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Is Equity Market Efficient? Evidence from a Small Open Economy

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Abstract

This study investigates relationships between macroeconomic variables and stock market over the period of 1987Q1-2012Q1 for Turkey. The study is conducted by evaluating 2001 crisis, the most severe crisis in the history of Turkey which caused a cyclical shift, which has not been in consideration by the previous literature. This study used Toda and Yamamoto (1995) method to uncover those relationships. Here, those investigations provide information on whether Turkish stock market is efficient or not and whether the stock market can be used as a leading indicator for one or more fundamental macroeconomic variables. The results indicated that 2001 crisis had statistically significant impact on the stock market and Turkish economy. Before 2001 crisis, the stock market was not efficient but after 2001 crisis the stock market became efficient. The stock market was also found as a leading indicator for the real economic activity that is consistent with the literature findings on Turkey.

Keywords: efficient market hypothesis, stock market, macroeconomic variables, leading indicators, cyclical shifts

1. Introduction

As a source of risk, modern financial theory focuses on systematic factors and in the long-run return on an individual asset is accepted to reflect change in systematic factors, so modern financial theory suggests that financial assets' market is related to economy's financial and real segments (Ahmed, 2008, p. 142). According to this, the stock market either follows change in economic factors or it moves before the economic factors. This is based on Fama (1970)'s efficient market hypothesis, which assumes that stock price reflects all past information so by using past information nobody obtains above normal returns. If it does so, a market can be called as informationally efficient and if it is otherwise, it can be called as informationally inefficient.

There is a huge literature on researching market efficiency since it was coined as a hypothesis. Interest rate, exchange rate, real gross domestic product (RGDP), inflation rate and money supply are considered to be the most relevant indicators on the state of the economy. Macroeconomic developments affect all the actors operating in an economy. As a result, it is expected that these factors affect the stock market. For this reason, the macroeconomic variables -the main indicators of the economy- and the stock market are expected to be causal relationships.

This study tests two hypotheses that were suggested by Fama (1970). In fact, these hypotheses are essentially two sides of the same coin. First one is that, by using past information of economy, can someone predict stock market outcome? And if it can be made, then relevant stock market is inefficient. Otherwise, the stock market can be considered as efficient. The second hypothesis is whether Istanbul Stock Exchange (ISE) can be used a leading indicator for any fundamental macroeconomic variables. According to literature findings, there is no consensus on the existence and nature of relationship between key macroeconomic variables, at least the ones included in this study, and stock market. Furthermore, according to literature review, there is not much study on Turkish economy in this respect. In addition, the studies in the literature have covered shorter time period compared to this study. This study investigates long-run relationship between stock market and abovementioned fundamental macroeconomic variables over the period of 1987Q1 to 2012Q1 by using Toda and Yamamoto (1995). According to the study results, the 2001 crisis extracts statistically significant negative influence on stock market and points out that the stock market before 2001 crisis was inefficient. On the other hand, after 2001

crisis stock market became efficient.

The following parts of this study consist of a literature review that discuss briefly economic literature on theoretical and empirical relationship between the macroeconomics variables and stock market, model that is used in this study and empirical application, and conclusion which the results of this study are discussed.

2. Literature Review

In following Fama (1970) one of earliest studies on this topic is made by Chen, Roll and Ross (1986). Chen et al. (1986) expressed existence of the economic situation as state of economy, researched causal relationship between state of economy and stock market, and obtained mixed result for existence of efficiency. After that point, lots of studies were conducted on stock market and macroeconomic variables relationship. Here below, first the theories which associate the related macroeconomic variables to stock market will be discussed, empirical findings will be mentioned, and the recent literature that used similar methodology to the study will be discussed.

There are various theories that associate macroeconomic variables to stock market. Economy theory claims that interest rate and returns on stocks are inversely related with different reasons, e.g. present value, opportunity cost, asset portfolio allocation (Horobet & Dumitrescu, 2009). There are studies supporting this negative relationship between those two variables (Fama & Schwert, 1977; Chen et al., 1986; Cook & Hahn, 1988; Abdullah & Hayworth, 1993; Jensen & Johnson, 1995). Yet, Ratanapakorn and Sharma (2007) studied the US and found that stock market was negatively related with long-term interest rate but positively related with short-term interest rate.

