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MACROECONOMIC VARIABLES AND STOCK MARKET: EVIDENCE FROM IRAN

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Abstract

In this paper, we examine the relationship between Tehran Stock Exchange (TSE) price index and a set of three macroeconomic variables from 2001 to 2007 using Unrestricted Vector Autoregressive (VAR) model. Our analysis based on Impulse Response Function (IRF), indicate that the response of TSE price index to shocks in macroeconomic variables such as consumer price index (CPI), free market exchange rate, and liquidity (M_2) is weak. In addition, generalized Forecast Error Variance Decomposition (FEVD) reveals that share of macroeconomic variables in fluctuations of TSE price index is about 12 per cent. Finally, it seems that political shocks or other economic forces can effect on TSE price index in Iran.

Key Words: *Stock Price Index, Macroeconomic Variables, VAR Model,*
JEL Classifications: G10, G15,

1. INTRODUCTION

Stock market is affected by many highly interrelated economic, social, political, and these factors interact with each other in a very complicated manner. Therefore, it is generally difficult to identify the effective factors on stock price index. Over the past few decades, the interaction of stock market and macroeconomic variables has been an interesting case study for the relationship between macroeconomic variables and stock market in both developed and developing countries. It is often argued that stock prices are determined by some of macroeconomic variables such as the interest rate, the exchange rate, the inflation rate, and money supply. Anecdotal evidence from the financial press indicates that investors generally believe that monetary policy and macroeconomic events have a large influence on the volatility of the stock price (Gan *et al*., 2006). This implies that macroeconomic forces can influence

investors' investment decision and motivated many researchers to investigate the relationship between stock price and macroeconomic variables.

Iran is one of developing countries and its stock market has not improved. Therefore, there is not appropriate theory to explain behaviors of Tehran Stock Exchange (TSE). Several studies have attempted to capture the effect of economic forces on TSE price index. Mohammadi and Taghavi (1999) used some macroeconomic variables to explain TSE price index. They utilised the Vector Autoregressive (VAR) model and found that share of macroeconomic variables such as house price index, means of transport price index, and free market exchange rate in fluctuation of stock price index are about 13 per cent. In this paper, we examine that how does the TSE price index respond to a change in macroeconomic variables? We analysis the relationship between stock price index and a set of three macroeconomic variables using Unrestricted Vector Autoregressive (VAR) model and other its tools such as Impulse Response Functions (IRF), and generalized Forecast Error Variance Decomposition (FEVD).

The remainder of the paper is organized as follows: Section 2 provides a brief review of background on the relationship between stock market and macroeconomic variables. The econometric methodology and the data used are presented in section 3. Section 4 provides time series analysis and model estimation and final section offers a summary and the conclusion.

2. BACKGROUND

An important body of research in financial economics is concerned with the forces that determine the prices of risky securities, and there are a number of competing theories of asset pricing. These include the original capital asset pricing models (CAPM) of Sharpe (1964), Lintner (1965) and Black (1972), the intertemporal models of Merton (1973), Long (1974), Rubinstein (1976) and the arbitrage pricing theory (APT) of Ross (1976). In each case a relation between expected return and one or more measures of exposure to systematic risk is derived. A third approach to asset pricing empirical work is advanced by Chan *et al.* (1985) and Chen *et al*. (1986). These studies look at pricing relative to a set of observable macroeconomic variables, or factors, selected primarily based on economic intuition.

Several theoretical and empirical frameworks have been proposed and tested in an effort to explain the relationships between inflation and stock prices in the post-war period. For instance, Fama (1981) assumes that the negative correlation between inflation and stock returns is a proxy for the positive relationship between real activity and inflation. Geske and Roll (1983) found that U.S. stock price is negatively related to the inflation rate and positively related to the real economic activity. Lee (1992) argues that stock returns appear to explain economic activity but not to inflation, in the presence of interest rates, and that inflation does not seem to explain variations in real economic activity.

Fama and Gibbons (1982) examine the relationship between inflation, real returns and capital investment. They suggest that this relationship arises with share returns duo to a positive relationship between expected real returns on financial assets and real activity.

Regarding the causal linkages between monetary policy and stock returns, the evidence is mixed. For instance, some researchers (e.g., Bernanke and Gertler, 1999) contend that the central bank should pay attention to asset price inflation since the targeting of inflation, by properly setting interest rates, will stabilize asset prices in turn. Cogley (1999) goes further by suggesting that intentional attempts to deflate asset bubbles may actually destabilize the economy. By contrast, Fair (2000) argues that traditional monetary policy moves may be unable to correct asset price disturbances. Another strand of empirical research on the linkages between monetary policy and the equity market examines the issue of whether monetary policy can improve economic performance by paying attention to asset prices. Here, the evidence is again mixed. For instance, while some authors (e.g., Cecchetti, 1998, Chami *et al*., 1999) find evidence that central bankers can indeed contribute to economic stability and growth by targeting asset prices, others (e.g., Filardo, 2000) find little evidence that concentrating on asset prices the Fed do much to improve the economic activity.

