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Review

The Effect of Asymmetric volatilities of exchange rate and oil price on Stock index of Tehran stock exchange

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Abstract

The aim of this study was to investigate the asymmetric effects of exchange rate shocks on Stock index of Tehran Stock Exchange. For this purpose, we first calculated the exchange rate shocks using model General Autoregressive Conditional Heteroskedastic (GARCH), and then the effect of these shocks on the Stock index of Tehran Stock Exchange was estimated using the Generalized Method of Moments (GMM). Also, the effect of positive and negative shocks were separated and included as independent variables in the model. The results of fitting the model indicate that the effect of exchange rate volatilities on the Stock index of Tehran Stock Exchange is direct. The results of the model estimation showed that the effect of the positive and negative shocks of the exchange rate is asymmetric, so that the effect of the exchange rate increase on the Stock index of stock exchange is far greater than the effect of its reduction. Oil price volatilities have a direct relationship with the Stock index.

Keywords: Stock Index of Stock Exchange, Exchange Rate, Asymmetric, General Autoregressive Conditional Heteroskedastic, GMM model.

JEL Classification: D82,C51,E32,G00

INTRODUCTION

One of the main and most influential markets in each country is the financial market. The conditions of these markets affect heavily the real sectors of the economy and also influenced by other sectors. One of the important components of financial markets is the stock market, which is one of the most important investment channels in the world (Durandish et al., 2014). Because it is necessary to invest in countries to produce goods, and one of the ways to fund needed to make investment by companies is stock issuance (Vakili Fard and Ali Farri, 2015). In developing countries such as Iran, macro-economic variables have a high degree of volatility and instability. In countries where the exchange rate has high volatilities, investment plans, especially those projects where the bulk of its machinery and equipment is supplied through foreign imports, and the duration of the implementation of the plan is also long due to the length of implementation of plans is heavily exposed to the risk and uncertainty caused by the increase of the exchange rate and due to the high volatilities of exchange rate (rising exchange rate) and the occurrence of financial problems during the forecast period don't exploit. Problems caused by increasing volatilities in exchange rate, especially when the implementation of the plan is done through the acquisition of currency facilities through banks, creates an uncertain environment for investors and causes investors not to be able to easily and securely decide on future investment and may be unexpectedly damaged. When the exchange rate increases over time, companies that invest by taking foreign exchange facilities and exchange earnings from their exports is not impressive practically defraud to repay

bank facilities. Assuming the Marshall-Lerner condition increases the decline in exchange rate of relative competitiveness of domestic goods (Seifollahi, 2015). Therefore, to increase investment and, consequently, to achieve long-term and stable economic growth, to establish relative stability in the foreign exchange market and to pay attention to the capital market, especially the stock exchange, as one of the main pillars of the capital market and factors affecting the stock price index like the exchange rate and its uncertainty is very important. Considering that the Tehran Stock Exchange is the most important part of the Iranian capital market, knowing the factors affecting it can significantly help the decision making of investors.

Many empirical studies have examined the relationship between these two variables for different countries. For example, it is possible to refer to Aggarwal (1981) Soenen and Hennigar (1988) Jorion (1990).

Organizing article is that in the next section of the literature, the effect of exchange rate changes on the Stock index of the stock exchange will be expressed and in the third part, the background of studies conducted in this field expressed. In the fourth section, while introducing the variables used, the method and how decomposing the positive and negative shocks of the exchange rate have been introduced. In the following, we examine the asymmetric effect of exchange rate on the Stock index of Tehran Stock Exchange using the GMM pattern. In the final section of this research, we also conclude and present policy recommendations based on research findings.

Theoretical Foundations 1-2 The effect of exchange rate volatilities on Stock index

According to research conducted by Arratibel, Henrike. M(2014), arvalhoand Nechio (2015), Muellery et al., (2015), Syarifuddin et al. (2014), exchange rate volatilities can affect monetary policy through its effect on demand for money.