In contemporary literature, there are theories relate stock market returns to Exchange rate, such as good market approach (Dornbush & Fisher, 1980), portfolio balance approach (Branson & Henderson, 1985). Empirically, the relationship between stock price or stock performance and exchange does not present a consistent result in the literature. Some studies find positive relationship between exchange rate and stock market for the US (Agarwal, 1981; Soenen & Hennigar, 1988), and some other studies find negative relationships between them (Ratapakorn & Sharma, 2007). In multi country studies, however, the relationship is positive for some countries and negative for some other countries (Soenen & Agarwal, 1989; Mao & Kao, 1990).

According to Morck, Shleifer, Vishny, Shapiro, and Poterba (1990), stock market plays three roles in the economy: (i) it is an passive indicator for future economic activity, but investors do not make investment decision based on this activity; (ii) it provides information regarding future event that would be right or wrong; (iii) it is perhaps the most common theory on stock market, which affects cost of investment funds so as investments. Greenwood and Smith (1997) suggests that stock market reduces cost of mobilizing financial funds and creates opportunities to companies to find liquid financial resources cheaply. Holsmtröm and Tirole (1993) claims that stock market improves resources allocation in terms of international risk-sharing. In addition to those three, recently, another channel relates stock market to real economic activity. That is, increasing stock market value affects consumers' expectations positively so consumers spend more money than if it is otherwise (Jansen & Nahuis, 2003). This suggests that the relationship between real sector and stock market is related through consumers' expectations. This also extracts influence over investments. Similar expectations lead investors to increase investment expenditures. Positive expectations on investor side create positive expectations on consumer side as well, so this becomes self-feeding process.

As understood above, the theory suggests a positive relationship and causal relationship that runs from stock market to real economic activity. Ratapakorn and Sharma (2007) supported this positive relationship for the US. On the other hand, some other studies claimed that stock market affected real economic activity negatively: Deverux and Smith (1994) claimed that international risk-sharing would reduce efficiency of resource allocation; Bhide (1993) argued that speculations and volatility in stock market would reduce efficiency of investments and this would severely affect real economic activity; lastly, Mauro (1995) suggested that developing stock market would reduce public sector savings so as growth. The last point is thought to lose its importance in Turkey after initializing "Transition to a Strong Economy Program" in 2000 crisis (Central Bank of Turkey, 2001) and with development of ISE. Yet some other studies has found no correlation between stock market and real economic activity and claimed that the relationship between them broke up (Stock & Watson, 1990, 1998; Binswanger 1999, 2004; Mao & Wu, 2007). Those studies are either for the US or developed countries.

The literature provides similar results to above-mentioned perspective on relationship between stock market and inflation. Based on empirical findings, some theoretical views suggest negative relationship between them; while some others suggest positive relationship between them.

Fama (1981) put the negative relationship and this relationship relied on empirical findings that the theory constructed on top of this base. There were studies that support this negative relationship for the US (Schwert, 1990; Barro, 1990; Fama 1990; Dominian, Glister, & Louton, 1996; Choi, Smith, & Boyd, 1995; Foresti, 2006) and for G7 countries (Hassapis & Kalyvitis, 2002). Even though there were studies in the literature that supported this negative relationship, there were some other claims that there was positive relationship between those two. If the companies are net borrower, increase in inflation would reduce loans of the companies so inflation increase the value of companies (Kessel, 1956; Fisher, 1930) claims that nominal return on stocks and expected inflation moves one to one and investors buy stocks to protect themselves from inflation, which is called as Fisher effect. In cross-sectional study, Al Khazali (2004) found supporting evidence for both negative relationship in short-run and positive relationship in long-run.

There were studies that support Fisher effect but most of the studies supported negative relationship between stock market and inflation (Litner, 1975; Bodie, 1976; Jaffe & Mandelker, 1976; Nelson, 1976; Fama & Schwert, 1977; Fama, 1981; Geske & Roll, 1983; Gultekin, 1983; Solnik, 1983; LeRoy, 1984; James, Koreisha, & Partch, 1985; Stulz, 1986; Kaul, 1987; Lee, 1992; Marshall, 1992; Al-Khazali, 2004). But if the relationship between inflation and stock prices was calculated by covering longer time periods, the results supported the hypothesis Fisher's effect claimed (Kaul, 1987; Boudoukh & Richardan, 1993). Yet there were studies that support positive relationship between stock market and inflation, for example Firth (1979) for the United Kingdom, Abdullah and Hayworth (1993), Graham (1996) and Ratapakorn and Sharma (2007) for the US and Gultekin (1983) claimed no relationship between those two variables according to his cross-sectional study on 26 countries.

