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Posted Date: 27 May 2024

doi: 10.20944/preprints202405.1712.v1

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The Relationship between Exchange Rate, Interest Rate, and Tehran Stock Exchange Dividend and Price Index (TEDPIX)

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Abstract: One of the factors in the mobility of a nation's economy is the stock exchange which plays a decisive role in sustainable economic development. Accordingly, and for the special place of the stock exchange in the economy, we decided to investigate the relationship between the interest and exchange rates and the Tehran stock exchange dividend and price index (TEDPIX). Using the autoregressive distributed lag method, the present study is conducted utilizing the annual data over the period of 1991 to 2020. The results indicate that the exchange rate has a positive long-run relationship with the TEDPIX, but no statistically significant relationship was found between the TEDPIX and the interest rate. Furthermore, the results of the estimation of the error correction model show that 30.786% of the disequilibrium in each period is adjusted to the long-run equilibrium.

Keywords: tehran stock exchange dividend and price index (TEDPIX); exchange rate; interest rate; ARDL model; error correction model

1. Introduction

Over the past few years, macroeconomists and financial researchers have found that macroeconomic variables can change the stock price (Dritsaki, Bargiota, & Dritsaki, 2004). An important reason for this influence is the liberation of money markets and the technological developments that justify the relationship between the stock, foreign exchanges, and money markets (Tiwari, Andries, & Ihnatov, 2013). As stock markets are highly intertwined with the economy of most nations, and since the stock exchange index is becoming an indicator of the health of a nation's economy, experts and academics have tried to formulate some theories to describe the performance of stock markets.

The interest and exchange rates are among the factors that influence stock markets. Theoretically, there is a negative correlation between the interest rate and the stock price. The basis for this theory is as follows: due to an inverse relationship between the interest rate and the present value of expected future stock returns, the higher the interest rate, the lower the present value of expected future stock returns, and subsequently, the lower the stock price. On the other hand, when interest rates are low, the opportunity cost of borrowing becomes lower, and it motivates economic activities and increases the stock price (Hamrita & Trifi, 2011).

In recent decades, an increase in international diversification, certain decisions such as reducing foreign exchange restrictions, and the adoption of more flexible exchange regimes in emerging countries have raised the dependency between stock and exchange markets. Accordingly, there are two views regarding the relationship between the exchange rate and the stock price (Azizi, 2015). According to the traditional view, the rise in the exchange rate accompanied by national currency depreciation increases the competitive potential and exports of firms. Consequently, it results in higher profits for firms and higher stock prices in the short run. The portfolio adjustment view (movements in the foreign capital or inflows and outflows of foreign capital) is another view that is worth mentioning here. The basis of this view is the stock price fluctuations, and it occurs when stock

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prices change in a way that the rise in stock prices will attract foreign capital, and the decline in stock prices will result in the loss of foreign capital that subsequently reduces the firm's wealth, and eventually, the country's wealth. As a result, the demand for money will decrease, and the country's economic authorities reduce the interest rate to enhance the situation. When the interest rate is low, there will be an outflow of capital from the country to other nations with higher interest rates. Therefore, it can be stated that according to the portfolio adjustment theory, any decline in stock prices leads to the depreciation of the currency value (Mgammal, 2012).

On account of various theories about the relationship between macroeconomic variables and the stock price, numerous studies have been carried out on the subject. Amarasinghe and Amarasinghe (2015) investigated the dynamic relationship between interest rate and stock price (empirical evidence from the Colombo stock exchange), and they showed that there was a one-way causality from the interest rate to the stock price using the Granger causality test. In addition, the results of running a regression analysis on the stationary dataset to investigate the Granger causality test showed that there was a significant negative relationship between the interest rate and the stock price. Ali (2014) found that the interest rate negatively influenced the stock market. According to that study, one of the main reasons behind the negative impact of the interest rate on the stock market was that higher interest rates and access to risk-free profits left no desire for investors to invest in the stock market.

In a study to investigate the effects of exchange and interest rates on the Nigerian stock market, Okoli (2012) showed a negative relationship between the exchange rate and the stock market returns. According to this work, an increase in exchange rates reduced stock market returns, and as a result, the stock market activity proceeded in a downward trend. In addition, the study revealed a negative relationship between the interest rate and the stock market returns. According to Kutty (2010), there was a short-run relationship between the stock price and the exchange rate. The results of the Granger causality test indicated a short-run relationship leading from the stock price to the exchange rate. However, the study found no long-run relationship between these two financial variables.

Bahmani-Oskooee and Sohrabian (1992) found a bidirectional causal relationship between stock prices measured by the S&P 500 index and the effective exchange rate of the dollar in the short run. However, the cointegration test showed no long-run relationship between these two variables. Khan (2019) showed that the exchange, interest, and inflation rates had a statistically significant and negative impact on the stock returns of the Shenzhen stock exchange. In addition, Olugbenga (2012) revealed that the exchange rate had a significant impact on the Nigerian stock market both in the short and long runs. The implication of this was that the exchange rate had a positive impact on the Nigerian stock market in the short run, but there was a negative relationship between the two variables in the long run. Based on the given evidence, the current study aimed to investigate the relationship of the interest and exchange rates with the TEDPIX.

