices in India, Korea and Pakistan. On the contrary, the reverse causation was found for the Philippines. 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 (Mehrara, 2006: 4). Caporale and Jung (1997) show that the existence of an inverse relationship between inflation and real stock prices, even after controling for output shocks. Kwon and Shin (1999) found a long-run association between stock prices and four macroeconomic variables like industrial production index, exchange rate, trade balance and money supply for Korea. Ibrahim (1999) found that macroeconomic forces have systematic influences on stock prices via their influences on expected future cash flows.

Nath and Smantha (2002) note the type of causal relationship between stock prices and macro-economic factors in India. They stating that change in industrial production affects the stock prices. Kim (2003) uses monthly data for the 1974:01-1998:12 periods in the U.S.A. and the empirical results of the study reveal that S&P's common stock price is negatively related to the exchange rate. Ozair (2006) examines the causal relationship between stock prices and exchange rates in the USA using quarterly data from 1960 to 2004. The results show no causal linkage and no cointegration between these two financial variables. Maghayereh (2003) investigated the long run relationship between the Jordanian stock prices and selected macroeconomic variables by using Johansen's methodology in cointegration analysis and monthly time series data over for the period from January 1987 to December 2000. He found that macroeconomic variables (exports, foreign reserves, interest rates, inflation, and industrial production) were reflected in stock prices in the Jordanian capital market. Islam and Watanapalachaikul (2003) showed a strong, significant long-run relationship between stock prices and macroeconomic factors (interest rate, bonds price, foreign exchange rate, price-earning ratio, market capitalization, and consumer price index) during from 1992 to 2001 in Thailand. Bhattacharya and Mukherjee (2003) tested the causal relationships between the BSE Sensitive Index and the three macroeconomic variables (exchange rate, foreign exchange reserves and value of trade balance) using monthly data for the period 1990-91 to 2000-01. The results suggested that there was no causal linkage between stock prices and the three variables under consideration.

Nishat and Shaheen (2004) examined the relationship between a set of macro-economic variables and the Index of Karachi stock exchange. The set of variables included index of industrial production, money supply (M1), interest rate and CPI. It was found that there was positive and strong impact of industrial production on stock prices. It was also found that inflation was negative determinant of stock market. Granger causality test showed that causality run from macroeconomic variables to stock prices while stock price affected industrial production. Nishat and Shaheen (2004), who found causal relationship between stock exchange and macro-economic variable in Pakistan,. They noted industrial production as the largest positive predictor of equity prices in Pakistan, while inflation is the major negative determinant of stock prices in Pakistan. Maysami et al. (2004) examined the long-term equilibrium relationships between selected macroeconomic variables and the Singapore stock market index. The study concludes that the Singapore's stock market and the property index form cointegrating relationship with changes in the short and long-term interest rates, industrial production, price levels, exchange rate and money supply. Implications of the study and suggestions for future research are provided. Al-Sharkas (2004) determined the impact of the long-term equilibrium relationships selected macroeconomic variables (real economic

activity, money supply, inflation, and interest rate) on Amman Stock Exchange (ASE). The empirical results showed that the stock prices and macroeconomics variables have a long-term equilibrium relationship. Bargiota and Drisaki (2004) found a significant causal relationship between ASE and its macroeconomic fundamentals (industrial production, inflation and interest rates). Chakravarty (2005) also viewed that stock exchange prices are highly sensitive to fundamental macroeconomic indicators. Chakravarty has also examined positive relationship between industrial production and stock prices using Granger causality test.