So that it can be divided two general views in theoretical relations between stock price and exchange rate: stock-oriented models and flow-oriented models. Dornbusch and Fischer (1980) assume with the design of “flow-oriented” models that the country’s current account and trade balance are two important determinants of the exchange rate. Accordingly, changes in the exchange rate affect international competitiveness and trade balance, and thus affect actual economic variables such as real production and income, and the current and future cash flows of companies and their stock price. According to this model, domestic currency devaluation (increasing exchange rate) will make local companies more competitive and make their exports cheaper in an international comparison. Increasing the advantage of domestic production and, consequently, increasing exports will lead to higher incomes, which in turn increases stock price of companies. Therefore, in these models, the exchange rate affects the stock price a positive relationship (Kahraman and Ozden, 2016). The second view is well-known in terms of stock-oriented models (Branson and Frankel, 1983). In these models, it is assumed that the capital account is the determinant of the exchange rate. These models include the model of portfolio equilibrium and monetary model. According to this model, the fall in stock price reduces the wealth of domestic investors which will result in lower demand for money with lower interest rates. Lowering the interest rate will lead to the outflow of capital towards markets out of country, assuming the stability of other conditions and the devaluation of the domestic currency and the appreciation of the exchange rate. As a result, there is no reason that only one of these theories to be empirical; all of the mechanisms mentioned above may have an effect simultaneously. The nature of the relationship between the stock price and the exchange rate is likely to depend on the details of the countries.

The effect of oil price volatilities on the Stock index

According to economic theories, change in the price of crude oil through the two channels of supply and demand affects the economy. The effect of the supply side can be indicative of the fact that oil is the primary substance of many products. Therefore, rising oil pricewill reduce demand for oil. The demand side also influences the economy through consumption and investment. Consumption is indirectly influenced by changes in oil price due to its positive relationship with captive income. By increasing oil price, we are witnessing the transfer of income from importing countries to exporting countries, so consumption in oil-importing countries is decreasing. Also, the increase in oil price by increasing the cost of companies has an inverse effect on investment. In addition to the effects of change in the price of crude oil through supply and demand, it also influences the economy through the exchange rate and inflation (Ekhtiyari, 2016).

Research background

Exchange rate volatilities can also affect internal stocks through monetary policy on the market. Subari and Salihu (2004) found that exchange rate volatilities affect the stock market in Nigeria. Lawal, M.; Ijirshar, U.V. (2015) also examined the relationship between exchange rate volatilities and stock market performance in Nigeria. Their findings showed that increasing volatilities in the exchange market have a negative effect on stock market performance. Lim and Sek (2014) examined the relationship between exchange rate volatilities and stock

Table 1. Descriptive statistics of the research variables

Oil	EXCHANGE	INDEX	Statistics
83.187	20957	46232	Mean
102.08	24835	52188	Median
124/64	31200	75182	Maximum
22.48	10364	18308	Minimum
30.27	8084.58	18622.73	SD
-0.047026	-0.020358	-037828	Skewness
1.5021	1.2192	1.5239	kurtosis

returns in emerging Asian countries. Their research showed that there is a relationship between the two variables of exchange rate volatilities and stock returns in Indonesia, Korea and Thailand.

A change in the exchange rate can have two different effects on stock price. On the one hand, the increase in the exchange rate (demand dimension) led to an increase in the revenue of the companies exporting the goods and, as a result, the price of their shares, and on the other (supply dimension) led to a reduction in the profit of the intermediary companies and decrease in stock price. Stock buyers, in addition to stocks, also pay attention to changes in the company's inherent value (Chi, 2009). The industries whose creation and establishing require the provision of machinery from abroad, their inherent value are affected by the exchange rate. If a company enters the machinery required at low prices, with the increase of the exchange rate, the inherent value of the company will also increase, and this inherent increase will intensify when the establishment of the same company due to the high exchange rate is unavailable, and if the products of the company are exclusive, demand for it will increase and the company's profit will increase over time. Considering the above, the demand for the stock of these companies has increased by investors, which will increase the stock price of these companies (Chung, 2009). Rault and Arouri (2009) examined the long-term relationship between oil prices and stock markets in the Persian Gulf Cooperation Council using co-integration techniques. The results showed that rising oil price has a positive effect on the stock market in these countries, except Saudi Arabia.

