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Investigating the Relationship between Exchange Rate and Stock Price (Case Study : iran)

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ABSTRACT

Developing countries such as Iran have a high degree of instability in their macroeconomic variables. In these countries, exchange rates, stock prices, and other significant macro variables are fluctuating compared with advanced and industrial economies, and in turn, this creates an unstable environment for investors. Therefore, to guarantee long-term economic growth, it is necessary to analyze the capital market and the key factors affecting the stock price index, such as the exchange rate and its uncertainty. This study investigates the statistical relationship between exchange rate and stock prices. Accordingly, this study utilizes data on the exchange rate and the price index of the stock exchange during the years 2008-2017 to quantify the relationship between these two variables in the Iranian market. The results of the research show that the relationship between the exchange rate and the stock price index is different. The results indicate that the exchange rate and stock prices change in the same direction, and in a long-term analysis, the change in the exchange rate depends on the change in stock prices.

Keywords: Exchange rate; Stock market; Stock exchange; Short-term fluctuations; vector auto-regression

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Introduction

Macroeconomist theory indicates that exchange rate changes will affect corporate profits, which will lead to a change in stock prices. Changes, whether positive or negative, have even more impact on companies whose incomes are primarily related to foreign markets (Zaidi et al., 2018). From the macroeconomic point of view, the reduction in stock market prices in a country will lead to an investor's sales and a decline in demand for the country's money, and ultimately lead to a devaluation (Yang, 2017). A key aspect of sustainable economic development is to obtain the necessary financial resources for a set of economic activities by utilizing national resources. In recent decades, the expansion of capital markets in developing countries has led to favorable economic growth. Developed countries indebt a large part of their developmental path to financial markets, and especially to stock markets (Nieha and Leeb, 2001).

Financial markets play an essential role in the economic growth of developing countries. One of the critical components of the financial markets is the stock market. The stock market is one of the most crucial investment channel so that it places at the heart of the world's commodity and securities markets. Money and capital markets are the pillars of the financial sector in a way that these markets provide resources for the real sector of the economy (Shaki and Tofiqi, 2012). Factors like increased international diversity in recent years, mutual correlation of the market returns, the gradual removal of barriers to the capital flow and foreign exchange constraints, exchange rate as well as the emergence of foreign currencies markets have become interdependent (Idimir and Demirhan, 2009). Therefore, this study is motivated by the need to investigate the impact of the stock price index on the exchange rate in markets of five selected countries from the D-8 group including Iran, Indonesia, Malaysia, Turkey, and Pakistan, which have similar economic structures. Both of these variables are important in succeeding the country's development. However, previous studies showed contradictory empirical evidence.

In general, the literature of stock market and the foreign exchange can be categorized based on the balanced portfolio effect (Bahmani, Skoie and Sohrabian, 1992) and the monetary model (Gavin, 1989). Bahmani et al. (1992) used a balanced portfolio method to analyze the effect of stock prices on the exchange rate. Stock price changes affect the exchange rate by the wealth channel and people's expectations. Reducing the stock prices will reduce the wealth of investors who have invested in equity markets, which in turn reduces investors' income. The decrease in investors' income reduces their demand for money due to reduced purchasing power (trading demand) as well as due to the reduced trade in financial markets. Reduced money demand means reduced interest rates and withdrawal of capital from the country. With the increasing demand for foreign currency, the exchange rate rises, and this way, the stock price has an adverse effect on the exchange rate (Mosaei et al., 2010).

In addition to financing the economic enterprises, the stock market plays a significant role in boosting the economic activities, monitoring the purifying enterprise's functions and their management, as well as helping to increase the growth rate of savings and investment and controlling inflation through the

proper management of liquidity. Today, the role of the stock market is evident in line with creating economic equilibrium. The stock markets have been a significant contributor to the growth and development of the countries in recent decades. However, in some cases, such as lack of obligation, government interference, and other economic and political factors, this market has been considered as a misfortune for some communities. Although stock market developments and fluctuations in the price index have been accompanied by changes in the economy and its macro variables, any changes in the variables such as interest rates, gross domestic product, investment risk, inflation rate, and exchange rate have been valid on the stock market. According to economic theories, the exchange rate is the most crucial variable in the monetary sector of the economy. This variable has created changes in its stock price index with uncertainty and instability. Also, an inverse relationship between the volatility effect of the stock price index and the uncertainty of the exchange rate has occurred. As a result, the existence of a two-way relationship between these two variables is probable (Kurihara, 2006).

