IMPACT OF MACROECONOMIC VARIABLES ON STOCK MARKET: THE CASE OF IRAN

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Abstract

This paper investigates the relationship between a set of economic variables (i.e. inflation rate, interest rate of one-year investing deposits in state banks, interest rate of bonds and the growth rate of gold price) and Tehran Stock Exchange (TSE) indicators during April 1998 to March 2008.

The findings of VAR model & JOHANSEN co- integration test show that the relationship between inflation rate and stock return as well as growth rate of Tehran Stock Market transactions volume in long term is positive and meaningful.

Moreover, The results indicate that an increase in bank interest rate through drawing investments results in a reduction in the stock transactions volume growth and return and vice versa. So, stock and money markets can be considered as two competing and supplementary markets in the long run, but the bonds are not the competitor investment opportunity for stock and the increase in its return rate has no negative effects on Tehran stock Exchange.

The results of vector-error correction model show that in short run, gold market could be a substitute for stock market and gold return has an important role in explaining the stock market trend, but this relationship is not meaningful in the long run.

Keywords: Economic variables, Tehran stock Exchange(TSE), Vector auto-regressive model, Johansen co- integration test, Vector-error correction model.

1. Introduction

Both investors and economic decision makers for achieving their purposes need analysis of information; investors for selection the suitable market to invest and reach the

most return and economists for decision making and improvement of capital market, as one of the fundamental sections of economy. Economic information is one of the most relevant and effective information for these purposes.

Inflation affects savings and investment decisions through different channels. Since the inflation rate is high In Iran , and the interest rate don't change based on market mechanism but is determined by government, and gold price is a good protection against inflation, it is important to know how is the relationship between Tehran Stock Exchange indicators and these economic variables, and whether gold and money markets are competitors for TSE or not.

For these reasons, in this study, we examine the relationship between stock transaction volume growth and return in TSE, as dependent variable, and independent variables such as inflation rate, bank interest rate, bond return rate and gold yield. In fact, changes in these economic variables are considered as factors of market risk.

2. Literature and background

In each economy there are four markets: the goods market, the money market, the securities market and the labor market (Wongbangpo and Sharma, 2002). The sum of the goods and labor markets is named the real section of economy and two other markets make the financial section of it (financial markets). At least, because of two following reasons study about these markets is important:

First, the financial markets are influenced by the declaration of any event accrued in other markets. Each important circumstance can change financial assets' price, especially stock. Fama in Efficient Market Hypothesis implies that securities' price reflects all information available in market fairly and without any bias (Hendriksen and Vanbreda, 1992). Second, based on Markowitz' Portfolio Theory, people want to decrease risk and increase the return associated with that and they try to make a portfolio consist of suitable and various investments. Hence, they may invest in each of above markets. Therefore, these markets (i.e. gold, currency, real estate, bond or bank deposits and etc) can be a substitute for each other.

Sharp and Linter presented Capital Assets Pricing Model (CAPM) in 1961. According to them, both economy-wide factors (systematic risk) and firm-specific factors can change the stock return. CAPM is a one factor model; in other words, it encompasses only one factor named Beta as systematic risk indicator (Raei, 2008). Because the systematic risk is only risk that remains even after diversification, *Modern*

Financial Theory concentrates on its factors. Based on this theory, long term yield of individual assets reflects violation of systematic risk factors (i.e. ones derived from changes in economic variables).

As illustrated above, CAPM considers one factor for pricing the securities, but it is possible that factors other than Beta influence on asset's return. Ross (1970) in Arbitrage Pricing Theory (APT), with emphasis on more factors, represents another model for securities pricing. The main goal of this model was involving the various risk factors for explaining the stock return violation (Sekhara et al, 2000).

The primary opinion of the relationship between inflation and stock market is related to Irving Fisher. He states that the nominal return rate should move one-to-one with the expected inflation rate. Fisher Hypothesis is applicable not only for interest rate but also for every asset. For instance, its application for stock returns means that an increase in inflation rate raises nominal stock return, and investment in stock market is a protection against inflation for investors. Although, results of several researches through world are not consistent with Fisher Hypothesis and so, the relationship between inflation and return is known as the 'stock return-inflation puzzle' (Gazioglu and Bulut, 2003).