Basher and Sadorsky (2006) examined the impact of oil price changes on the stock market returns of 21 emerging economies. They found strong evidence of the effect of oil prices being positive and statistically significant. Mehrara (2006) examined the causal relationship between stock prices and macroeconomic aggregates in Iran, by applying the techniques of the long–run Granger non–causality test proposed by Toda and Yamamoto (1995). The results show unidirectional long run causality from macroeconomic variables to stock market. Accordingly, the stock prices are not a leading indicator for economic variables, which is inconsistent with the previous findings that the stock market rationally signals changes in real activities. Contrarily, the macro variables seem to lead stock prices. So, Tehran Stock Exchange (TSE) is not information efficient. Ratanapakorn and Sharma (2007) explored positive relationship between stock prices and money supply in US. They reported positive relationship between S&P 500 and treasury bill rate in US. While, Humpe and Macmillan (2009) found negative impact of money supply on NKY225 in Japan, Also they found negative impact of Treasury bill rate on SP55 in US. Ratanapakorn and Sharma (2007) reported a positive relationship between stock prices and inflation. Gay (2008) investigated the time-series relationship between stock market index prices and the macroeconomic variables of exchange rate and oil price for Brazil, Russia, India, and China (BRIC) using the Box-Jenkins ARIMA model. No significant relationship was found between respective exchange rate and oil price on the stock market index prices. Aydemir and Demirhan (2009) investigated the causal relationship between stock prices and exchange rates about Turkey. The results of empirical study indicate that there is bidirectional causal relationship between exchange rate and all stock market indices. While the negative causality exists from national 100, services, financials and industrials indices to exchange rate, there is a positive causal relationship from technology indices to exchange rate. On the other hand, negative causal relationship from exchange rate to all stock market indices is determined. Humpe and Macmillan (2009) explored positive long-run relationship between stock prices and the industrial production in US while they illustrated negative impact of inflation on stock prices.

Muradoğlu and Önkal (1992) find that monetary and fiscal policy instruments affect stock prices significantly, in a later studies, Muradoğlu and Metin (1996) and Balaban et al. (1996), is that the ISE is vulnerable to both macroeconomic and political conditions and Muradoğlu et al. (2001) report that the influence of monetary expansion and interest rates disappears over time. In fact, the latter studies also finds that the variables explaining stock prices might change over time (Erdoğan and Özlale, 2005: 71).

The relationship between macroeconomic variables and stock market returns is, by now, well-documented in the literature. The outcomes of all these studies suggest that fundamental macroeconomic dynamics are indeed influential factors for stock market returns. Consequently, the message derived from all of these previous studies is that: macroeconomic factors are vital and have time-varying degrees of influence in explaining stock prices.

Dewan and Steven (1993) found that stock returns are related positively to inflation and money growth and negatively to budget deficit, trade deficits and both short and long term interest rates. Lee (1992) allowed for a separate role of interest rates and found that stock returns explain little variation in inflation, while interest rates explain a substantial fraction, such that inflation responds negatively to shocks in real interest rates. Also Lee (1992) found that real interest rates explain stock returns insignificantly. Fama (1981) and Lee (1992) found a positive relationship between stock returns and lagged real activity. The relationship between real interest rates and stock prices is less clear. Zhao (1999) show that the relationship between stock returns and unexpected output growth is significantly positive, but that between stock returns and expected output growth is

significantly negative. The relationship between stock prices and inflation is significantly negative. Chatrath et al. (1997) investigated relationship between stock returns and inflationary trends in India. The author's study provided an evidence of a negative relationship between market returns and inflationary trends in India.

Muradoglu et al. (2000) investigated possible causality between 19 emerging market returns and exchange rates, interest rates, inflation, and industrial production from 1976 to 1997. Their results revealed that the relationship between stock returns and macroeconomic variables were mainly due to the relative size of the respective stock market and their integration with world markets. Karamustafa and Küçükkale (2003) investigated whether current economic activities in Turkey have explanatory power over stock returns, or not. They 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 cannot be inferred for the sample period. Contrarily, stock returns are the leading indicator for the macroeconomic performance for the Turkish case by supporting emerging market issues.

Sohail and Hussain (2009) examined long-run and short-run relationships between Lahore Stock Exchange and macroeconomic variables in Pakistan. The monthly data from December 2002 to June 2008 was used. The results revealed that there was a negative impact of consumer price index on stock returns, while, industrial production index, real effective exchange rate, money supply had a significant positive effect on the stock returns in the long-run. Durai and Bhaduri (2009) show that there is a strong negative relationship between inflation and real stock return in the short and medium term whereas in the long term Fama's (1981) explanation holds, that this negative association between real stock return and inflation is a result of the relationship real stock return and inflation has with the output individually.