Stock shares are affected by several factors, including company performance, payment, gross domestic product, exchange rate, interest rate, current account, financial supply, and employment. Meanwhile, the exchange rate is one of the decisive factors in calculating the profitability and efficiency of investment projects. The stability of the exchange rate will ensure confidence in the domestic economy, and as a result, investors will easily decide on investing in the present and future periods. The stock market and currency are among the primary indicators for assessing the country's economic condition.

Increasing investment and attracting capital to the currency market requires high stock market returns and minimal risk. The creation of favorable investment conditions is a necessity since the macroeconomic variables such as exchange rate, inflation, oil prices, etc., affect the return on the stock market. Thus, the distinction between economic variables and stock markets can be a gateway for decision-makers and future investors (Shayan, Zeynivand, et al., 2015). Typically, it is difficult to determine precisely the exchange rate in a floating exchange rate system because the equilibrium is characterized by market supply and demand; therefore, any change in the exchange rate will affect buyers' and sellers' predictions (Hoo and Motavani, 2014). Therefore, any economic activity that is dependent on the exchange rate is affected by market price fluctuations. Therefore, the exchange rate fluctuations can cause economic activity to retard (Castello, 2014).

Background

The section reviews the theoretical basis of the exchange market. Early studies on the effects of exchange rate on import prices began since the 1970s. For the first time, Daranboosh (1988) proposed an analytical model to investigate the relationship between the exchange rate and domestic prices concerning market concentration, import volume, import-substitution, and domestic production. One of the first theories in the literature of exchange rate studies is the unit price principle. This theory investigates the relationship between exchange rate changes and the general level of commodity prices. Based on this theory, assuming the existence of a

perfect arbitration efficient market and the lack of restrictions on the trading of homogeneous and similar goods with the same price per unit, the same money is exchanged in different countries. Taylor's hypothesis indicates that high inflationary conditions would lead to an increase in the exchange rate, and low inflationary conditions will slow down the exchange rate passage degree. The theory is based on the fact that countries being placed in a quiet inflation environment have reduced the final cost of producing service and goods. In this condition, it can be expected that exchange rate changes have less effect on the price of goods (Asgharpour et al., 2011).

Therefore, if an unknown parameter affects the stock market positively, then the wealth of domestic investors will increase. This phenomenon is based on the balanced portfolio investment theory that would increase demand for the currency. This demand for the common currency will drive interest rates upward, and consequently, the flow of foreign capital will be absorbed, and it will increase the value of the domestic currency. Therefore, the more optimistic the investor's perspective about the stock market in a country is the more investment in the stock market due to speculative demand and indirectly increase the country's currency value. Therefore, the effect of a balanced portfolio supports the existence of a negative relationship between stock prices and the exchange rates (T. Sayeh, 2012). Based on the monetary model of Gavin (1989), in contrast to the balanced portfolio effect, there is no relationship between the exchange rate and the stock price.

Abovafaei and Chambers (2015) used the structural vector auto-regression (VAR) model and investigated the relationship between monetary policy, exchange rate and stock prices in five countries of Central Asia, including Kuwait, Oman, Saudi Arabia, Greece, and Jordan, separately. To identify structural shocks, they used short-term and long-term constraints. Results of immediate reaction functions indicated that characteristic of various monetary policies and the stock market are specific to each country. In most countries, monetary policy and exchange rate had a significant effect on stock prices. The result of the study suggests an independent monetary policy and a flexible currency system. Liang et al. (2013) used Granger causality method and DOLS method and investigated the relationship between the stock market and the exchange market in ASEAN countries. Their results supported the Branson and Frankl stock-oriented hypothesis. Their findings indicated an adverse effect of the exchange rate on stock prices in the countries studied. Also, based on the results of the causality test of the exchange rate on the stock price, there was a one-way causality. They suggested that the monetary authorities allow the money value in ASEAN countries should be determined based on the real economy foundations. Chinzera (2011) investigated the uncertain relationship between the macroeconomic variables and stock prices using the Generalized AutoRegressive Conditional Heteroskedasticity (GARCH-VAR) models in South Africa. The findings showed the significance of a two-way relationship between these variables and, the uncertainty of macroeconomic variables, i.e., stock market volatility.

Salifo et al. (2010) investigated the effect of exchange rate fluctuations on Ghana's stock market based on empirical data from

1981 to 2007 using GARCH models and the error correction model. The results showed that the exchange rate fluctuations have a negative and significant effect on the stock price, while interest rates and inflation rates had no long-term relationship with the stock market.