Some researchers such as Aga and Kocaman (2006) in Istanbul Stock Exchange and Hondroyiannis and Papaetrou (2006) in Greece Stock Exchange don't find an important relationship between these two variables. But many of other researches proved the Fisher theory (i.e. Sonmez (2007) in Turkey and Canada Stock Exchanges, Lotfi(1995), Razzaghi (2002), Adib (2003), Sadegh Vaziri (2004) and Dabbagh (2005) in Tehran Stock Exchange in different terms and with various methodologies). However, the results of some studies show the negative relationship between inflation and stock market return (Macmillan & Humpe , 2007 ; Liu & Shrestha , 2008 ; Sethu Durai , Bhaduri ,2009; Erbaykal et a l ,2008 ; Kyereboah-Coleman & Agyire-Tettey, 2008; Anokye & Tweneboah , 2008).

Moreover, several studies have been carried out about the relationship between gold yield and stock market. For example, Baryshevsky shows that gold 10-years average yield has high and inverse correlation with real stock return and when P/E increases, gold average yield decreases and vice versa. Also, the relationship between Treasury bill and gold yield is negative. VarErlach and Faugere(2005) show that in long run the relationship between gold yield and return of other assets such as stock is negative and gold yield moves inversely to the stock market P/E.

In respect to the relationship between interest rate and stock market, numerous researches have been accomplished and many of them indicate that there is a negative relationship between interest rate and stock return or stock price. This finding is consistent with Dividend Discount Model (Macmillan & Humpe , 2007 ; Liu & Shrestha , 2008 ; Sethu Durai , Bhaduri , 2009 ;Kyereboah-Coleman & Agyire-Tettey, 2008; Anatolyev , 2008; Anokye & Tweneboah , 2008).

3. Data and Methodology

For identification of the relationship between some of the economic variables and TSE we use the monthly data covering April 1998 to March 2008 so that sample size is 120 observations. These data were obtained from issues published by Central Bank of the Islamic Republic of Iran and annual reports of Tehran Stock Exchange. Following table shows the research's variables and their calculation method:

Table 1. variables

variables	Calculation method
Stock Market Return (Growth Rate of Tehran Dividend & Price Index)	ΔLog(TP)
Growth Rate of Stock Market Transactions Volume	ΔLog(TV)
Inflation Rate(Growth Rate of Consumer Price Index)	ΔLog(CPI)
Growth Rate of Gold Price(Gold Return)	ΔLog(GP)
Interest Rate of One-year Investing Deposits in State Banks	ID
Interest Rate of Bonds(Bond Return)	IB

Note that both ID and IB are used as measure of interest rate without the need for logarithm, because these variables represents the investment rate of return bythemselves and are stationary. But about other variables there is a need for logarithm and differentiation to reach the growth rate of them. The results of the test of integration show that all variables are stationary in level I(1).

Then we estimated two co- integration regressions. Employed method is VAR model and Johannes co- integration test and vector error correction models (VECM). These tests examine both long-run and short-run dynamic relationship between the stock market indexes and the economic variables. one of the advantages of using a VAR model is that the researcher doesn't need to provide prior assumptions about which variables are response variables and which are explanatory variables because in a VAR model all

variables are treated as endogenous and each variable depends upon the lagged values of the variables in system(Brooks , 2002).the regressions are:

$$\Delta \log(TP) = \alpha + \beta_1 \Delta \log(CPI) + \beta_2 \Delta \log(GP) + \beta_3 IB + \beta_4 ID \quad (1)$$

$$\Delta \log(TV) = \alpha + \beta_1 \Delta \log(CPI) + \beta_2 \Delta \log(GP) + \beta_3 IB + \beta_4 ID \quad (2)$$

First, for each of above equations we determined VAR model as following:

$$\Delta X_t = \beta_1 \Delta X_{t-1} + \beta_2 \Delta X_{t-2} + ... + \beta_{\rho-1} \Delta X_{t-\rho+1} + \pi X_{t-p} + U_t$$

In this model, X_t consists of following variables:

X_t = [d(LTP) , d(LTV), d(LCPI), d(LGP) , IB , ID]

In the above equation, variable X is a n vector of endogenous variables and βj is a n*n matrix of regression coefficients that estimated. The error term,U, is assumed to be independent identically distributed with a zero mean and constant variance(Brooks , 2002).

4. Empirical Results

One of the most important phases of our research is determining the appropriate lag length of VAR model, that in this research by Akiake Criterion it is identified equal 2. The lag length is corresponding to the maximum amount of Akiake Criterion.

Table2. The amount derived from Akiake Criterion and determination of appropriate lag length.