Specifying the pattern

The statistical population of the study includes all companies in the Stock is accepted in Tehran Stock Exchange. The variables studied in this research include the dependent variable of Stock index and independent variables including exchange rate, oil price, increasing exchange rate scaling and decreasing exchange rate scaling. Data used in this paper is daily and extracted from the Central Bank of the Islamic Republic of Iran, the website of the Stock Exchange and the World Bank.

Stock Indicator: Industrial enterprises are companies that operate in various industries such as automotive, petrochemical, basic metals, telecommunications, buildings, and so on. The Stock index indicates general level of stock price of companies active in the industrial sector. Table 1

General Autoregressive Conditional Heteroskedastic

An EGARCH or GARCH pattern was proposed by Nelson (1991). This pattern is another method for formulating conditional variance, which is:

$$(1)\ \ln \sigma^2{}_t = \omega + \alpha\left|\frac{u_{t-1}}{\sigma_{t-1}}\right| + \gamma\frac{u_{t-1}}{\sigma_{t-1}} + \beta \ln \sigma^2{}_{t-1}$$

or

$$(2)\ \ln\sigma^2_t = \alpha_0 + \alpha_1\left|\frac{u_{t-1}}{\sqrt{\sigma^2_{t-1}}}\right| + \gamma\frac{u_{t-1}}{\sigma_{t-1}} + \beta\ln\sigma^2_{t-1} \quad ,$$

$$\alpha = \omega - \alpha_1\sqrt{\frac{2}{\pi}}, \alpha_1 = \alpha$$

This model has several advantages. Of course, in this model, the dependent variable σ_t^2 is as the logarithmic, so the coefficients of the right variables can be positive or negative. Therefore, there is no need to apply non-negative constraints on the coefficients. Secondly, asymmetric shock effect in this model is considered. Because γ is the coefficient u_{t-1} that can be positive or negative. While α is a coefficient that considers only absolute value $|u_{t-1}|$. If $\gamma = 0$, then the model is symmetric and otherwise is asymmetric. The effect of positive shocks is equal to the coefficient $\alpha + \gamma$ and the effect of negative shocks is equal to $\alpha - \gamma$. Therefore, the effect of the positive and negative shocks is the same if y=0.

In Table 2, the first equation is the conditional average under which we have the conditional variance equation. At the bottom of the table, criteria such as R^2, etcis given for the conditional average equation. In the conditional variance equation (3) C represents the constant value or

Table 2. Estimation of the conditional average equation and conditional variance equation GARCH (1.1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2/567	0/345	7/23919	0.000
EXCHANG(-1)	0.88345	0.10543	8.379493	0.000
Variance Equation				
C(3)	2.43245	0.45367	5.361716	0.000
C(4)	1.23415	0.378473	3.260866	0.000
C(5)	0.64235	0.136783	4.6963438	0.000
R-squared	0.823456	Mean dependent var		38.65436
Adjusted -squared	0.818534	S.D. dependent var		35.83205
S.E. of regression	14.54329	Akaike info criterion		8.842394
Sum squared resid	5673.674	Schwarz criterion		8.134976
Log likelihood	-154.034	Hannan-Quinn criter.		7.974538
Durbin-Watson stat	1.765345			

References: Research calculations

the width of the origin (α_0) in equation (2), C(3), C (4) C (5) represent the value α_1, γ and β in equation (2), respectively. Since γ is significant and positive, so the model is asymmetric and the effect of positive shocks is more than the effect of negative shocks.

Distinction of positive and negative shocks

To distinguish between the effect of positive and negative shocks on the Stock index of the stock exchange, three nonlinear specifications for the exchange rate variable are presented: (1) non-symmetric specification (2) specification of scale (3) specifying the net increase of the exchange rate. In this paper, the method of specifying the exchange rate scale is used as follows:

The mean of the equation for the exchange rate variable

$$E_t = \alpha_0 + \alpha_1 E_{t-1} + \alpha_2 E_{t-2} + \alpha_3 E_{t-3} + \alpha_4 E_{t-4} + e_t$$

$$e_t \left| I_{t-1} \right. \approx N(0,h)$$

$$h_t = \gamma_0 + \gamma_1 e_{t-1}^2 + \gamma_2 h_{t-1}$$

The equation of variance for the exchange rate variable

$$SEPI_t = MAX\ (0, \hat{e}_t / \sqrt{\hat{h}_t})$$

$$SEPD_t = MIN\ (0, \hat{e}_t / \sqrt{\hat{h}_t})$$

Where Et is a change in the exchange rate and h_t is conditional variance.

