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Macroeconomic Variables and Stock Price: New Evidence from Iran

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Abstract: The main purpose of this paper is to investigate the impact of macroeconomic variables such as interest rate, house price and gold price on stock price in capital market of Iran. To do so, we have used a sample of monthly data from March 2001 to April2011. The study is based upon a vector auto regression (VAR) model and Johansen-Juselius Cointegration positive relationship between stock price and house price, but the relationship between nominal interest rate and gold price with stock price are negative. Also, the results of Impulse-Response Functions shocks show that stock price reaction to the shocks is very fast. Furthermore, study of the variance decomposition indicated although most of fluctuation in stock price can be attributed to itself, but among the selected variables, the house price has main role on stock price fluctuation.

Key words: Stock market · Interest rate · Housing market · Gold market · Johansen-Juselius cointegration method

INTRODUCTION

The development o f stock market and its application in economic was accompanied by with the European industrial revolution. Due to separation of owner-manager principle, the demand for capital and also financial resources increased. This was the first factor for establishing stock exchange in industrial countries. Nowadays, Stock Exchange is the main component of economy in most developed and developing countries. Economists believe that land, labor and capital are the main factors of production and capital is one of the most important of them [1,2].

Many researchers have been done the long-run and short-run relationships among stock price index and macroeconomic variables in developed and developing countries. Empirical results show that interest rate, housing market and gold price can greatly affect the economy and stock market. Historical experience shows that in countries during period of stock market slump, the gold market always has uptrend.

According to Tehran Stock Exchange's financial data, most of the fluctuations have been happened in this market in two last decades. These fluctuations affected macroeconomic variables and stock market of Iran. Therefore, this article examines the impact of macroeconomic variables including gold price, house price and interest rate on stock price in Iran.

The rest of this paper is organized as follows: section two, the past literature is reviewed. While in section 3, describes the model and data specification. The empirical results are discussed in fourth part and finally the conclusion is stated in the fifth part.

Review of Literature: One of the most important developments on modern capital market theory accomplished by Sharpe, Mossin and Lintner, is the capital assets pricing model (CAPM). This model assumes that investors choose their portfolio based on Markowitz mean-variance criterion. This model summarizes the effect of all factors on stock market in one factor, whereas the stock market may be affected by various factors. These can be divided into macro and micro economic factors including economic development, gold price, house price, money supply, interest rate, exchange rate and internal factors of companies and economic institutes such as profit division, company agenda and so on [3,4]. In addition Arbitrage pricing theory (APT) suggested by Ross, [5] and the multifactor theory of Fama and French, [6] confirmed that each economic variables can affect stock market.

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Several empirical studies have been done on the economy of industrial and developing countries. These studies have reviewed the effect of some factors such as industrial products, inflation, exchange rate, oil price, various interest rates, money supply, income level and imports on the stock market.

Many studies investigate a relationship between interest rate and stock price. Hardouvelis, [7] has concluded that the reaction of stock price to interest rate changes would be negative using American Central Bank discount rate as a proxy of interest rate. Wasserfallen, [8] studied the effect of unexpected deviations in many economic variables on stock price index of England, Germany and Switzerland over 1977-1985. He discovered unexpected changes in nominal interest rate may have negative effect on stock price in these countries. Asprem, [9] suggests that the interest rate of long-term bond may have negative effect on stock price in 10 European countries. Kim, [10] discovered that the effect of interest rate on stock price of Standard and Poor's 500 Index is negative using Johansen cointegration analysis. Because higher interest rates cause to investors adjust their portfolio through sales stock and purchase bonds. Apergis and Eleftheriou, [11] surveyed relationship between stock price and interest rate in Greece in 1988-1999 by using instrumental variables regression. They discoveredthat the relationship is negative. Sariannidisand *et al.*, [12] using GARCH method conclude that the 10-year bond yield may have positive effect on Dave Jones stock index. Nouri and Jafari [26] examined the relationship between money suppy and economic growth in Iran during 1974-2008. They found that there is a positive and significance relationship between money supply and economic growth in Iran.

In comparison with other economic variables, not many studies have been carried on about a relationship between housing price and gold price on stock market. It is believed that housing market transformations will basically affect stock market. LiliandZuliu Hu, [13] reveal that unforeseen construction operations may have positive meaningful effect on stock price index. Chen and Patel,[14] found a relationship between house and stock price as well as several variables in Taiwan. They discover causality between house and stock prices. Green, [15] examines the relationship between house price and stock price in the united State. He found a positive relationship between these two variables. Simand chang, [16] studied the relationship between real estate prices and stock price in Korea using Vector Auto Regression (VAR) method and Granger causality test. Their finding indicates that a unilateral causality form real estate price to stock price.