Calculation of Akiake Criterion for determination of appropriate lag length of regression 2	Calculation of Akiake Criterion for determination of appropriate lag length of regression 1	Description
AIC Statistic	AIC Statistic	order VAR
182.1696	-23.0264	0
1131.4	1429.6	1
1131.5	1437.4	2
1125.7	1429.6	3
1123.6	1428.4	4

Then the rank of matrix π for each regression, the number of cointegration vectors (long term relationship between variables), is determined 1 by Trace and Maximal Eigen Value Tests and after these vectors are estimated as below:

Estimation of

$$dLTP = -8.38 + 4.087\,dLCPI - 0.001\,dLGP + 3.963\,IB - 4.826\,ID$$
$$t: \quad (-1.612) \quad (4.976) \quad (-0.002) \quad (4.138) \quad (-4.089)$$

regression 1

Estimation of

$$dLTV = 6.13\,dLCPI + 0.152\,dLGP + 9.439\,IB - 9.714\,ID$$
$$t: \quad (5.439) \quad (0.164) \quad (7.072) \quad (-5.916)$$

regression 2

In this stage, by calculation T-statistic, it can easily be analyzed that the relationship between each of economic variables and stock market return (by coefficient of regression 1) and growth rate of stock transaction volume (by coefficient of regression 2) is meaningful or not. T statistic is calculated as this : $t = \frac{\hat{\beta}_i}{Se(\hat{\beta}_i)}$

In above equation, $\hat{\beta}_i$ is the estimated coefficient of β_i in cointegration regression and $Se(\hat{\beta}_i)$ is the standard deviation of estimated coefficient. If significant level is considered 0.05, when the amount of absolute value of test statistic is greater than 2, not null hypothesis ($H_0 : \beta_i = 0$)but alternative hypothesis ($H_1 : \beta_i \neq 0$) is accepted. This means that there is a meaningful relationship between that economic variables and stock market return and vice versa (Noferesti , 2008).

Table 3. Analysis of coefficients of regression 1(the relationship betwee

economic variables and stock market return). **Long-run Results**	**| t |**	**the amount of β**	**coefficient**
The positive meaningful relationship between inflation rate and stock return	4.976	4.087	**β_1**
Lack of any meaningful relationship between gold yield and stock return	-0.002	-0.001	**β_2**
The positive meaningful relationship between bond return and stock return	4.138	3.963	**β_3**
The negative meaningful relationship between interest rate and stock return	-4.089	-4.826	**β_4**

Table4. Analysis of coefficients of regression 2(the relationship between economic variables and growth rate of stock transaction volume).

Long-run Results	| t |	the amount of β	coefficient
The positive meaningful relationship between inflation rate and growth rate of stock transaction volume	5.439	6.13	β_1
Lack of any meaningful relationship between gold yield and growth rate of stock transaction volume	0.164	.152	β_2
The positive meaningful relationship between bond return and growth rate of stock transaction volume	7.072	9.439	β_3
The negative meaningful relationship between interest rate and growth rate of stock transaction volume	-5.916	-9.714	β_4

5.Conclusion

The findings of this study summerised as followes:

1. In the study time period, the relationship between inflation and stock transactions volume growth and return is meaningful and positive; in other words, the more inflation rate, the more return and growth rate of Tehran Stock Market transaction. This result is conformity with Fisher Hypothesis that indicates increase in inflation rate tends to increase in nominal stock return. Results of Vector-error correction model (VECM), that examines the stability of model and extracts short term relationship coefficients, don't demonstrate meaningful relationship between inflation rate and stock market (appendixes 1 & 2).

2. There is a negative meaningful relationship between bank deposits interest rate and stock market indicators. In other words, the more bank deposit return rate, the less return and growth rate of Tehran Stock Market transaction volume and vice versa. Because bank deposit interest rate is a significant index of money market, it can be found that there is a meaningful and negative relationship between stock and money markets. On this result, it can be said that each decision about interest rate in money market will affect stock market performance. Therefore, these two markets are competitor and substitute for each other in drawing idle moneys. in recent years, with this belief that decline of interest rate will improve the stock return, government has decreased the bank

interest rate However, some of these monyes depart into other markets such az real estate. The negative relationship between interest rate and stock return has been approved in all studies done in different countries.

3. There is a positive meaningful relationship between bond interest rate and TSE indicators(stock transactions volume growth and return). While it seems that the return of bond, as a substitute for investment in stock, has the negative relationship with stock market return, the result was adverse. This means that not only investment in bonds is a competitor for stock but it has an adverse role. Therefore, investment in bond has a behavior similar to stock market instead of money market. Although these securities published in money market in Iran, many of listed company in TSE invest in them; so, increase in bond return finally tends to increase in these companies return.