Many economists examined the relationship between foreign exchange rate and stock prices during the last two decades. But, results are mixed. For instance, Aggarwal (1981) found positive relationship between foreign exchange rate and US stock prices, while, Soenen and Hennigar (1988) detected negative correlation between the two variables.

3. METHODOLOGY

Iran is one of developing countries and its stock market has not improved. Therefore, there is not suitable theory to explain behaviors of TSE in Iran. The empirical methods employed in this paper are standard tools obtained from Vector Autoregressive (VAR) model. This approach provides a parsimonious yet insightful specification to treat the problem at hand. Although some critics remark that such method may resemble econometrics without a baking economic theory, VAR analysis has been employed in a wide range of economic problems where the dynamic impact of shocks need to be estimated, mostly in macroeconomics. The specification includes 4 variables: TSE price index (TSI), consumer prices index (CPI), free market exchange rate (FER) and liquidity (M_2). The general VAR specification is:

$$p_t = \alpha_t + \sum_{i=1}^{n} A_i p_{t-i} + BX_t + \varepsilon_t$$

Where P_t is the transformed variables vector, P_{t-i}, are the lagged variables vectors, X_t are the explanatory variables, matrices A_i, B to be estimated.

One of the advantages of VAR specifications is that it allows for the computation of Impulse Response Functions (IRF), i.e. functions of the response of any endogenous variables to one standard deviation shock in any other endogenous variable in the system. In the usual VAR toolbox, the portion of the total variance of an observed variable that is due to the various structural shocks is called variance decomposition. We use generalized Forecast Error Variance Decomposition (FEVD) to complete the analysis of system.
We used monthly data in analyses. The information is according to time series and duration of this study was in 2001 – 2007. The main source that was use for the data related to model variables is Central Bank of Iran (CBI).Table 1 reports some information about data.

Table 1: Data Used for VAR System

series [1]	Description	Unit	Source
TSI	TSE Price Index	-	CBI
CPI	Consumer Price Index	1997=100	CBI
M_2	Liquidity	Rials- Billion	CBI
FER	Free Market Exchange Rate	Rials / U.S.$	CBI

1 All the series have used as logarithmic form.

4. MODEL ESTIMATION AND INTERPRETATION

4.1. Time series analysis

The purpose of this section is to empirically examine the relationship between TSE price index and a set of three macroeconomic variables. The first step of the time series analysis is to investigate the properties of the series individually. Identifying the time series properties of the model variables enables the researchers to avoid the problem of spurious estimates. We used Augmented Dickey-Fuller (1979) test for check the order of integration of model variables.

Table 2: Results of Unit Root Test

Series	Order	ADF[1]
LnTSI	Level	-2.46
	1st difference	-5.48
LnCPI	Level	-2.38
	1st difference	-5.50
LnM_2	Level	-2.47
	1st difference	-7.77
LnFER	Level	-2.75
	1st difference	-6.97

1 Augmented Dickey-Fuller, denotes significance at 5%

With respect to the Table 2 the null hypothesis of unit root is not rejected by Augmented Dickey-Fuller (1979) test and so are the series non-stationary in the level. We conducted the same test on the first difference of these series and find them stationary.

4.2. VAR System Results

The selection of lag to VAR model is very important step. The lag order of the VAR model is selected based on Akaike Information Criteria (AIC). The order of VAR was one (Table 3).

Table 3: Test Statistics and Choice Criteria for Selecting the Order of the VAR Model

Order	LL	AIC	SBC	LR test	Adjusted LR test
4	675.75	603.75	518.45	…….	……
3	666.58	610.58	544.23	CHSQ(16) = 18.3557[.303]	14.1734[.586]
2	660.12	620.12	572.74	CHSQ(32) = 31.2574[.504]	24.1355[.839]
1	650.85	626.85	598.42	CHSQ(48) = 49.8026[.401]	38.4552[.836]
0	632.79	624.79	615.32	CHSQ(64) = 85.9174[.035]	66.3413[.396]

Source: Calculated by *Microfit* (4.0).
AIC=Akaike Information Criterion
SBC=Schwarz Bayesian Criterion

The VAR results are presented in Table 4. When we consider the TSE price index equation, we see that TSE price index with lag [DLTSI (-1)] has a positive effect and is statistically significant. In addition, coefficient of time trend variable [T] is statistically significant. However, other coefficients are not statistically significant.

It is well known when we estimate Unrestricted Vector Autoregressive (VAR) models; all the coefficients will not always be statistically significant. However, *F* statistic shows that estimated equation is statistically significant.

The main purpose of this paper was to examine the relationship between TSE price index and macroeconomic variables. Therefore, we have focused on stock price index equation in VAR system and other equations have not reported.