The equation of average is AR and variance equation (1 and 1) is GARCH. SEP It shows the increase of exchange rate scaling and SEPDt shows decrease of the exchange rate scaling. According to this specification, the increase in exchange rate depends on the exchange rate volatilities (h_t). An increase in the exchange rate that occurs after a period of price stability has had more effects than the decrease of exchange rate in the previous period. The advantage of the model is that when plotting the positive and negative shocks of the real exchange rate, it considers the environment in which the price changes, which implies that the same changes in exchange rates in different environments, have different effects on the Stock index of stock exchange.

For the nonlinear specification of the real exchange rate, the method of specifying the scale with regard to the non-linearity of the real exchange rate variable should create two SEPI series (increasing exchange rate scaling) and SEPD (decreasing exchange rate scaling) for exchange rate changes. To create SEPI and SEPD, as previously stated in the scale specification, EGARCH (1.1) should be estimated for the exchange rate variable. Then the standardized residuals of this estimate should be obtained and compared it with zero. Selects the maximum between zero and these residuals and the resulting series is named SEPI. Thus, in the series, for each negative residual is zero. The other series is SEPD, which instead of positive residuals, we place zeroand instead of negative residuals, we place the residual.

The test framework is based on the Panel data auto-regression model is presented as follows:

$$INDEX_{it} = \alpha + \beta_0 INDEX_{it-1} + \beta_1 OIL + \beta_2 EXCHANGE_{it} + \beta_3 SEPI + \beta_4 SEPD + \\ + Z_i + \varepsilon_{it}$$

Where INDEX is a dependent variable and independent variables including Stock index of a previous period (INDEX), oil price (OIL), exchange rate, increasing exchange rate scaling (SEPI), decreasing exchange rate scaling (SEPD), intergroup heterogeneities (Z_i) and the ε_{it} component of error are represented.

Table 3. Results fromPanel-data unit-root tests

Statistics of test PPF	Statistics of test ADF	Statistics of test IPS	Statistics of test LLC	Length of interruption	Variable
37.4582 (0.0000)	23.6723 (0.0000)	-8.6291 (0.0000)	-6.5423 (0.0000)	0	Stock Index
110.6784 (0.0000)	94.3465 (0.0000)	-14.2341 (0.0000)	-13.9301 (0.000)	0	Exchange rate
303.5634 (0.0000)	320.4562 (0.0000)	-39.4735 (0.0000)	-34.8120 (0.0000)	0	Price Oil

*High numbers are statistical coefficients of tests for variables and numbers in parentheses are their probabilities. Source: research findings.

Table 4. Test results

Probability level	df	Value	Statistics	Tests
0.0000	6.375	15.53	F	Chow test
0.0000	1	1731.45	x^2	Bourush-Pagan test
0.0245	2	13.17	x^2	Hausman test

Source: Research findings

Estimation of the model and research findings1-5 Results of Panel-data unit-root tests

In order to study the stationary of variables, the tests of Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS), Phillips and Perron, and Dicky Fuller (ADF) D test is used. The results of the tests are presented in Table 3.

Choice between constant effects and combined effects (Chow Test)

Considering the values of the calculated statistics and their probability level, the null hypothesis cannot be accepted and therefore the model will be estimated by panel data method.

Choice between random effects and cumulative effects (LM Test)

The results in Table 4 show that the null hypothesis based on the existence of cumulative effects is rejected and therefore random effects are accepted.

Choice between constant and random effects (Hausman test)

According to the results presented in Table 4, the method of fixed effects is accepted.