4. There is not a meaningful relationship between gold price and stock return as well as growth rate of stock transaction volume in 10 years period. But, the results of Vector-error correction model that correlate the short term coefficients to long term equilibrium relations, as a complementary function, demonstrated that despite lack of significant relationship in long term, gold price changes influence on stock market treatment in short run and there is a negative relationship between gold price growth and stock market return. These results indicate that in Iran, in short time,gold market is a substitute for stock market. Also, outcomes of Vector-error correction model show that if a shock from independent variables, such as growth of gold price, affects stock market return, it is adjusted gradually in each period (by rate of 14.8%) and is inclined to own long term relation. (appendixes 1&2).

Appendix no 1

Extermination of Vector-error correction model regression 1.

ECM for variable dLTP estimated by OLS based on cointegrating VAR(2)

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Dependent variable is ddLTP

118 observations used for estimation from 1998M6 to 2008M3

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Regressor	Coefficient	Standard Error	T-Ratio[Prob]
ddLTP1	.39215	.081298	4.8236[.000]
ddLCPI1	-.40428	.48932	-.82622[.410]
ddLGP1	-.25663	.11230	-2.2852[.024]
dIB1	-.050206	.21626	-.23216[.817]
dID1	-.099501	.27110	-.36703[.714]
ecm1(-1)	-.14810	.039655	-3.7347[.000]

****

List of additional temporary variables created:

ddLTP = dLTP-dLTP(-1) ddLTP1

=dLTP (-1)- dLTP(-2) ddLCPI1 =

dLCPI (-1)- dLCPI (-2)

ddLGP1 = dLGP(-1)- dLGP(-2)

dIB1 = IB (-1) - IB (-2)

dID1 = ID(-1)- ID(-2)

ecm1 = .40594* d LTP -1.6591* d LCPI + .7680E-3* d LGP -1.6087* IB +1.9593*ID + 3.4021

****

R-Squared	.23723	R-Bar-Squared	.20318
S.E. of Regression	.039655	F-stat. F(5, 112)	6.9666[.000]
Mean of Dependent Variable	.026279	S.D. of Dependent Variable	.044424
Residual Sum of Squares	.17612	Equation Log-likelihood	216.4941
Akaike Info. Criterion	210.4941	Schwarz Bayesian Criterion	202.1820
DW-statistic	1.9151	System Log-likelihood	1499.0

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Diagnostic Tests

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Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(12)= 24.3115[.018]	F(12, 100)= 2.1624[.019]
B:Functional Form	CHSQ(1)= 6.2856[.012]	F(1, 111)= 6.2454[.014]
C:Normality	CHSQ(2)= 39.3968[.000]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 10.5105[.001]	F(1, 116)= 11.3427[.001]

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

Appendix no2

Extermination of Vector-error correction model regression 2.

ECM for variable dLTV estimated by OLS based on cointegrating VAR(2)

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**************************************************************************************
 Dependent variable is ddLTV
 118 observations used for estimation from 1998M6  to 2008M3
**************************************************************************************
*
 Regressor          Coefficient      Standard Error      T-Ratio[Prob]
 Intercept          -14.0987          2.4277             -5.8075[.000]
 ddLTV1             -.13936           .10107             -1.3789[.171]
 ddLCPI1             -1.5995          6.2552             -.25571[.799]
 ddLGP1              -2.6714          1.5537             -1.7194[.088]
 dIB1                .72124           3.1007             .23260[.816]
 dID1                2.4768           3.8506             .64321[.521]
 ecm1(-1)            3.3013           .56287             5.8652[.000]
**************************************************************************************
 List of additional temporary variables created:
 ddLTV = dLTV-dLTV(-1)
 ddLTV1 =dLTV(-1)- dLTV(-2)
 ddLCPI1 = dLCPI(-1)- dLCPI(-2)
 ddLGP1 = dLGP(-1)- dLGP(-2)
 dIB1= IB (-1)- IB (-2)
 dID1= ID (-1)- ID (-2)
 ecm1 =   -.25050*dLTV +   1.5356*dLCPI +  .038167*dLGP +   2.3646*IB   -2.4335*ID
**************************************************************************************
*
 R-Squared                  .47494   R-Bar-Squared                .44656
 S.E. of Regression         .56287   F-stat.    F(  6, 111)   16.7343[.000]
 Mean of Dependent Variable  .032265  S.D. of Dependent Variable     .75661
 Residual Sum of Squares     35.1670  Equation Log-likelihood      -96.0108
 Akaike Info. Criterion    -103.0108  Schwarz Bayesian Criterion  -112.7082
 DW-statistic               2.0551   System Log-likelihood         1196.3
**************************************************************************************
                      Diagnostic Tests
**************************************************************************************
*
*   Test Statistics  *       LM Version       *       F Version        *
**************************************************************************************
**      *         *         *
* A:Serial Correlation*CHSQ(  12)=  24.5160[.017]*F(  12,  99)=   2.1636[.019]*
*               *                 *                   *
* B:Functional Form   *CHSQ(   1)=   1.3977[.237]*F(   1, 110)=   1.3186[.253]*
*               *                 *                   *
* C:Normality         *CHSQ(   2)=  .031302[.984]*      Not applicable      *
*               *                 *                   *
* D:Heteroscedasticity*CHSQ(   1)=   1.0411[.308]*F(   1, 116)=   1.0326[.312]*
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A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