2. The Data and Model Specifications

The present study used the ARDL method to investigate the relationship between the interest and exchange rates and the TEDPIX. Moreover, all the data used in this work were based on the data obtained from the Central bank of Iran and the Iranian Ministry of Economic Affairs and Finance (Azizi and et al, 2023).

$$lnTSI_t = \beta_0 + \beta_1 lnIR_t + \beta_2 lnEX_t + \varepsilon_t \quad (1)$$

where:

Dependent variable:

$lnTSI_t$ = TEDPIX

Independent variables:

$lnIR_t$ = Interest rate[1]

$lnEX_t$ = Exchange rate

β_0 = The constant or the intercept

β_1 & β_2 = The coefficients/parameters of the explanatory variables

ln = The natural logarithm

While the expected signs of the parameters were $\beta_1 > 0$ and $\beta_2 > 0$, the error term (ε) was assumed to be independently and identically distributed. The subscript (t) indexed time.

3. Method

3.1. Specifications of the ARDL Model

One of the tests applied to investigate the long-run relationships between variables is the cointegration test developed by Johansen and Juelius (1990). However, such techniques have certain drawbacks. For example, all the variables tested in these methods must be stationary at the same level, and the cointegration test cannot be applied to a variable at a stationary level different from the level of other variables. However, the problem was solved in the ARDL model proposed by Pesaran, Shin, and Smith (2001), and having stationary variables at different levels was no longer an obstacle to applying the method. According to this model, the variables can be tested by the ARDL method even if they need to be tested at different levels of I_1 and I_2. However, it should be noted that if the variables are stationary in the second difference, the ARDL model cannot be applied. In addition, the ARDL model has other advantages that enable it to outperform other methods; for instance, it provides more reliable statistical results and offers applicability to small samples (Turna & Özcan, 2021).

The ARDL bounds testing approach is as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta Y_{t-j} + \varepsilon_t \quad (2)$$

where α_0 is the drift component, and ε_t shows the white noise errors.

According to Equation (2), the unrestricted error correction version of the ARDL model is as follows:

$$\Delta lnTSI_t = \varphi + \lambda_1 lnTSI_{t-1} + \lambda_2 lnIR_{t-1} + \lambda_3 lnEX_{t-1} + \sum_{i=1}^{p} \alpha \Delta lnTSI_{t-i} + \sum_{i=0}^{q_1} \beta \Delta lnIR_{t-i} + \sum_{i=0}^{q_2} \gamma \Delta lnEX_{t-i} + \varepsilon_t \quad (3)$$

The long-run dynamics of the model are shown in the first part, while the short-run impacts/relationships are shown with summation signs in the second part. In Equation (3), Δ is the first difference operator, λ_i shows the long-run multipliers, φ is the drift, and ε_t shows the white noise errors (Zafar, 2020).

3.2. The Bounds Testing Procedure

According to Zafar (2020), the first step in the bounds tests is to test the null hypothesis H_0 as to the lack of cointegration i.e., $H_0: \lambda_1 = \lambda_2 = \lambda_3 = 0$ against $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$ because the F-test statistic is asymptotically distributed. Pesaran, Shin, and Smith (2001) estimated the critical values for the F-statistic in two stages. They assumed that all the variables were, on the one hand, I

[1] Due to the Islamic nature of the Iranian banking system and proscription of interest, in our study, we replaced the interest rate with the on-account interest rate of 1-year deposits.

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(0), and on the other hand, I (1). Using these assumptions, they defined the lower and upper bounds for I (0) and I (1) repressors, respectively. If the calculated F-statistic is above the upper critical value, the null hypothesis H_0 is rejected, and if it is below the lower critical value, the null hypothesis H_0 is accepted. If the F-statistic falls between the upper and lower critical values, the test is inconclusive. In the next step, after the cointegration is estimated, the long-run ARDL (p, q_1, q_2) model is derived from the following equation:

$$\Delta lnTSI_t = \varphi + \sum_{i=1}^{p} \alpha \Delta lnTSI_{t-i} + \sum_{i=0}^{q_1} \beta \Delta lnIR_{t-i} + \sum_{i=0}^{q_2} \gamma \Delta lnEX_{t-i} + \varepsilon_t \tag{4}$$