Gold market is alternative to stock market. Smith, [17] reviews the relationship between gold price and stock price variables in the United States over 1991-2001. He finds the correlation between the mentioned variables may be negative. By using Johansen-Juselius method, Wang and *et al.*, [18] analyze a long-run relationship between stock and gold prices, also oil price and currency rate in Taiwan. They suggested that the long-run relationship between these variables may be negative. The relationship between Taiwanese stock price index and gold price can be positive, but it is negative between the index and both currency rate and oil price. In addition, there is causality among all variables. Mishraand *et al.*, [19] reviews causality between Indian stock market and gold price liability. The results show that there is Granger causality between stock market and gold price.

Also there have been studies on a relationship between stock price and some macroeconomic variables in Iran stock market. Taghavi and Janani, [20] studied the effect of macroeconomic variables on stock price index over 1990-1998. For this purpose, cointegration and vector auto regression methods have been used. The results indicate that there is a fragile relationship among all independent (macroeconomic variables) and the dependent variable (stock price index).Taghavi and Mohammadzadeh, [21] stated that there is a positive relationship between stock price index and both house price and exchange rate, but negative relationship between the index and money supply, private sector investment and oil price. Karimzadeh, [1] Examined long run relationship between Stock price index and Macroeconomic Variables in Tehran Stock Exchange. Some variables have been used including total price index, Exchange rate, liquidity and interest rate in this study over 1990-2002. The results indicate that there is a cointegration vector of market stock price index with Macroeconomic Variables; therefore there is a positive relationship between market stock and liquidity but a negative relationship between the index and both exchange rate and bank interest rate.

Iran capital market has been confronted with too many fluctuations affecting the whole market operations as well as its relationship with other economic branches of Iran since two last decades. Due to the importance of financial market in any countries' economy, the present study tries to investigate the effect of nominal interest rate, gold price and house price on stocks price in Iran capital market.

The Model and Data: The analysis will study the relationship between the stock price and three variables including house price, gold prices and interest rate in Iran. The data are monthly time series extracted from journals of Central Bank of Iran (4/2001-3/2011) and including the data of stock price, interest rate, house price and gold prices.

To measure stock price (SP), Tehran Exchange Dividend Price Index (TEDPIX) is used at the end of the period. The index has been computed by weighted mean based on issued current stock value. The gold price has been measured by gold coin price in the market. House price index is considered to estimate house price (HP) and nominal interest rate of five-year deposits representing interest rate (INT). In this study, we use a vector auto regressive model (VAR) to investigate relationship between the variables. The model is as follows;

$$LNSP_t = \beta_1 + \beta_2 LNGP_t + \beta_3 LNHP_t + \beta_4 INT_t + U_t$$

Before estimating the model, the stationary of the model variables will be examined by the augmented Dickey-Fuller (ADF) unit root test.The unit root test is used to detect the stationary of the macroeconomic variables under study. The test is undertaken for two cogent reasons. First, avoiding the problem of spurious regression. Second, a basic assumption underlying the application of causality test is that the time series in question should be stationary. A non-stationary series mean, variance and covariance are changing over time, so that standard t tests in regression are no longer valid.

Individual economic time series may not be stationary, but there may be cases of linear combination among them. This means that nonstationary economic time series may produce stationary relationships if they are cointegrated. To do so, we investigate stationary of time series variables. The number of optimal lags for the test is specified by Schwartz criterion, thus the number of lags has been selected by the maximum amount of Schwartz. The results of Augmented Dickey-Fuller (ADF) unit root test for the model variables are summarized as follows.

As it can be seen in Table (1), all variables are non-stationary at 0.05 significant levels. Then, the stationary test has been done on first variables differences. The data are shown in Table (2).

Regarding above table (Table 2), all variables are stationary at 0.05 significant levels after first difference.In other words, variables are integrate from order one [I(1)].

RESULTS AND DISCUSSION

Cointegration: Since the four variables are noted to be I(1). (Table 2), there exists the probability long-run equilibrium relation between these four variables. To do so, we apply cointegration tests of Johansen-juselius [22].