Table 4: OLS Estimation of a Single Equation in the Unrestricted VAR

Dependent Variable is DLTSI

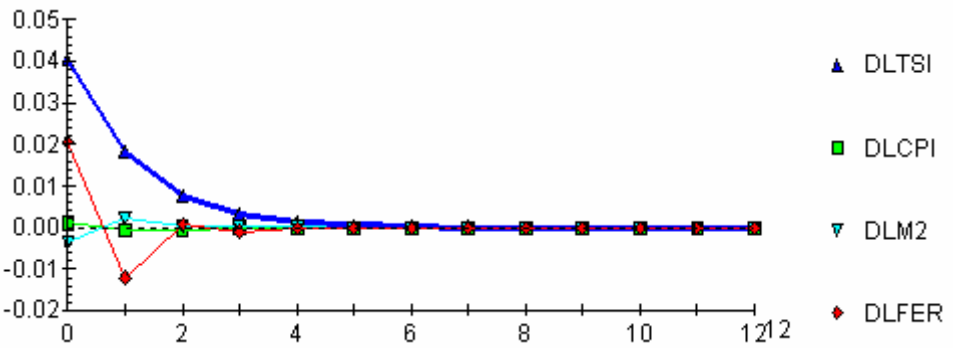
Regressors	Coefficient	Standard Error	T-Ratio [Prob]
Intercept	.00990	.030796	.77411[.235]
DLTSI (-1)	.44221	.10280	4.3017[.000]
DLCPI (-1)	.77436	.46344	1.6709[.099]
DLM_2 (-1)	.15060	.29775	.50580[.614]
DLFER(-1)	-.00329	.02767	-.11917[.905]
T	-.322E-3	.17E-3	-1.8243[.072]
R-Squared	0.29341	R-Bar-Squared	0.24692
S.E. of Regression	0.04051	F-stat. F (5, 76)	6.3117[.000]
Mean of Dependent Variable	0.01387	S.D. of Dependent Variable	0.04668
Residual Sum of Squares	0.12473	Equation log-likelihood	149.667
Akaike Info. Criterion	143.667	Schwarz Bayesian Criterion	136.446
DW-statistic	1.8612	System Log -Likelihood	680.424

Source: Calculated by *Microfit* (4.0).

4.3. Dynamic Changes in the VAR System

Figure 1, shows the impulse response graphs in VAR system and indicate that the response of the TSE price index to shocks in macroeconomic variables is weak and takes four months to die out. However, the response of TSE price index to shocks in free market exchange rate is initially positive, then becomes negatives and takes two months to die out.

Figure 1: Generalized Impulse Responses to One SE Shock in the Equation DLTSI



The variance decomposition is another tool that may use in VAR system analysis. Table 5 presents the 12-month generalized forecast error variance decomposition (FEVD) for system. Results show that share of economic variables such as consumer price index (CPI), free market exchange rate (FER) and liquidity (M_2) in fluctuation of TSE price index are about 12 per cen. In fact, the forecast error variance of the TSE price index is almost exclusively accounted for by own innovations (96 per cent). Notices that, unlike the orthogonalized FEVD, dose not add up to 100 per cent, as mentioned above.

Table 5: Generalized Forecast Error Variance Decomposition
For Variable DLTSI (Unrestricted VAR Model)

Horizon	DLTSI	DLCPI	DLM_2	DLFER
0	1.0000	.011029	.060385	.015561
1	.96842	.053490	.051303	.014673
2	.96195	.061231	.049831	.016387
3	.96048	.062784	.049520	.016708
4	.96024	.063033	.049468	.016776
5	.96020	.063077	.049459	.016787
6	.96019	.063084	.049458	.016789
7	.96019	.063085	.049458	.016789
8	.96019	.063086	.049458	.016789
9	.96019	.063086	.049458	.016789
10	.96019	.063086	.049458	.016789
11	.96019	.063086	.049458	.016789
12	.96019	.063086	.049458	.016789

Source: Calculated by *Microfit* (4.0)

5. CONCLUSION

The purpose of this paper was to examine the relationship between Tehran's stock price index and a set of three macroeconomic variables. Iran is one of developing countries and its stock market has not improved. Therefore, there is not suitable theory to explain behaviors of TSE. We used Unrestricted Vector Autoregressive (VAR) model, Impulse Response Function (IRF) and generalized Forecast Error Variance Decomposition (FEVD) to analyze behaviors of TSE price index during the period 2001-2007. The empirical results Based on time series monthly data during the period under investigation are summarised follows: First, Impulse Response Function (IRF) indicates that the response of stock price index to shocks in macroeconomic variables such as consumer price index (CPI), free market exchange rate (FER) and liquidity (M_2) is weak and takes four months to die out.

Second, the generalized Forecast Error Variance Decomposition (FEVD) reveals that share of macroeconomic variables such as consumer price index (CPI), free market exchange rate (FER) and liquidity (M_2) in fluctuations of TSE price index are about 12 per cent. In fact, macroeconomic variables don't play an important role in fluctuations of TSE price index in Iran.

Finally, these results support other studies, such as Mohammadi and Taghavi (1999). It seems that political shocks or other economic forces can effect on TSE price index in Iran.

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