Asian Journal of Empirical Research

journal homepage: http://aessweb.com/journal-detail.php?id=5004

REAL MACROECONOMIC VARIABLES AND STOCK PRICES: EVIDENCE FROM TURKEY

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ABSTRACT

This paper investigates the relationship between reel macroeconomic variables and stock prices in Turkey. Consumption expenditures, industrial production index, employment level and fixed investments are used as indicators of real economic activity and consumption price index as an indicator of inflation. The ARDL bounds testing is applied to the long-run relationship between the variables. Our empirical evidence reveals the validation of Proxy hypothesis in case of Turkey.

Keywords: Proxy hypothesis, Stock prices, Real macroeconomic variables, Turkey

INTRODUCTION

The relationship between the real macroeconomic variables and the stock prices has been investigated by many studies in exiting finance literature. Until the Proxy hypothesis- whose basis was built by Fama and Schwert, (1977) and developed by Fama (1981), it has been claimed that an increase in the real economic activity causes a rise in inflation and also declines stock prices due to the negative relationship between inflation and stock prices. However, Proxy* hypothesis developed by Fama, (1981) reveals that there is a positive relationship between stock prices and real economic activity. In contrast to previous approaches, Proxy hypothesis says that an increase in the real economic activities causes not an incline but decline in inflation [Fama and Schwert, (1977); Schwert, (1981)]. The decline in inflation results in an increase in stock prices due to the negative relationship between them.Price of a stock may be defined as discounted value of its future cash flows. A decline in expected cash flows or an increase in the real interest rate (discount factor) causes a decrease in stock prices. Cash flows of the firms move according to the real

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* Proxy is defined as "agent, representative" in the dictionary. Fama uses the real stock returns as an agent, representative of real economic activities. In other words, real returns of stocks are the representative indicators of real economic activities.

economic activity. In the periods of rise in real economic activity, expected cash flows and therefore price of stocks may rise. The rise in the economic activity also increases inflation. In case of inflation, the authorities usually implement anti-inflationist, contractionary policies to slow down the demand. These policies increase the real interest rate; decrease the expected cash flows of the firms which also mean a decrease in stock prices. As a result, the initial increase in the stock prices will have been balanced after the implementation of macroeconomic policies. In conclusion, the effect of a macroeconomic variable on stock prices depends on the relationship between future cash flows and inflation. A variable which has a negative effect on cash flows and/or a positive effect on inflation will be in a negative relationship with the stock prices. Friedman, (1977) argued that inflation decreases the production efficiency. Reduction in efficiency slows down the real economic activity and the cash flows of the firms. Malkiel, (1979) stated that fluctuations in the inflation increase the risk of owning a stock and therefore he found a negative relationship between inflation and stock prices. Cukierman, (1983) implied that there is a positive relationship between anticipated inflation, fluctuations in inflation, unanticipated inflation and actual inflation.

Proxy hypothesis has been tested in many empirical studies since Fama, (1981). Geske and Roll, (1983) Kaul, (1987) and Barnes *et al*. (1999) found evidence supporting this hypothesis in their studies. Mc Queen and Roley, (1993) claimed that the negative relationship between real economic activities and stock prices appears only under some specific circumstances. They stated that news regarding an incline in economic activities reduces the stock prices in booming economies, but increases stock prices in weak economies. Park, (1997) approached to the subject in a different aspect in his study regarding USA. He mentioned about a negative relationship between the economic variables that might be the indicator of future inflation and stock prices. Park, (1997) exposed that employment level is the most important variable which might be the indicator of future inflation. He found a negative relationship with stock prices. Merikas and Merika, (2006) examined the relationships between the stocks and real macro economic variables in Germany in 1960 – 2000 period. They employed the VAR model and used employment growth, output growth, investment, industrial production and retail sales as real macroeconomic variables. In their study, they claimed that the real economic variables which are in a positive relationship with inflation would be in a negative relationship with stock prices. They found a positive relationship between stock prices and employment level on the one hand, and a negative relationship between the stock prices and economic growth which is in a positive relationship with inflation on the other hand. According to this result, they concluded that there is a positive relationship between real economic variables and stock prices, where as there is a negative relationship between real economic variables which might be the indicator of future inflation and which are also in a positive relationship with inflation- and stock prices. Kim and In (2005) investigated the relationship between inflation and nominal and real returns of stocks in USA. As a result, they detected a positive relationship between inflation and returns of stocks in short (1 month) and long (128