Sue Katkine and Norderszkehner (2007) analyzed the dynamic relationship between exchange rate and stock price used monthly data from 1986 to 2006 and found a two-way and positive relationship between these two variables in Turkey.

Kim (2003) conducted a study on the dollar exchange rate and stock price considered both multivariate coexistence and error correction model. They analyzed the relationship between the stock market and foreign exchange in the United States from 1974 to 1998. It was showed that stock prices and exchange rates both in the long term and in the short term, have a negative correlation.

Hatami and Irandoost (2002) studied the causality between the exchange rate and the stock price used the monthly data from 1993 to 1998 to analyze the stock price in Sweden. Their results showed that Granger causality is one-way from the stock price to the exchange rate.

Rawazola and Flickatchis (1998) used co-integration methodology and Granger causality and investigated the relationship between stock prices and dynamics of the exchange rates and the channels by which exogenous impulses affect these markets in the Pacific countries. The results showed that there is a positive bilateral relationship between the stock market and the foreign exchange market.

Agarwal (1981) conducted a study on the currency rate and stock price in the USA capital markets under the condition of the hover exchange rate using monthly stock price data from 1974 to 1978. The results show that stock prices and exchange rates are positively correlated. Since no evidence can show that the two variables are correlated, other studies have suggested that in the long-term, the stock market and the foreign exchange market operate separately (Solnick, 1984; Azyr, 2006).

Given the importance of the studying the correlation between the exchange rate and stock prices, this research is conducted to analyze the data related to the exchange rate and the price index of the stock exchange in the past years to emphasize on correction of the relationship between these two variables in Iran. The research has two main hypotheses: first, in the long and short term, the growth of exchange rates and stock prices will change in the same way. Second, in the long and short term, the change in the exchange rate growth is the cause of the change in stock prices. Next section discusses the methodology used to analyze the economic variables in the studied problem.

Methodology

The methods for estimating the autoregressive model of panel vector vary according to the composition of the data. Hence, these methods can be classified into two general categories: 1) microeconomic data (panel data with large N and small T), and 2) financial data and macroeconomic of panel data with large N and large T), in which T implies the size of the time series and N indicates the number of sections (Kanova and Sisarli, 2013). The model used in this research is the panel VAR model. The period of this research is from 2008 to 2017 and the variables are tested in terms of reliability. At that time, the number of optimum lags for the Vector Auto-Regressive (VAR) is extracted by using Eviews software. The co=integration

vectors of the Johansson and Juselius tests and the normalized integral vector are determined. After obtaining long-term coefficients, an error correction mechanism is used to combine the short-run, and long-term relationship, and ultimately, the hypotheses are analyzed.

Notations of the model

The notation and the definition of the variables and parameters are summarized as follows:

f_x: Growth of the exchange rate

SI: stock price index growth (weighted mean of stock price ratios equal to the stock value at the base time, which is obtained according to the Laspeyres price index)

IR: a real interest rate of inflation - Nominal interest rate = Real interest rate

Introducing the model

The model under consideration, which indicates the long-run relationship between the growth of the exchange rate and the growth of the real price index, is defined as follows (Lu Sui and Lijuan Sun, 2017):

$$\Delta FX_t = a_0 + \sum_{i=1}^{n} b_i \Delta PS_{t-1} + \sum_{i=1}^{n} c_i \Delta IR_{t-1} + \sum_{i=1}^{n} d_i \Delta FX_{t-1} + \gamma_1 PS_{t-1} + \gamma_2 IR_{t-1} + \gamma_3 FX_{t-1} + \varepsilon_1 \quad (1\text{-}4)$$

$$\Delta PS_t = w_0 + \sum_{i=1}^{n} g_i \Delta FX_{t-1} + \sum_{i=1}^{n} h_i \Delta IR_{t-1} + \sum_{i=1}^{n} k_i \Delta PS_{t-1} + \delta_1 PS_{t-1} + \delta_2 IR_{t-1} + \delta_3 FX_{t-1} + \mu_1 \quad (2\text{-}4)$$

$$:\gamma_1 = \gamma_2 = \gamma_3 = 0, \delta_1 = \delta_2 = \delta_3 = 0$$

The purpose of this study is to examine the effectiveness of the growth of the exchange rate on stock index growth based on VAR. VAR was originally generalized by Sims in 1980 as general results of single-variable auto-regressive models. VAR is a collection of regression models (that is, there are more than one independent variables) that can be considered as a kind of link between single-variable time series models and simultaneous equation models. An essential feature of the VAR model is its flexibility and straightforward generalization. This model can also be extended to cases where the model includes first-order difference items and co-integration relationships. In the estimation of the VAR pattern, the following processes should be performed:

1. Analyzing variable durability.
2. Selecting the optimal lags in the model
3. Investigating the long-term relationship between variables (Nofarasti, 1999).