Estimating the Pattern Using Generalized Torque (GMM)

The results of pattern fitting by the GMM method in Table 5 indicate a positive relationship between the Stock index of a previous period, the exchange rate and the price of oil with the Stock index. The effect of positive and negative shocks of the exchange rate on the Stock index is positive, but the effect of positive shocks on negative shocks has a greater impact on the Stock index. Positive shocks with coefficient of 0.25 have more influence on Stock index than negative shocks with coefficient of 0.03. The t-statistic shows the validity and meaningfulness of all estimated coefficients and the F-statistic indicates that the total regression is significant and therefore the null hypothesis based on the zero of all the coefficients at a significant level of 5% is rejected. Table 5

The value of the coefficient of determination in the estimated model also indicates the high power of explaining the independent variables. The results of the model estimation using the GMM method (Table 5) show that in the long run, with a unit increase in the exchange rate, the Stock index is equal to 15%, and therefore there is a positive correlation between exchange rate and price index changes. Also, by increasing oil price, the Stock index is rising, and therefore there is a direct relationship between oil price changes and Stock index. The Stock index is affected by the value of a previous day and, as seen, by increasing one unit on the previous day's index, the Stock index is also rising by about 50%. The effect of exchange rate shocks on Stock index is the asymmetric, positive shocks increase the index of the stock market Stock. Positive shocks with coefficient of 25% have a

Table 5. Model Estimation by Generalized Method of Moments (GMM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.32561	0.052670	14.22492	0.0000
INDEX(-1)	0.538954	0.037305	14.447232	0.0000
EXCHANGE	0.15734	0.0118561	8.454594	0.0000
OIL	0.089539	0.023427	0.8220423	0.0000
SEPI	0.257891	0.0979011	2.634199	0.0020
SEPD	0.002634	0.0123712	0.293749	0.8145
AR(1)	0.005620	0.0178400	0.322988	0.7299
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.71471	Mean dependent var	12.57342	
Adjusted R-squared	0.70647	S.D. dependent var	11.83452	
S.E. of regression	6.90341	Sum squared resid	23644.01	
Durbin-Watson stat	2.15834	J-statistic	27.87964	
Instrument rank	12	Prob(J-statistic)	0.000001	

more effective effect on the stock market index than negative shocks, which, of course, is not significant, and therefore the effect of decreasing the exchange rate has no effect on the index of the stock market Stock. The t-statistic shows the validity and meaningfulness of all estimated coefficients and the F-statistic indicates that the total regression is significant and therefore the null hypothesis based on the zero of all the coefficients at a significant level of 5% is rejected. The value of the determination coefficient also indicates the high power of the explanation of the independent variables.

CONCLUSION AND POLICY RECOMMENDATIONS

As expected, the effect of exchange rate on the Stock index of the stock exchange is positive. By increasing the exchange rate, the competitiveness of domestic companies will be strengthened, and thus the effect of increasing the exchange rate will increase the profitability of the bourse companies in general. In order to create equilibrium in the stock market, the government securities should avoid the high shocks in the exchange rate by creating a balance in supply and demand, as well as increasing the internal rate of inflation, reduces the competitiveness of stockbrokers. Thus, with the decrease in sales of domestic firms, their profitability has decreased and has a negative effect on the index of the stock market Stock. Also, by rising oil price, government revenues increase from oil sale, and as a result, government expenditures expand and stimulate demand, resulting in increasing firm sales and profitability, and so increasing oil price has a positive impact on the Stock index of the stock exchange.

In Iran, where the exchange rate has high volatilities, investment projects, especially those projects where the bulk of its machinery and equipment is supplied through imports from abroad, and the duration of the implementation of the project, also due to the length of the implementation of projects is long heavily exposed to the risk and uncertainties caused by the increase of the exchange rate and due to the high volatilities of exchange rate (rising exchange rate) and the occurrence of financial problems during the forecast period doesn't exploit. When exchange rate increases over time, companies that invest by taking currency facilities and exchange earnings from their exports are not remarkable virtually unable to repay their banking facilities. So to create long-term stability in the stock market, the government should prevent severe shocks of exchange rate and high volatilities through monetary and currency policies.

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