We are interested whether there exists at least one co-integrating vector in a multivariate test of cointegration. In other words, the rank of the coefficient matrix is at-least 1.Thus, the null hypothesis (no cointegration) is rejected, if the rank of the matrix is greater than or equal to 1. Therefore, the VAR model

Table 1: Results of Augmented Dickey-Fuller Test for Variables level

	Intercept no Trend			Intercept and Trend		
Variables	Test Statistic	Test critical value (%5 level)	Prob.	Test Statistic	Test critical value (%5 level)	Prob.
LNSP	-1.23	-2.88	0.65	-2.04	-3.44	0.57
LNGP	-1.67	-2.88	0.44	-1.68	-3.44	0.75
LNHP	-0.99	-2.88	0.75	-3.38	-3.44	0.06
INT	-1.96	-2.88	0.30	-1.98	-3.44	0.61

Table 2: Results of Augmented Dickey-Fuller Test for Variables 1st difference

	Intercept no Trend			Intercept and Trend		
Variables	Test Statistic	Test critical value (%5 level)	Prob.	Test Statistic	Test critical value (%5 level)	Prob.
LNSP	-11.60	-2.88	0.00	-11.56	-3.44	0.00
LNGP	-10.73	-2.88	0.00	-10.75	-3.44	0.00
LNHP	-12.47	-2.88	0.00	-12.47	-3.44	0.00
INT	-10.77	-2.88	0.00	-10.72	-3.44	0.00

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

Order	LL	AIC	SBC	LR test	Adjusted LR test
6	687.7322	587.7322	450.9223	------	------
5	673.5926	589.5926	474.6723	CHSQ(16)= 28.2793[.029]	22.0777[.141]
4	664.3795	596.3795	503.3487	CHSQ(32)= 46.7055[.045]	36.4631[.269]
3	658.0460	606.0460	534.9049	CHSQ(48)= 59.3724[.126]	46.3521[.541]
2	648.1514	612.1514	562.8998	CHSQ(64)= 79.1616[.096]	61.8016[.555]
1*	640.6791	620.6791	593.3171	CHSQ(80)= 94.1063[.134]	73.4689[.684]
0	-26.9800	-30.9800	-36.4524	CHSQ(96)= 1429.4[.000]	1116.0[.000]

AIC=Akaike Information Criterion SBC=Schwarz Bayesian Criterion

Table 4: Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

List of eigenvalue in descending order:				
.71576.	092609.	033323.	014476.	0000
Null Alternative Statistic 95% Critical Value 90% Critical Value				
r = 0	r = 1	34.96	28.27	25.8
r<= 1	r = 2	14.11	*22.04	19.86
r<= 2	r = 3	7.26	15.87	13.81
r<= 3	r = 4	4.24	9.16	7.53

Table 5: Cointegration LR Test Based on Trace of the Stochastic Matrix

List of eigen value in descending order:				
.71576.	092609.	033323.	014476.	0000
Null Alternative Statistic 95% Critical Value 90% Critical Value				
r = 0	r>= 1	60.58	53.48	49.95
r<= 1	r>= 2	25.62*	34.87	31.93
r<= 2	r>= 3	11.51	20.18	17.88
r<= 3	r = 4	4.24	9.16	7.53

Table 6: Choice of the Number of Cointegrating Relations Using Model Selection Criteria

List of eigen value in descending order:				
.71576.	092609.	033323.	014476.	0000
Rank Maximized LL AIC SBC HQC				
r = 0	643.75	643.75	643.75	643.75
r = 1	661.24	653.24	644.13*	648.72*
r = 2	668.29	654.29 *	634.84	646.39
r = 3	671.92	653.92	628.91	643.77
r = 4	674.04	654.04	626.25	642.76

optimum rank is estimated after specifying variables stationary. Because of monthly data, the maximum rank is considered 12. Johansen and Juselius, [22] suggest Akaike criteria (AIC), Schwarz Bayesian (SBC), LR statistics, modified LR statistics to specify the VAR model optimum rank. According to Akaike criteria and Schwarz Bayesian, the VAR model optimum degree introduced rank (1). The optimum rank (1) accepted based on LR statistics, too. Therefore, VAR (1) rank will be selected as an optimum rank.

Then the significance of the intercept has been done and it indicates that at the 5%level of confidence is significant (appendix; Table 1). Johansen and Juselius[22], suggest maximum eigen value statistics, trace statistics, Schwarz Bayesian, Hannan-Quinn and Akaike criteria to cointegrated vectors reported in Tables 4, 5 and 6.