Research results

The reliability test of variables

Co-integration methods based on the VAR model are based on the assumption that the indigenous variables are all first order co-integrated variables that is they have a single root and will be valid with one differentiation. Therefore, before testing these methods, the unit root test should be performed. Based on this assumption, a time series variable is reliable when the mean, variance, and self-correlation coefficients remain constant over time. Table 1 shows the result of the Dickey-Fuller test for variables level.

Table 1: Dickey-Fuller test for variables level

Variables	Intercept	Trend	ADF	1% level	5% level	10% level
FX	Have	Do not have	-7.722883	-3.491345	-2.888157	-2.581041
PS	Have	Do not have	-5.022323	-3.487046	-2.88629	-2.580046
IR	Have	Do not have	-4.273513	-3.48755	-2.886509	-2.580163

Source: Based on ADF tests that have been computed by using Eviews software.

Determining the optimal number of lags

The first step of estimating the model is to determine the number of optimal lags that are selected by the Schwartz-Bayesian (SBC) criterion for the exchange rate growth function of two lags, which is shown in table 2.

Table 2: Different values of criteria to determine the variability of the VAR Model for the exchange rate growth function

Rank	LR	AIC	SBC	HQ
0	NA	0.000692	1.238043	1.370003
1	226.4176	9.68e-07	-5.337507	-4.809667*
2	21.67816*	7.65e-07*	-5.585030*	-4.661310
3	5.805128	1.04e-06	-5.308304	-3.988705
4	13.43080	1.01e-06	-5.392252	-3.676773

Source: Based on the VAR optimum grade test by Eviews software, which is summarized.

First hypothesis test

As mentioned previously, the first goal is to achieve a long-term equilibrium relationship between the exchange rate growth and the stock index growth for the period of 2006 to 2015. At this stage, the co-integration vector and the normalized vector by the Johansson method is obtained, which reflects the long-term equilibrium relationship between the two variables. The results are presented in Table 3.

Table 3: Johansson Cointegration Test Results

Variable	Normalized vector

FX	-1
PS	18.59101
IR	21.37454-
C	12.37668

The first hypothesis suggests that "in the long term, the growth of the exchange rate and the growth of the stock index will change in one direction."

$$Wrd = \alpha + \beta A\inf$$

$H_0 : \beta \leq 0$

$H_1 : \beta \succ 0$

To test this hypothesis, the maximum likelihood ratio (LR) test is used with a distribution of χ^2 at a significant level of 5%, and the rejection of the null hypothesis will be the same as a confirmation of the first hypothesis of the research.

FX = 18.59101PS -21.37454 IR + 12.37668

The above equation shows the direct relationship between the growth of the exchange rate and the growth of the stock price index and the inverse relationship between the exchange rate and the real interest rate.

Impulse Response Function

The most crucial point towards the autoregressive models is to study the effects of shocks on variables. We analyze the effects of shocks of explanatory variables.

Figure 1: Impulse Response Function in line with shock from explanatory variables

Figure 1 shows the shock of the growth of the stock price index and the real interest rate on the exchange rate. According to the obtained results, if a shock exceeds up to one standard deviation by the growth of the stock price index, then the first period will have a negative effect on the exchange rate and this effect will continue until the fifth period. At the fifth period, it will have an ascending trend and will continue until the last period of this trend. Also, if the shock is equal to one standard deviation through the real interest rate, it will have a positive effect on the growth of the exchange rate and this trend will continue until the end of the period.

Analysis of variance

This section provides the variance analysis to show how much of the percentage of the variance of predictive error can be explained by the variation of the variable itself and by variations of other variables.

Table 4: Analysis of the variance of the growth of the exchange rate

Period	S.E.	FX	PS	IR
1	0.322922	100.0000	0.000000	0.000000
2	0.434665	94.66092	5.224616	0.114460
3	0.519647	94.33360	5.467319	0.199076
4	0.589004	95.16710	4.651488	0.181407
5	0.648917	96.00860	3.841766	0.149633

6	0.701905	96.50841	3.354801	0.136785
7	0.748945	96.66752	3.208623	0.123853
8	0.790699	96.54046	3.344000	0.115538
9	0.828088	96.12041	3.710945	0.168645
10	0.862300	95.34595	4.289257	0.364790

The first row of Table 4 shows that in the first period, the entire variance of the error is justified by the variable of the exchange rate growth itself. In the second period, 94.66% of the variance of error in the growth of exchange rate, is justified by the variable itself, 5.22% of the error variance is explained by the growth of the stock price index and 0.11% by the real interest rate variable. In the subsequent periods and eventually in the last period, 95.34% of the error variance in the growth of the exchange rate is justified by the variable itself, 4.28% is justified by the growth of the stock price index and 0.36% by the real interest rate.