Monetary policy can extract either positive or negative effect on stock market. Market players hold money beside other assets in their portfolio and as the monetary policy changes, the amount of money besides other assets in portfolio also change, which is called as portfolio effect or substitution effect (Hamburger, 1966, 1977, 1983). This is a direct effect of change in amount of money. There is also indirect effect that the change in money supply would also change inflation expectation, interest rate and discount rate and at this point a negative relationship would be possible but other indirect channels create positive impacts on stock price. For example, decline in interest rate would increase investment and increase in money supply also increases in amount of fund available for investments (Thornbecke, 1997; Bernanke & Kurtner, 2005). Thus, changes in stock prices can possibly change the amount of money in portfolio and the supply of money also adjusts according to change in demand of money. Besides it, Bernanke and Kutner (2005) claimed that holding stock in portfolio carried monetary value for an investor and is perceived as risk. If the monetary value of a stock is high, it becomes more and more attractive. Therefore, Bernanke and Kutner (2005) claimed that monetary policy influenced stock market through change in monetary value of stock and perceived risk.

Empirically, some studies has predicted positive relationship between stock market and money supply (Palmer, 1970; Sprinkel, 1971; Rozeff, 1974; Ho, 1983; Smirlock & Yawitz, 1985; Cook & Hanh, 1988, Fung & Lie, 1990; Malliaris & Urrutia 1991; Fosback 1991; Abdullah & Hayworth, 1993; Lin 1993; Dhakal, Kandil, & Sharma, 1993; Fitzpatrick, 1994; Cheng, 1995; Alexakis, Apergis, & Xanthakis, 1996; Thorbecke, 1997; Ratanapakorn & Sharma, 2007) and some other studies detected negative relationship between them (Bodie, 1976; Fama, 1981; Geske & Roll, 1983; Pearce & Rolley, 1983; Pearce, 1983). Further, Friedman (1988) mentioned wealth and substitution effect of change in stock price. Therefore, as increase in stock price create either positive or negative influence on money supply depending on wealth effect or substitution effect. If wealth effect is dominant, then money supply increase and if substitution effect is dominant, a negative relationship would arise. Firedman (1988) expected wealth-effect dominancy so that there is positive relationship between those two variables. On the other hand, Mukherjee and Naka (1995) claimed similar relationship as expansion in real economic activity would increase optimism in economy and it would increase demand for money and stock market. The monetary expansion would arise as a result. As a conclusion, literature agreed on only one issue: there is a relationship between money supply and stock market but it does not agree the sign or direction of this relationship.

In conclusion as seen above, there are various theories relating to concerned macroeconomic variables and stock market. Here, we further briefly review recent literature empirical findings that have used similar methodology around what the study is testing. Even though earlier studies are for developed countries and relied on testing existing relationships and direction of these relationships between macroeconomic variables and recently more and more studies become available for developing countries as well.

Studies researched macroeconomics variables and stock market relationship has found mixed results on efficiency and leading indicators. The results vary according to the methodology, time and country. Most of above studies did provide information regarding Fama (1970) hypothesis but they only put the very existing

relationship and gave reasoning following the research. There are lots of studies found stock markets are informationally inefficient (Thornbecke, 1997 for the US; Erbaykal & Okuyan, 2007 for Turkey; Bhattacharya & Mukherjee, 2002; Chakravarty, 2005; Ahmed, 2008; Ahmad, 2009 for India; Kwon & Shin, 1999 for Korea; Rasiah & Ratneswary, 2010 for Malaysia; Bahadur G. C. & Neupane, 2006; Bhattarai & Joshi, 2009 for Nepal; Plinkus, 2009 for Lithuania). Further, Horobet and Dumitrescu (2009) studied four east European countries, Li and Wu (2008) and Lin, Li, and Liu (2007) studied very same four East Asia countries and all of them found that all stock markets were not informationally efficient. Also there were studies found stock market efficient, for example, Aydemir (2008) and Kaplan (2008) found that Turkish stock market were informationally efficient.