Maximum eigen value and trace statistics, Schwartz-Bayesian, Henan-Queen criteria show a cointegrated vector representing a long-run balance relation among variables. The estimated equation and coefficient is as follows:

$$LNSP = 33.94 + 0.84LNGP_t + 0.88LNHP_t\text{-}10.88INT_t$$

These estimated long run coefficients can be interpreting as elasticity since the variables are expressed in natural logarithms.

The results shown that Long run relationship between the stock price and gold price is negative that is gold market prosperity may cause investment in stock market decrease. This consequence can be expected because gold market is an alternative to stock market. The finding will support with the obtained results by Smith [17] in the United Stated but in contrast to the result of Wang and *et al*. [18] in Taiwan. There is also a positive relationship between stock and housing prices. It would be worth expressing that housing price increases and its market prosperity may affect stock market for a short term but in a long term, investment increase in housing market can help increase demand for capital and final goods, market prosperity of production factors, inflow of companies and finally rising stock price. This finding consistent with the Green [15] in the United States, Sim and Chang [16] in Korea, Taqavi and Janani [20], and Mohammadzadeh[19] in Iran. In addition, the relationship between stock price and nominal interest rate is negative. Because, increase in the interest rate cause to increase discount rate and with respect to the standard stock assessment models cause to reduce the stock price.

wangbangbo and Sharma, [23] discovered that there is a positive relationship between short-run interest rates and stock price in Malaysia and Indonesia. This shows that short run interest rates may not consider alternative investment opportunities in these countries, in other words in stock price evaluation model, the short run interest rate could not be seen as discount rate. This finding is compatible with the obtained results by Hardouvelis [7] for the United States, Wasserfallen [8] for Britain, the United Stated and Switzerland, Asprem [9] in 10 European countries, Li Li and Zuliu Hu [11] in the United States, Nasseh and Strauss [24] in France, Switzerland, Germany, Italy, Netherland and Britain, Apergis and Eleftheriou [11] for Greece, Kim [10] for the United States and Karimzadeh [1] for Iran.

Variance Decompositions and Impulse-Response Functions: In this section, we specify a dynamic model using VAR framework and generate variance decompositions and impulse response functions to examine short-run dynamic interactions between the variables. Generally, there are two different ways of specifying a VAR when the time series under study are cointegrated-an unrestricted VAR in levels or a Vector Error Correction Model (VECM). Which specification are more appropriate remains debatable. While the VECM conveniently combines the long-run behavior of the variables and their short-run relations and thus can better reflect the relationship among the variables, there is no guarantee that imposing restriction of cointegration can be a reliable basis for making structural inferences [25]. Accordingly, with low computational burden required by the VAR in levels, we implement the VAR using the variables in levels.

Compactly, the VAR model can be expressed as follows:

$$A(L)zt = ut$$

Where A (L) is a matrix of polynomials in the lag operators and z is a vector consisting of the five variables considered. Orthogonalized innovations in each of the variables and the dynamic responses to such innovations are identified from the Cholesky decomposition of the variance-covariance matrix. For our analysis, the variables making up z are entered in the following order:

$$z = (LNSP, LNGP, LNHP, INT).$$

In Table 7, variance decompositions generated by VAR model is mentioned. Considering the table, since lots of percentage of non-stationary in LNSP can be attributed to itself, an important role of selected variables may be seen to predict stock price variance.

Among the selected variables, up to 23th period, gold price has main role in non-stationary and stock price variance. After 24th period, house price explains more percentage of stock price variance.

Valid evidence resulted from Impulse-Response Functions indicates that stock price may react to independent variables changes. Interestingly, stock price shows a negative reaction with a standard deviation in gold price, that means, gold market will have a negative effect on stock market in a short time(Fig.1). In addition, it appears that the stock price reaction to housing price changes is negative for a short run. In other words, housing market changes come along stock substitution and more investment is accomplished in housing market in a short run considering portfolio theory(Fig.2). But in Sim-Chang's study [16] in Korea, impulse-response functions indicate that abrupt shocks in real estate prices come with immediate positive reaction from stock price.