3. DATA AND METHODOLOGY

This paper studies the impact of selected macro-economic variables on the stock price in Turkey using monthly data from March 2001 to June 2010. The reason of selecting this period is that exchange rate regime is determined as floating in this period in Turkey. To measure the general stock price level, we use the end-of-month values from Istanbul Stock Exchange-100 (ISE), which are obtained from ISE website (Istanbul Stock Exchange, 2010). While a number of macroeconomic variables may affect stock prices directly or indirectly, in this paper only the most proximate macroeconomic determinants are chosen. These macroeconomic variables, namely foreign exchange rate (ER), gold price (GP), broad money supply (MS), industrial production index (IIP) and consumer price index (CPI) are obtained from the database of Central Bank of Republic of Turkey (CBRT). All variables are transformed into natural logarithm and all analysis have been performed in the econometrical software program *EViews 5.1*, whereas the ordinary calculations in *Excel*.

Unit root test has a crucial importance in the time series analysis as the choice of the techniques and procedure for further analysis and modeling of series depends on their order of integration. Without taking into account the presence of unit root in the variables, the analysis may produce spurious results. So, we first conduct Augmented Dickey-Fuller (ADF) test to establish the order of integration for the stock price (ISE), foreign exchange rate (ER), gold price (GP), broad money supply (MS), industrial production index (IIP) and consumer price index (CPI) series. Table 1 shows the results of the test for presence of a unit root in levels, first and second differences.

The results of a unit root test reported in Table 1 indicate that ISE, ER, GP, MS, IIP and CPI are not stationary in their level but ISE, ER, GP and MS are stationary at their first difference in ADF unit root statistics, similar conclusion is drawn with IIP and CPI at their second differences. Hence the null hypothesis of non-stationary for ISE-100, ER, Gold and MS series is rejected at first difference and this null hypothesis for IIP and CPI series is rejected at second difference at the particular level of significance described by the p-values in the parenthesis. As a result, while ISE, ER, GP and MS series can be characterized as I (1), IIP and CPI series can be characterized as I (2) for the period of analysis.

Table 1. Results of Unit Root Tests

	Augment Dickey-Fuller Test (ADF)					
	Levels		First differences		Second differences	
Variables	Intercept	Intercept and Trend	Intercept	Intercept and Trend	Intercept	Intercept and Trend
ISE	-0.991195	-2.157108	-5.123312	-5.097748	-5.929465	-5.888543
	(0.7545)	(0.5081)	(0.0000)	(0.0003)	(0.0000)	(0.0000)
ER	-3.244863	-3.235145	-5.384292	-5.336194	-7.069424	-7.040602
	(0.0201)	(0.0832)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
GP	-0.067915	-3.148857	-6.150296	-6.111123	-6.292739	-6.278310
	(0.9492)	(0.1005)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
MS	-1.417844	-4.068968	-6.408686	-6.487780	-6.250836	-6.229631
	(0.5710)	(0.0093)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
IIP	-1.649403	-1.749977	-2.203448	-2.074632	-9.480241	-9.470287
	(0.4537)	(0.7213)	(0.2065)	(0.5531)	(0.0000)	(0.0000)
CPI	-0.776887	-2.479804	-2.944075	-2.478503	-5.341057	-5.210611
	(0.8209)	(0.3374)	(0.0440)	(0.3380)	(0.0000)	(0.0002)

Notes: (a) The proper lag order for ADF test is chosen by considering Akaike Information Criterion (AIC) and white noise of residuals. MacKinnon (1996) one-sided p-values are used for ADF, representing in parenthesis. (b) MacKinnon (1996) critical values are used for ADF test. The 1%, 5% and 10% critical value for the ADF test is -3.491928, -2.888411 and -2.581176 for intercept and -4.045236, -3.451959 and -3.151440 for intercept and trend respectively.

As mentioned before the main objective of this study is to investigate the causality between stock price and macro-economic variables. For this purpose we can apply standard co-integration tests but the most crucial requirement for applying the standard co-integration tests is that the variables should be integrated of the same order. In the present case, the six variables under study are not integrated of same order. Therefore, the standard co-integration tests cannot be used to study the equilibrium relationship between these six variables. Fortunately, Toda and Yamamoto (1995) have developed a procedure which can be used to study the long term causality between the variables not integrated of the same order. Hence, to establish the causal relationship between stock price and macroeconomic variables in Turkey, this paper uses Granger non causality test suggested by Toda and Yamamoto.