On the other hand, Al-Khazali (2004) studied nine Asian countries and found their stock markets were informationally efficient. Ajayi, Friedman, & Mehdian (1998) studied fifteen developed and developing countries together, 8 developing Asian markets and 7 developed markets. Developed countries stock market found to be informationally efficient and developing countries stock market, in general, found to be informationally inefficient. Ajayi and Mougoué (1996) studied eight developed countries stock market. In general, developed countries stock markets were not informationally efficient as opposed to what Ajayi et al. (1998) found. Abdalla and Murinde (1997) studied four developing stock market and found three of them informationally inefficient and one of them found informationally efficient.

Studies on market efficiency also provided information on leading indicators. Stock market was found as leading indicator for real economic activity and interest rate for the US (Lee, 1992), for real economic activity for Turkey (Erbaykal & Okuyan, 2007; Kaplan 2008; Aydemir, 2008). For India, stock market was found as leading indicator for inflation (Bhattacharya & Mukherjee, 2002), for money supply (Chakravarty, 2005), for export, exchange rate, and IPI (Ahmed, 2008), and for real economic activity (Ahmad, 2009). Stock market has been found as leading indicator for real economic activity and money supply for Korea (Kwon & Shin, 1999). Stock market has been found as leading indicator for monetary policy for Nepal (Bhattarai & Joshi, 2009). Plinkus (2009) used forty macroeconomic variables and found stock market as a leading indicator for, such as money supply, CPI for durable goods. For Romania, stock market has been found as leading indicator for interest rate, for Czech Republic and Romania, stock markets have been found as leading indicator for CPI and for Poland stock market has been found as a leading indicator for exchange rate (Horobet & Dumitrescu, 2009). Al Khazali (2004) examined 9 Asian countries and studied expected and unexpected inflation on stock markets and found out that only Philippines stock market acts as a leading indicator for expected inflation. Ajayi et al. (1998) studied 15 developing and developed countries and for developed economies, stock markets have been found as leading indicators for exchange rate and for developing economies, there were no such findings. Ajayi and Mougoué (1996) studied 8 developed countries and studied exchange rate, except for United States, and the findings indicated that those stock markets were found as leading indicators for exchange rate. Abdalla and Murinde (1997) found stock market as a leading indicator for Philippines.

On the other hand, Karamustafa and Küçükkale (2003) studied money supply, exchange rate, current account balance and IPI and found no causality at all by using Granger (1969). Hence, stock market cannot be used as a leading indicator. Pethe and Karnik (2000) studied India by using ECM and obtained no causality between stock market and macroeconomic variables, exchange rate, interest rate and IPI.

Abovementioned studies research this relationship through Granger causality framework by using VAR, VECM or Toda and Yamamoto (1995) if data does not allow running ECM. The literature review suggests that the relationship between stock market and macroeconomic variables around efficient market hypothesis still is an empirical issue to study. Here we extend the data set by including more recent data and adding an exogenous break that is thought to create cyclical shift and should be taken into consideration.

3. Data and Application

The article used quarterly data over 1987Q1–2012Q2 period to study causal relationships between Istanbul Stock Exchange (ISE) and macroeconomic variables for Turkey. The time span was determined by data availability. Macroeconomic variables are interest rate (INTEREST), exchange rate (EXRATE), real GDP (RGDP), inflation (INFLATION), and money supply (M1). International Financial Statistics (IFS), database of Monetary Fund (IMF) is used to obtain data set and the index variable for ISE is obtained through Central Bank of Turkey website. INTEREST rate is defined as an interest rate paid for 1-year term deposit; EXRATE is defined as amount of US dollar bought by per 1000000 Turkish Liras that become a new Turkish Lira on the first of January, 2005 and that 1 new Turkish Lira = 1000000 Turkish Lira (Note 1). Hence to become consistent with period before change, this type of exchange rate is used; RGDP is obtained as nominal GDP divided by GDP deflator; INFLATION is obtained by using Consumer Price Index (CPI) and estimating $INFLATION_t$ = LN

(CPI_{t-1}/CPI_t)*100; M1 was readily available in IFS database in terms of million new Turkish Liras. As stock market variable, ISE composite price index (ISE100) is used. ISE100 closing values are available daily and three month average is taken and used in this study (Note 2).