Table 7: Variance decompositions

Innovations in					
Vds	Periods	LNSP	LNGP	LNHP	INT
LNSP	1	99.51	0.27	0.06	0.16
4	95.63	2.50	0.69	1.18	
8	88.44	6.72	2.50	2.34	
12	81.46	10.47	5.29	2.78	
16	75.38	13.04	8.83	2.74	
20	70.19	14.40	12.86	2.55	
24	65.74	14.80	17.09	2.36	
28	61.92	14.62	21.23	2.22	
32	58.63	14.15	25.12	2.10	
36	55.77	13.57	28.66	1.99	
40	53.27	13.00	31.80	1.92	
44	51.08	12.47	34.56	1.88	
48	49.15	11.99	36.96	1.90	

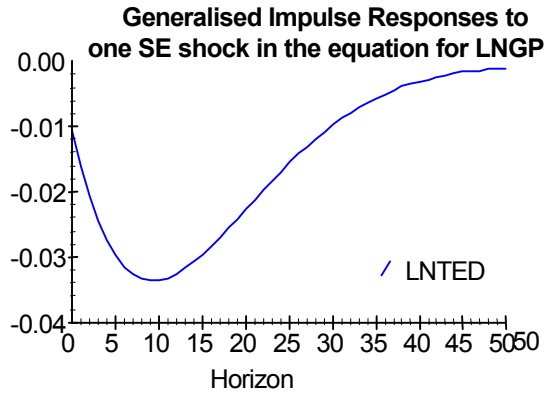

Fig. 1:

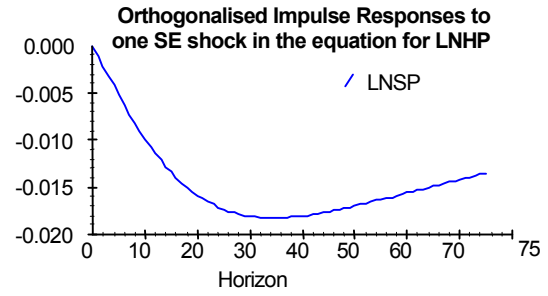

Fig. 2:

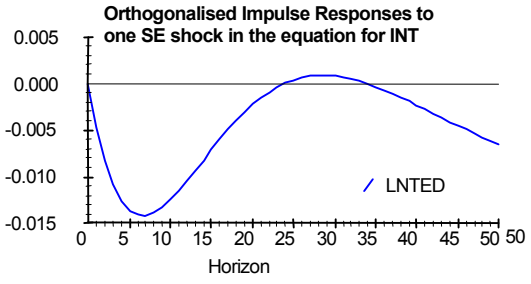

Fig. 3:

Appendix

Table 1: LR Test of Deletion of Deterministic/Exogenous Variables in the VAR

List of variables included in the unrestricted VAR:			
LNTED	LNGP	LNHP	INT
List of deterministic and/or exogenous variables:			
---------- C ----------			
Maximized value of log-likelihood = 674.0458			
LR test of restrictions, CHSQ(4)= 16.3336[.003]			

Finally, stock price may negatively react to the shocks resulted from nominal interest rate (Fig.3). It obtains the least extent up to the 7th period and then may increase. Also, stock price increases in the period of 28th through 29th and then it decreases. That means, nominal interest rate have been considered as discount rate but when gradually inflation rate rise, real interest rate, which is the difference of nominal rate and inflation rate will be declined. Therefore, the investment price which is the same interest rate may be reduced and demand starts increasing to accomplish more investment based on demand rule.

CONCLUSION

The purpose of this study is to review of the effect of gold and housing markets and long-term bank deposits on stock price in Tehran Securities Market. After clarification and estimation of the model, Johansen-Juseliuscointegration method has been used. The result indicates that there is a cointegrated vector for these variables. The estimated long-run relation shows that

there is a negative relationship between gold and stock prices. There is also a positive relationship between housing and stock prices. And the effect of nominal interest rate on stock price is negative. Real interest rate has been decreasing by nominal rate growth for study years. So, real interest rate is considered as discount rate in Iran. Finally, short-run relations among variables have been studied through variance decomposition and impulse-response functions review by using VAR. The data indicate that dynamic interaction with stock price lag to the selected variables changes may represent Iran stock market efficiency. The findings can help develop effective visions to set and fulfill government's economic policies (monetary and financial) to achieve stability in financial market. Macroeconomic variables such as gold and housing prices, interest rate and the like influence on financial market will be necessary for the government to provide appropriate atmosphere to expand financial market in Iran's economy.

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