6.References

1- Aga , Mehmet و Kocaman , Berna . (2006) . An Empirical Investigation of the

Relationship between Inflation , P/E Ratios and Stock Price Behaviors Using a New Series Called Index- 20 for Istanbul Stock Exchange . International Research Journal of Finance and Economics , no 6 .(www.eurojournals.com)

2- Anatolyev , Stanislav .(2008). A 10-year retrospective on the determinants of Russian stock returns . Research in International Business and Finance , no 22, pp56-67.

3- Anokye , Adam ; Tweneboah , George .(2008) . Do macroeconomic variables play any role in the stock market movement in Ghana? , online at http:// mpra.ub.nui-muenchen.de /9368/.

4- Baryshevsky , Dmitry , V . (2004) . The interrelation of the long-term gold yield with the yields of another asset classes , available at www.ssrn.com .

5-Brooks , C . (2002). Introductory Econometrics for Finance.Cambridge University

Press. United Kingdom.

6- Erbaykal ,E; Okuyan,H ; Kadioglu,O.(2008).Real Macro Economic Variables And Stock Prices : Test OF Proxy Hypothesis In Turkey. Yeditepe International Research Conference on Business Strategies , Istanbul , Turkey , June 13-15 .

7- Faugere , Christophe ; Var Erlach , Julian . (2005) . The Price of Gold: A Global

Required Yeild Theory , The Journal of Investing. (www.ssrn.com).

8- Gazioglu , Saziye ; Bulut ,Erol . (2003). Nominal stock returns and inflation : Evidence from the IstanbulStock Exchange, available at www.google.com,(mfs.rutgers.edu).Eleventh Annual conference Multinational Finance Society , ceylan intercontinental , Istanbul.

9-Hendriksen , E; Van Breda , M.(1992).Accounting Theory.Fifth Edition. The McGraw- Hill Companies.

10- Hondroyiannis , George ; Papapetrou, Evangelai .(2006).Stock returns and inflation in Greece :A Markov switching approach. Review of Financial Economics , no 15, pp 76-94.(www.elsevier.com).

11- Kyereboah-Coleman , Anthony ; Agyire-Tettey ,Kwame F.(2008). Impact Of macroeconomic indicators on stock market performance:The case of the Ghana Stock Exchange , The Journal of Finance ,Vol 9 ,No 4 , pp 365-378 .

12- Liu , Ming-Hua ; Shrestha , Keshab M.(2008).Analysis of the long –term relationship between macroeconomic variables and the Chinese stock market using heteroscedastic ciontegration. Managerial Finance , Vol 34 , No 11 , pp 744-755.

13- Macmillan, Peter ; Humpe , Andreas .(2007). Can macroeconomic variables explain long term stock market movements? A Comparison of the US and Japan.Centre Dynamic Macroeconomic Analysis Working Paper Series . (www.ssrn.com).

14-Noferesti , mohammad.(2008).Unit Root and Co-integration in Econometrics. Rasa Press, second edition. Tehran, Iran.

15-Raei , reza ; Talangi , Ahmad.(2008).Advanced Investment Management. Samt Press,forth edition. Tehran, Iran.

16- Sekhara, Rao ; Chandra , K and Radjeswari , A . (2000) . Macroeconomic Factors And Stock Prices In India : A Study , capital market conference , 21-22 December 2000 at Navi Mumbai.

17- Sethu Durai , S.Raja ; Bhaduri , Saumitra. (2009) .Stock Prices , inflation and output: Evidence from Wavelet analysis, Economic Modelling, no 26 , p1089-1092.

18- Sonmez , Saryal.F. (2007) . Does Inflation Have An Impact on Conditional Stock Market Volatility? Evidence from Turkey and Canada , International Research Journal of Finance and Economics ,no 11.

19- Wongbangpo. P; Sharma , S.C. (2002). Stock market and macroeconomic fundamental dynamic interaction : ASEAN-5 countries, Journal of Asian Economics, no 13 , p :27-51.

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