The financial crisis happened in 2001 in Turkey started from public industry and spread out to the financial industry and affected real industry adversely. The crisis became the most severe crisis in the history of the country. In order to stabilize the economy "Transition to Strong Economy" program was implemented. There were five basic pillars of this program. The first one was fighting against inflation firmly within floating exchange rate system, the second one was restructuring banking sector, the third one was strengthening public finance, the fourth one was running an income policy in line with inflation targets, and the last one was preparing legal infrastructure to implement those changes within an efficient, flexible and transparent framework. Those measures implemented after 2001 crisis, extracted serious impacts, first, on financial industry and, later, on real economy. The banking sector has the largest share in finance industry and a closer look on the arrangements for the financial sector showed that "Banking Industry Restructuring Program" in May 2001 by the Banking Regulation and Supervision Agency (BRSA) was the main one. This program consisted of restructuring state banks and bringing affected private banks from crisis to financial health. In addition, to increase the effectiveness of surveillance and supervision in the banking sector, and to bring the sector to a more efficient and competitive level; the program also included the realization of the legal and institutional arrangements; for restructuring of the financial sector in respect of supervision and control, capital adequacy, risk regulations, accounting standards, independent auditing, credit and share holding constraints, the recapitalization of banks, regulations for private financial institutions, arrangements for the supervision and co-operation agreements concluded with foreign countries. Therefore, the 2001 financial crisis was an important milestone for the financial markets in Turkey and the effects of these changes on the financial markets are taken into account.by creating a dummy variable. The created dummy variable is called as Crisis2001, which takes 0 before 2001Q1 and takes values 1on and after 2001Q1.

First of all, a series of diagnostic checks, including graphing and correlograms, were used to see whether data contain trend and seasonality (Note 3). The results are indicated that INFLATION and RGDP series exhibit seasonality and after 2001 crisis it can clearly be seen that the nature of economy changed and entered into another phase. Therefore, in order to extract seasonality from those two series, this study uses the TROMA/SEATS method, which is the most common method used for seasonal adjustment in recent literature. After de-seasonalizing, RGDP and INFLATION are called as RGDP_SA and INFLATION_SA respectively. Further, the graphs and correlograms also indicated that there are strong trends all the series used in this study. Therefore, the natural logarithms of all variables are taken in order to reduce the impact of outliers and smoothes out time series. After taking natural logarithm, letter L is added to the front of each variable such that ISE100 become LISE100 after taking logarithm.

Three analyses were conducted. The first analysis used full-sample and the other two used sub-samples. The first sub-sample covers the period before 2001 crisis and the other sub-sample covers the period after 2001 crisis. Later, the study formally tested whether the series have unit root and the results are reported in the Table 1. According to ADF test results, some of the variables are integrated level and the others are integrated at the first difference: At full sample INFLATION_SA, at the sub-sample before 2001 crisis LISE100, LRGDP_SA and INFLATION_SA and at the sub-sample after 2001 crisis LEXRATE variables are accepted I (0) and the rest of variables are accepted I (1) series. Therefore maximum integration order is determined as 1.

Table 1. Augmented Dickey Fuller test (ADF)

	Full-Sample (1987Q2-2012Q1)			
	Level		First Difference	
Variables Names	Constant	Constant+Trend	Constant	Constant+Trend
LISE100	-1.2368	-0.8852	-8.8190*	-8.8450*
LINTEREST	-0.7209	-2.5118	-9.2554*	-9.3711*
LEXRATE	-3.9708*	0.4665	-7.6930*	-9.0613*
LRGDP_SA	-0.2111	-3.0536	-10.3280*	-10.2892*
INFLATION_SA	-1.8366	-3.7859**	-10.7008*	-10.6612*
LM1	-3.0185**	0.8279	-2.9462**	-12.7012*
	Sub-Sample (1987Q2-2000Q4)			
	Level		First Difference	
Variables Names	Constant	Constant+Trend	Constant	Constant+Trend
LISE100	-0.3817	-4.7975*	-6.8320*	-6.8492*
LINTEREST	-2.9231**	-2.9772	-7.3057*	-7.3182*
LEXRATE	0.1564	-2.1144	-7.7110*	-7.6495*
LRGDP_SA	-0.6817	-3.5542**	-8.9953*	-8.9090*
INFLATION_SA	-6.0072*	-5.9122*	-8.1937*	-8.2608*
LM1	1.8239	-3.1492	-7.7260*	-8.1862*
	Sub-Sample (2001Q1-2012Q1)			
	Level		First Difference	
Variables Names	Constant	Constant+Trend	Constant	Constant+Trend
LISE100	-1.1436	-2.1963	-5.0758*	-5.0268*
LINTEREST	-3.2260**	-2.2784	-4.7341*	-5.2542*
LEXRATE	-5.2291*	-5.0945*	-8.2552*	-8.0503*
LRGDP_SA	-0.4860	-2.0177	-5.4969*	-5.4543*
INFLATION_SA	-2.4887	-3.1457	-14.1701*	-15.6335*
LM1	-1.8784	-1.4922	-3.5874**	-8.5081*