Toda and Yamamoto (1995) methodology provides the possibility of testing for causality between integrated variables based on asymptotic theory. This methodology uses a Modified Wald (MWALD) test for restrictions on the parameters of the VAR (k) model. This test has an asymptotic chi-squared distribution with k degrees of freedom in the limit when a VAR ($k+d_{max}$) is estimated (where k is the lag order of VAR and d_{max} is the maximal order of integration for the series in the system). The underline objective of the Toda-Yamamoto causality test is to overcome the problem of invalid asymptotic critical values when causality tests are performed in the presence of non-stationary series or even co-integrated.

Two steps are involved to implement the Toda-Yamamoto based Granger causality test. The first step involves determination of the lag length (k) and the maximum order of integration (d_{max}) of the variables in the system. Given VAR (k) selected, and the order of integration (d_{max}) is determined, a level VAR can then be estimated with a total of $k+d_{max}$ lags. The second step is to apply standard Wald tests to the first k VAR coefficient matrix to make Granger causal inference. In order to analyze Granger causality between stock market price and macroeconomics variables by using Toda-Yamamoto procedure, the following VAR system should be estimated.

$$\begin{bmatrix} ISE_t \\ ER_t \\ GP_t \\ MS_t \\ IIP_t \\ CPI_T \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \\ \alpha_6 \end{bmatrix} + \sum_{i=1}^{k+d_{max}} \begin{bmatrix} \gamma_{1i} & \eta_{1i} & \phi_{1i} & \theta_{1i} & \omega_{1i} \\ \gamma_{2i} & \eta_{2i} & \phi_{2i} & \theta_{2i} & \omega_{2i} \\ \gamma_{3i} & \eta_{3i} & \phi_{3i} & \theta_{3i} & \omega_{3i} \\ \gamma_{4i} & \eta_{4i} & \phi_{4i} & \theta_{4i} & \omega_{4i} \\ \gamma_{5i} & \eta_{5i} & \phi_{5i} & \theta_{5i} & \omega_{5i} \\ \gamma_{6i} & \eta_{6i} & \phi_{6i} & \theta_{6i} & \omega_{6i} \end{bmatrix} \begin{bmatrix} ISE_{t-i} \\ ER_{t-i} \\ GP_{t-i} \\ MS_{t-i} \\ IIP_{t-i} \\ CPI_{t-i} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (1)$$

Table 2. Results of Long Run Causality Due to Toda-Yamamoto (1995)

Null Hypothesis	MWALD Statistics	*p*-values
Stock price (ISE) versus Exchange Rate (ER)		
Stock price does not *Granger cause* exchange rate	17.81220	0.0128*
Exchange rate does not *Granger cause* stock price	10.17853	0.1787
Stock price (ISE) versus rate of gold price (GP)		
Stock price does not *Granger cause* gold price	12.02597	0.0997**
Gold price does not *Granger cause* stock price	7.902733	0.3412
Stock price (ISE) versus money supply (MS)		
Stock price does not *Granger cause* money supply	12.29591	0.0912**
Money supply does not *Granger cause* stock price	10.23584	0.1756
Stock price (ISE) versus index of industrial production (IIP)		
Stock price does not *Granger cause* index of industrial production	17.95695	0.0122*
Index of industrial production does not *Granger cause* stock price	5.872914	0.5547
Stock price (ISE) versus rate of inflation (CPI)		
Stock price does not *Granger cause* rate of inflation	12.20136	0.0941**
Rate of inflation does not *Granger cause* stock price	3.364222	0.8494

*Notes: * and ** indicate significance at the 5% and 10% level, respectively.*

where;

ISE = Istanbul Stock Exchange-100 index at time t.
ER = Foreign Exchange Rate at time t.
GP = Gold Price at time t.
MS = Broad Money Supply (M2) at time t.
IIP = Industrial Production Index at time t.
CPI = Consumer Price Index at time t.

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ and α_6 are constant terms in VAR $(k+d_{max})$ model. $\gamma's, \eta's, \phi's, \theta's$ and ω's are the coefficients of ISE_t, ER_t GP_t, MS_t, IIP_t and CPI_t respectively. $\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}, \varepsilon_{5t}$ and ε_{6t} are error terms that are assumed to be white noise.