Error Correction Model

The co-integration between sets of economic variables provides a statistical basis for error correction patterns. The main reason for this model reputation is that it relates short-term fluctuations of variables to long-term equilibrium values. These models are, in fact, some partial adjustment models that measure long-term relationship with the input of reliable residue, effective forces in the short run, and the speed of approaching the long-term equilibrium value.

The estimation of the error correction model consists of two steps: the first stage involves estimating a long-term relationship and ensuring that it is not false. The second phase also uses the residue lag of the long-term relationship as the coefficient of error correction.

If there is a long-run relationship between the two variables of X_t and Y_t, one can use an error term, u_t, to link the short-run behavior of Y_t to its long-term equilibrium values. To do this, one can set the following pattern:

$$\Delta Y_t = a + b\Delta X_t + cU_{t-1} + e_t$$

In this equation, Y_t is related to the previous period error, and since X_t and Y_t are the first order I (1), their first-order difference is stable. As a result, the model can be estimated without worrying about false regression to the ordinary least squares (OLS) method. The error term C indicates the adjustment speed to the equilibrium and is expected to be negative.

Although the OLS estimators are consistent with the co-integration regression, these distributions are not normal and are strongly dependent on other model parameters. To test the meaningfulness of the overall regression, the t-statistic for coefficients meaningfulness and F statistic are used. Alternatively, by estimating the error correction pattern, we can examine the short-run dynamic variations of each of the variables.

Table 5: Estimated coefficients of vector error correction pattern

Regressor	Coefficient	Standard error	stat T

FX	-0.028	(0.02884)	[-1.00352]
PS	0.0089	(0.00480)	[1.87152]
IR	-0.0059	(0.00279)	[-2.14772]

Source: Based on the ECM test by using the Eviews software

It can be seen that the coefficient of the negative error term is statistically significant and equal to 0.02. Thus, it can be concluded that according to the error correction term during each year, 0.02% of the imbalance of a period in the exchange rate, will be reduced in subsequent periods. In other words, this coefficient shows that any imbalance created in the long-term relationship with a rate of 0.02 is adjusted by a change in the growth of the exchange rate and thus the economic balance is slow.

Hypothesis test results

The second hypothesis implies that, in the long run, a change in the rate of the exchange rate is the cause of the change in stock price index growth. Regarding the durability of the variables, a stable VAR model is estimated with an optimum lag and Granger's linear causality test. The results of Granger causality test are shown in Table 4-6. The null hypothesis (H_0) is expressed as follows: The change in the rate of exchange is the cause of the change in stock price index growth. The results show of a unilateral causality relation of the change in exchange rate shows the cause change in stock price index growth at a significant level of 10%.

Table 6: The results of the linear causality test

Df	F- value	P-value
2	2.66	0.46
2	8.33	0.05

In the second hypothesis, based on the t-statistic value, the null hypothesis is rejected at 5% significance level, which indicates the confirmation of the second hypothesis of the research. As can be seen, in general, it can be said that both hypotheses of the research are verified.

Conclusion and future research

According to the results, the significance of the first hypothesis is confirmed. It can conclude that, in both the long and the short run, the growth of the exchange rate and the growth of the stock price index change in the same direction. The research results are consistent with those obtained by Affalikatis et al. (2005) and Frederick et al. (2014).

The second hypothesis is also confirmed. The model outcomes indicate that, in both the short and long term, the change in the growth of the exchange rate is due to a change in the stock price index. The results of this study show that 55% of the companies surveyed are affected by the change in the exchange rate, the results of which are similar to the results of this hypothesis.

This study has several limitations that necessitate further research. First, it is suggested that the effect of currency rate transitivity should be tested on each industry index. In future research, the extent and manner of this transmission can be identified by performing this test. Thus,

the developed model of this research can predict the fluctuations of firms in the financial intermediation index. Second, the performance of the developed VAR model can be compared with other models so that the effectiveness of each model is measured precisely. Finally, the researchers suggest that the design of conceptual and mathematical models should be developed in order to develop this research, and these models can be used to predict the situation of the capital market and its parallel markets.

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