Note. *, %1significant, **, %5 significant and ***, %10 significant level. In order to get rid of autocorrelation, the Schwarz Information Criteria Used in those tests.

After unit root tests the Granger Causality method proposed by Granger (1969) is used. This method is one of the most common methods used in the literature. The mathematical representation of this method is shown in the Equation (1) and (2) below.

$$Y_t = \lambda_0 + \sum_{k=1}^{p+d_{\max}} \lambda_k Y_{t-k} + \sum_{k=1}^{p+d_{\max}} \vartheta_k X_{t-k} + \varepsilon_{1,t}, \quad (1)$$

$$X_t = \gamma_0 + \sum_{k=1}^{p+d_{\max}} \gamma_k Y_{t-k} + \sum_{k=1}^{p+d_{\max}} \kappa_k X_{t-k} + \varepsilon_{2,t}, \quad (2)$$

The model given in the Equations (1) and (2) is called as VAR(p+dmax). λ_0 and γ_0 are constant terms, λk, ϑk, γk, and κk are the parameters associated to lagged variables of Yt and Xt series, and ε1,t and ε2,t are identically and independently distributed error terms with mean 0 and constant variance. Rambaldi and Doran (1996) suggested a Toda and Yamamoto (1995) Granger causality test based on the model given in the Equations (1) and

(2). Here, the above equations are estimated by using Seemingly Unrelated Regression method. After that, by using MWALD tests ϑk, k=1, 2..p, parameters are tested jointly in the Equation (1) to extract whether Xt is Granger cause of Yt and, similarly, γk, k=1, 2..p, parameters are tested jointly in the Equation (2) to extract whether Yt is Granger cause of Xt. The reason using the Toda and Yamomoto test suggested by Rambaldi and Doran (1996) is to ease the application and the second reason is that in the case of a cointegration the existence of unit root creates various problems (Toda & Phillips, 1993; Dufour & Renault, 1998). If the degree of cointegration of time series and the number of cointegrated vectors between variables are determined wrongly, the statistical interpretation between variables also can also be wrong. On the other hand, the used Toda and Yamamoto (1995) is independent from these problems.

Table 2. Granger causality (long-run relationships) between ISE100 and macroeconomic variables (full-sample) (SC=1,k+dmax= 1+1=2)

Hypotheses Tested (H_0)	MWALD	P Value	Est. Coeff. for Crisis2001	P Value	Hypotheses Tested (H_0)	MWALD	P Value	Est. Coeff. for Crisis 2001	P Value
From INTEREST to ISE100	1.88(+)	0.17	-0.36*	0.00	From ISE100 to INTEREST	2.71***(-)	0.10	-0.02	0.08
From EXRATE to ISE100	0.41 (-)	0.52	-0.36*	0.00	From ISE100 to EXRATE	0.01 (-)	0.91	-0.04	0.51
From RGDP_SA to ISE100	0.49(+)	0.49	-0.36*	0.00	From ISE100 to RGDP_SA	6.33**(+)	0.01	-0.03**	0.05
From INFLATION_SA to ISE100	0.04(-)	0.85	-0.36*	0.00	From ISE100 to INFLATION_SA	2.44(+)	0.12	1.10	0.51
From M1 to ISE100	10.25*(+)	0.00	-0.36*	0.00	From ISE100 to M1	2.48(+)	0.12	-0.01	0.84

*, %1 significant, **, %5 significant, ***, %10 significant. Est. is Abbreviation for Estimated and Coeff. Is abbreviation for Coefficient.