months) terms and negative relationship in the medium term. They reached to conclusion that the relationship between these two variables depends on the length of the term and change in time. Adrangi *et al*. (1999) investigated the validity of Proxy hypothesis in Peru and Chile. They stated that inflationist pressure decreases the future cash flows of the firms and decreases the current values of future cash flows by increasing the nominal discount rates. They found a negative relationship between inflation and real stock returns and concluded that Proxy hypothesis is valid in these countries.

Besides the views supporting Proxy hypothesis, there are also counter views in the literature. McCarthy *et al*. (1990) investigated the relationship between the expected real returns of stocks and expected real economic activity in England, USA and Germany and could not find a significant relationship. Cochran (1993) for USA that Proxy hypothesis is not valid. Caporale and Jung (1997) tested the Proxy hypothesis for USA and detected -in contrast to Proxy hypothesis- a positive relationship between real returns of stocks and inflation. It is seen that contradictory results are obtained in the literature and a consensus is not reached about the validity of the proxy hypothesis. The aim of this study is to test the relationship between the real macroeconomic variables and stock prices in Turkey under the frame of Proxy hypothesis. In order to test this relationship, bounds testing approach developed by Paseran *et al*. (2001) is applied.

This study consists of four sections. First section is the introduction. Model, the data set and methodology are introduced in the second section. The long-run relationship between the stock prices and macroeconomic variables is investigated by the help of co integration method. Third section explains the empirical results and makes an evaluation. And section four concludes.

MODEL, DATA SET AND METHODOLOGY

The model which was developed by Merikas and Merika (2006) will be used in present study using Turkish data. The empirical equation of model is composed as follows:

$$LSP_t = \alpha_0 + \alpha_1 LCE_t + \alpha_2 LIPI_t + \alpha_3 LEL_t + \alpha_4 LFI_t + \alpha_5 LCPI_t + \varepsilon_t \qquad (1)$$

In the equation, SP, CE, IPI, EL, FI and CPI refer to stock prices, consumption expenditures, industrial production index, employment level, fixed investment and consumer price index respectively. ISE 100 index is used as the indicator of stock prices. Quarterly data is used covering the period of 1987Q1-2012Q9 and it is obtained from the Central Bank of Republic of Turkey' selectronic data distribution system. Natural logarithms of the variables have been taken and all the variables are used in their logarithmic form. L in the model implies that the variables are logarithmic.

Since facing a spurious regression problem among these series which include a unit root, some methods are suggested to solve this problem. One of them is taking the differences of the series and then putting them into regressions. However, in this case we are confronted with a new problem. This method leads to the loss of information that is important for the long-run equilibrium. As long as the first differences of the variables are used, determining a potential long run relationship between these variables becomes impossible. These all issues are covered by bounds testing approach developed by Pesaran *et al*. (2001). The bounds testing apporach is superior to all other traditional cointegtaion aparoches on two grounds. Firstly, it can be applied irrespective of whether the regressors are I(0), I(1), or even integrated of the same order.Secondly, Bounds testing procedure is robust for cointegration analysis with small sample study.