Usual Wald tests are then applied to the first k coefficient matrices using the standard chi-square statistic. The null hypotheses can be drawn as ER_t GP_t, MS_t, IIP_t and CPI_t "does not Granger-cause" ISE_t, if $\eta_{1t} = 0,\ \phi_{1t} = 0,\ \theta_{1t} = 0,$ and $\omega_{1t} = 0$ respectively against the alternative hypotheses as ER_t GP_t, MS_t, IIP_t and CPI_t "does Granger-cause" ISE_t if $\eta_{1t} \neq 0,\ \phi_{1t} \neq 0,\ \theta_{1t} \neq 0,$ and $\omega_{1t} \neq 0$ respectively. Similarly, other hypothesis can be drawn for unidirectional and bidirectional causality among rest of the variables.

4. EMPIRICAL RESULTS

The unit root test results presented in the earlier section, suggest that ISE, ER, GP and MS series are integrated of order one, so they are I (1) variables. But IIP and CPI series are integrated of order two, so they are I (2) variables. These series will be stationary after second differencing, therefore $d_{max}=2$. Having determined that $d_{max}=2$, we then proceed in estimating the lag structure of a system of VAR in levels and our results indicate that the optimum order of the VAR (k) is 5 in order to detect the causal relationship between ISE and ER, GP, MS, IIP and CPI. After specifying VAR (k) and d_{max}, VAR $(k+d_{max})$ model can be estimated by using MWALD test statistic. The results of the MWALD test statistic as well as its p-values are presented in Table 2.

The test results in Table 2 suggest that past stock price significantly cause current change in exchange rate and index of industrial production at 5% level of significance. Also, past stock price significantly cause current change in gold price, money supply and rate of inflation at 10% level of significance. In other words, the results suggest that ISE leads these five macro variables. Moreover, we fail to reject the null hypothesis of Granger non-causality from exchange rate, gold price, money supply, index of industrial production and rate of inflation to stock price at 1% level of significance. So, it seems that there is a unidirectional long-run causality from stock price to macro variables for Turkey. This implies

that the stock market can be used as a leading indicator for future growth in exchange rate, gold price, money supply, index of industrial production and rate of inflation in Turkey.

5. CONCLUSIONS

This paper extends our knowledge about relations among stock prices and macroeconomic factors. In this study we focus on causal relations among macroeconomic variables and stock prices in the ISE 100 using monthly data from March 2001 to June 2010. The reason of selecting this period is that exchange rate regime is determined as floating in this period. To measure the general stock price level, we use the end-of-month values ISE 100, which are obtained from ISE. The set of macro-economic indicators includes; foreign exchange rate (ER), gold price (GP), broad money supply (MS), industrial production index (IIP) and consumer price index (CPI) are obtained from the database of Central Bank of Republic of Turkey. The study employed Granger causality test to analyze the causal relationship between macro-economic variables and stock prices in Turkey.

We first tested for stationarity, since we are dealing with time series data. By applying Augmented Dickey-Fuller (ADF) test we find out their first differences are stationary and so the variables are integrated first order. Toda and Yamamoto (1995) have developed a procedure which can be used to study the long term causality between the variables not integrated of the same order. Hence, to establish the causal relationship between stock price and macroeconomic variables in Turkey, this paper uses Granger non causality test suggested by Toda and Yamamoto. This methodology uses a Modified Wald (MWALD) test for restrictions on the parameters of the VAR (k) model.

The test results suggest that past stock price significantly cause current change in exchange rate and index of industrial production at 5% level of significance. Also, past stock price significantly cause current change in gold price, money supply and rate of inflation at 10% level of significance. In other words, the results suggest that ISE leads these five macro variables. Moreover, we fail to reject the null hypothesis of Granger non-causality from exchange rate, gold price, money supply, index of industrial production and rate of inflation to stock price at 1% level of significance. So, it seems that there is a unidirectional long-run causality from stock price to macro variables for Turkey. This implies that the stock market can be used as a leading indicator for future growth in exchange rate, gold price, money supply, index of industrial production and rate of inflation in Turkey.

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