According to full sample results in the Table 2, Turkish stock market was not efficient since there is Granger causality from money supply to stock market and the dummy variable for the crisis 2001 is found to be statistically significant in the equation that stock market is dependent variable. Hence, 2001 crisis extract negative influence on stock market performance over the investigated period. Again, as seen in the Table 2, Turkish stock market can be used as leading indicator for interest rate and real GDP. Further the dummy variable only extract positive and statistically significant influences on real GDP in the cases of macroeconomic variables are dependent variables. Here the sign of causality were also investigated. Money supply affects stock market positively. On the other hand, stock market affects interest rate negatively and real GDP positively.

Table 3. Granger causality (long-run relationships) between ISE100 and macroeconomic variables (sub-sample before 2001 crisis) (SC=1,k+dmax= 1+1=2)

Hypotheses Tested (H_0)	MWALD	P Value	Hypotheses Tested (H_0)	MWALD	P Value
From INTEREST to ISE100	1.7941 (+)	0.1804	From ISE100 to INTEREST	6.1448**(-)	0.0132
From EXRATE to ISE100	0.0038(+)	0.9508	From ISE100 to EXRATE	0.0093(+)	0.9232
From RGDP_SA to ISE100	0.1438(+)	0.7045	From ISE100 to RGDP_SA	3.0120***(+)	0.0827
From INFLATION_SA to ISE100	0.8180(+)	0.3658	From ISE100 to INFLATION_SA	2.0572(+)	0.1515
From M1 to ISE100	10.6135*(+)	0.0011	From ISE100 to M1	2.4928(+)	0.1144

*, %1significant, **, %5 significant, ***, %10 significant.

In the Table 3, the sub-sample results before 2001 crisis are presented. These results are the same to the full-sample results. In the Table 4, on the other hand, after 2001 crisis, the stock market became efficient. Namely, there was no causality detected from macroeconomic variables to stock market. After 2001 crisis while the stock market can, still, be used as a leading indicator for real GDP, it cannot be used as a leading indicator for interest rate but now it became a leading indicator for exchange rate.

Table 4. Granger causality (long-run relationships) between ISE100 and macroeconomic variables (sub-sample after 2001 crisis) (SC=1,k+dmax= 1+1=2)

Hypotheses Tested (H_0)	MWALD	P Value	Hypotheses Tested (H_0)	MWALD	P Value
From INTEREST to ISE100	0.7434(-)	0.3886	From ISE100 to INTEREST	0.3653(-)	0.5456
From EXRATE to ISE100	1.4044(-)	0.2360	From ISE100 to EXRATE	7.5888*(+)	0.0059
From RGDP_SA to ISE100	0.2653(-)	0.6065	From ISE100 to RGDP_SA	23.0830*(+)	0.0000
From INFLATION_SA to ISE100	0.7332(-)	0.3919	From ISE100 to INFLATION_SA	0.3925(+)	0.5310
From M1 to ISE100	1.3094(+)	0.2525	From ISE100 to M1	0.6038(-)	0.4371

*, %1significant, **, %5 significant, ***, %10 significant.

4. Conclusion

This study worked on the relationships between ISE100, the stock composite index, and macroeconomic variables for Turkey. As working on this relationship, study used all available up to date data; very wide selection of macroeconomic variables compared to earlier literature on Turkey and considered a cyclical shift happened in 2001. According to the findings; Turkish stock market became efficient after 2001 crisis. Yet in the case of full sample and before the 2001 crisis, both of the findings are the same, the stock market inefficiency were consistent in result with Erbaykal and Okuyan (2007) and inconsistent with Aydemir (2008) and Kaplan (2008).

On the other hand, before crisis, at the case of full sample stock market in Turkey was found to be used as a leading indicator for two macroeconomic variables that are, interest rate and real GDP. For the rest of the variables, there was no such relationship detected. Those results were consistent with Erbaykal and Okuyan (2007) Kaplan (2008) and Aydemir (2008) since they all found stock market as a leading indicator for real economic activity.

Furthermore the cyclical change happened in February 2001, were not considered by earlier literature. This study considered this piece of information and found statistically significant results in two cases. It looks like that 2001 crisis extracts statistically significant influence on the stock market and real GDP. However, the study did not expect statistically insignificant results at any case for the dummy variable for the crisis.

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Notes

Note 1. Central Bank of Turkey (CBT), http://www.tcmb.gov.tr/tlkampanya/sss.html

Note 2. Daily data available after October, 23 1987. Before that date, data is available weekly.

Note 3. They are not reported but they can be supplied on demand.