EMPIRICAL RESULTS AND EVALUATION

Co-integration tests

In order to apply the Bounds testing approach, firstly an unrestricted error correction model (UECM) is formed. The form of this model adapted into our study is as follows:

$$\Delta LSP_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} \Delta LSP_{t-i} + \sum_{i=0}^{m} \alpha_{2i} \Delta LCE_{t-i} + \sum_{i=0}^{m} \alpha_{3i} \Delta LIPI_{t-i} + \sum_{i=0}^{m} \alpha_{4i} \Delta LEL_{t-i} + \sum_{i=0}^{m} \alpha_{5i} \Delta LFI_{t-i} + \sum_{i=0}^{m} \alpha_{6i} \Delta LCPI_{t-i} + \alpha_7 LSP_{t-1} + \alpha_8 LCE_{t-1} + \alpha_9 LIPI_{t-1} + \alpha_{10} LEL_{t-1} + \alpha_{11} LFI_{t-1} + \alpha_{12} LCPI_{t-1} + \mu_t \quad (2)$$

F-test is applied on first period lags of dependent and independent variables to test the existence of the co-integration relationship. Basic hypothesis for this test is established as (H_0:$\alpha_7=\alpha_8=\alpha_9=\alpha_{10}=\alpha_{11}=\alpha_{12}=0$). The calculated F-statistic is compared with bottom and upper critical value generated by Pesaran *et al*. (2001). If the calculated F-statistic is lower than lower bottom critical value then there is no co-integration relationship between the series. If the calculated F-statistic is between the lower and upper critical values, no exact opinion can be made and there is a need to apply other co-integration test approaches. Lastly, if the calculated F-statistic is higher than the upper critical value, there is a co-integration relationship between the series. After a co-integration relationship is observed between the series, Autoregressive Distribution Lag (ARDL) models are established to determine the long term and short term relationships. In UECM models, "m" represents number of lags.

Critical values like Akaike, Schwarz and Hannan-Quinn are used to determine the number of lags. Also the duration of the lag which provides the smallest critical value is identified as the model's duration of lag. However, if the model established with the duration of lag in which the selected critical value is the smallest involves an autocorrelation, duration of lag, which gives the second

smallest critical value is taken. If the autocorrelation problem still continues, this process is sustained until the problem is solved. In this study, maximum duration of lag has been taken as 8. The number of lags which minimize the Akaike information criterion is found as 8, but after applying the LM test, it has been detected that 8 lags cause an autocorrelation problem. In that case, the number of lags is determined as 7, which satisfies the second minimum value of Akaike information criterion. After performing an LM test, again an autocorrelation is detected.Then the third value minimizing the Akaike criterion which is 3 is determined as the number of lags. No autocorrelation problem has been observed after LM test. Criteria and test values are given in Table- 1.

Table 1: Lag length selecting

M	**AIC**	$X^{2\,BG}$
1	-0.140	1.475
2	-0.078	1.147
3	**-0.706**	**0.024**
4	-0.173	2.674
5	-0.249	2.148
6	-0.655	1.475
7	-0.764	15.175*
8	-1.340	16.275*

$x^{2\,BG}$: Breusch-Godfrey autocorrelation test.

* shows 1% significance level implying autocorrelation between error terms.

Table 2: Results of bound test

K	F statistics	Critical values (significance % 5)	
		Lower bound	Upper bound
5	7.25	2.62	3.79

K: number of independent variables in equation (2). Critical values were obtained from table CI (iii) Pesaran *at al*. (2001)

After the number of lags is determined, co-integration between series is investigated by the bounds testing approach. F-statistics calculated with UECM model are compared with the lower and upper critical levels by Pesaran *et al*. (2001). The bound test results are given in Table-2.As it is seen from Table 2, a co-integration relationship has been detected between the series, because F-statistic exceeds the upper bounds value of Pesaran *et al*. (2001).

That a co-integration relationship has been detected between the series, Autoregressive Distribution Lag (ARDL) model can be established to determine long-term and short-term relationships. As can be seen from Table-3, none of the econometric problems such as autocorrelation, heteroscedasticity, conflict to normal distribution and model specification error has been observed.Observing the long term coefficients in Table-4, a positive long term relationship has

been detected between stock prices and statistically significant independent variables which are industrial price index, employment level and fixed investments where as a negative relationship is seen between the stock prices and inflation. In addition, a significant relationship between the consumption expenditures and stock prices is not met.The error correction variable ECT(-1) has been found negative and also statistically significant (see Table-5).

Table 3: ARDL (4, 0, 1, 4, 1, 4) estimation results

Variables	Coefficient	T statistics
LSP(-1)	1.025	7.375*
LSP(-2)	-0.136	-0.445
LSP(-3)	-0.138	-0.555
LSP(-4)	-0.357	-2.841**
LCE	-0.241	-0.227
LIPI	0.324	0.507
LIPI(-1)	0.460	1.209
LEL	-0.640	-0.886
LEL(-1)	0.964	1.175
LEL(-2)	1.240	1.424
LEL(-3)	-0.068	-0.065
LEL(-4)	1.427	2.299**
LFI	0.038	0.445
LFI(-1)	0.247	2.474**
LCPI	-1.237	-1.945**
LCPI(-1)	2.304	3.105*
LCPI(-2)	-0.340	-0.442
LCPI(-3)	-1.227	-2.285**
LCPI(-4)	0.464	1.347
C	-28.024	-1.175
Results of Diagnostic Tests		
R^2	0.807	
$\bar{R}^2$	0.772	
X^2_{BG}	5.074[0.375]	
χ^2_{NORM} (2)	2.304[0.233]	
χ^2_{WHITE} (1)	0.054[0.142]	
X^2_{RAMSEY} (1)	0.738[0.336]	

χ^2_{BG} , χ^2_{NORM} , χ^2_{WHITE} , χ^2_{RAMSEY} areautocorrelation, normality, heteroscedasticity, model specification error test statistics, respectively.

Table 4: ARDL (4, 0, 1, 4, 1, 4) long-term coefficients

Variables	Coefficients	T statistics
LCE	-0.245	-0.498
LIPI	3.174	2.624**
LEL	5.247	2.174**
LFI	0.542	2.425**
LCPI	-0.521	-2.521**
C	-73.374	-2.475**

Note: * and ** significant at1% and 5% respectively

Table 5: Error correction model

Variables	Coefficients	T statistics
DLSP(-1)	0.398	5.375*
DLSP(-2)	0.267	4.438*
DLSP(-3)	0.187	3.987*
DLCE	-0.441	-0.484
DLIPI	0.265	0.434
DLEL	-0.745	-0.924
DLEL(-1)	-2.247	-2.201**
DLEL(-2)	-1.375	-1.409
DLEL(-3)	-1.396	-2.109**
DLFI	0.055	0.457
DLCPI	-1.787	-1.604
DLCPI(-1)	1.204	2.295*
DLCPI(-2)	0.904	1.795
DLCPI(-3)	-0.574	-1.596
C	35.974	-1.148
ECT(-1)	-0.698	-6.436*

Note: * and ** significant at1% and 5% respectively

CONCLUSION

In this study, the Proxy hypothesis developed by Fama, (1981) has been tested for Turkey. According to Fama (1981), there is a positive relationship between the real macroeconomic variables and stock prices. This relationship means that an increase in the real economic activity affects the inflation negatively. And because of the negative relationship between the inflation and stock prices, stock prices will be affected positively. Our results show a positive relationship between the stock prices and the real macroeconomic variables in long run. Also a significant negative relationship has been detected between the stock prices and inflation. Under the light of this evidence, it can be said that Proxy hypothesis developed by Fama, (1981) is valid for Turkey. This paper results that the variables which are the indicators of real economic activity such as

industrial production index, employment level and fixed investments are effective on stock prices via inflation. Therefore, these variables can be used as leading indicators in estimating the stock prices. As a result, it is obvious that an investor must take macroeconomic variables and inflation into account in estimating the future values of stock prices.

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