In this step, the Schwarz Bayesian information criterion (SIC) was used to select the order of the ARDL (p, q_1, q_2) model in two variables. In the third and last step, the error correction model related to the long-run estimations was estimated to obtain the short-run dynamic parameters. The model is specified as follows:

$$\Delta lnTSI_t = \varphi + \sum_{i=1}^{p} \alpha \Delta lnTSI_{t-i} + \sum_{i=0}^{q_1} \beta lnIR_{t-i} + \sum_{i=0}^{q_2} \gamma \Delta lnEX_{t-i} + \eta ECM_{t-i} + \varepsilon_t \tag{5}$$

where α, β, and γ are the short-run dynamic coefficients of the model's convergence to the equilibrium, η is the speed of adjustment, and ECM is the error correction term defined as follows:

$$ECM_t = \Delta lnTSI_t - \varphi - \sum_{i=1}^{p} \alpha \Delta lnTSI_{t-i} - \sum_{i=0}^{q_1} \beta \Delta lnIR_{t-i} - \sum_{i=0}^{q_2} \gamma \Delta lnEX_{t-i} \dots \tag{6}$$

Note that p shows the lag of the dependent variable, while q shows the lag of the independent variable.

4. Results[2]

4.1. The Augmented Dickey-Fuller (ADF) Test for Unit Roots

Before estimating the model, it was decided to examine the stationary level of the variables. Thus, the augmented Dickey-Fuller test was used to determine the stationary level of the tested variables. Table 1 shows the results of the ADF test.

Table 1. Results of the augmented Dickey-Fuller test.

Variables	Level I (0)	1st Difference I (1)
LTSI	1.373454	-3.417993***
LIR	-2.281434	-4.434845***
LEX	1.107330	-3.915129***

The confidence level (CL) is expressed as follows: * 10%, ** 5%, *** 1%. Source: The author's calculations.

Based on the findings from the unit-roots test, it could be concluded that the variables in the present study including the logarithms of the TEDPIX ($lnTSI_t$), the exchange rate ($lnEX_t$), and the short-run interest rate ($lnIR_t$) were non-stationary at levels, and they all are integrated of order 1 or I (1). Therefore, the ARDL bounds test could be easily applied to test the long- and short-run relationships between the variables. Accordingly, the ARDL model developed to test the long-run relationship between the variables is as follows:

[2] All the calculations were performed using EViews 12.

$$lnTSI_t = \varphi + \sum_{i=0}^{p} \alpha\, lnTSI_{t-i} + \sum_{i=1}^{q_1} \beta\, lnEX_{t-i} + \sum_{i=1}^{q_2} \gamma\, lnIR_{t-i} + \varepsilon_t \quad (7)$$

4.2. The ARDL Bounds Test Results

Before estimating the long-run model using the ARDL method, the existence of a long-run relationship between the tested variables needed to be confirmed. First, the cointegration test developed by Pesaran, Shin, and Smith (2001) had to be conducted. Table 2 shows the results of this test.

Table 2. The ARDL Bounds Test (1, 0, 0) .

F-Statistic = 11.87095	K = 2	Asymptotic: n = 1000
Significance Level	**Lower limit I (0)**	**Upper limit I (1)**
10%	2.63	3.35
5%	3.1	3.87
2.5%	3.55	4.38
1%	4.13	5

Source: The author's findings.

According to the results, the statistic (11.87095) obtained from the test was above the statistics of the upper and lower bounds at the level of 1%. Therefore, it could be concluded that the null hypothesis that implies the lack of a long-run relationship at the confidence level of 99% was not accepted.

4.3. Long-Run Coefficients from the ADRL Test

As shown in Table 3, the results of the test are as follows:

The interpretation of the obtained coefficients indicated that the interest rate negatively influenced the TEDPIX, but it was not statistically significant. According to the obtained coefficients, for a 1% increase in the exchange rate, the TEDPIX rose by about 0.63%. In addition, according to the estimated model, a lag in the Tehran stock exchange had a negative impact of about 0.30% on the TEDPIX.

Table 3. The ARDL test (1, 0, 0) of long-run relationship between the variables.

Dependent variable: D (LTSI)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LTSI (-1)	-0.307086	0.094565	-3.247363	0.0033
LEX	0.635326	0.149424	4.251843	0.0003
LIR	-0.334767	0.396208	-0.844929	0.4062
C	-2.040462	0.991566	-2.057816	0.0502

Source: The author's findings.

4.4. Short-Run Coefficients Obtained from the ARDL Test

In this section, it is discussed how the short-run disequilibrium in the TEDPIX is adjusted to the long-run equilibrium. Table 4 shows the results of this test.

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Table 4. The results of estimating the error correction model (ECM) for the TEDPIX from the ARDL model (1, 0, 0) .

ECM regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
CointEq. (-1)	-0.307086	0.042109	-7.292588	0.0000

Source: The author's findings.

The absolute value of the obtained coefficient was significant, and it implied that about 30% of the short-run disequilibrium in the TEDPIX was adjusted to the long-run equilibrium in each period.

4.5. The CUSUM and CUSUMQ Tests

These tests were used to assess the stability of a model at the significance level of 5%. The results of these tests are shown in Figure 1 as follows:

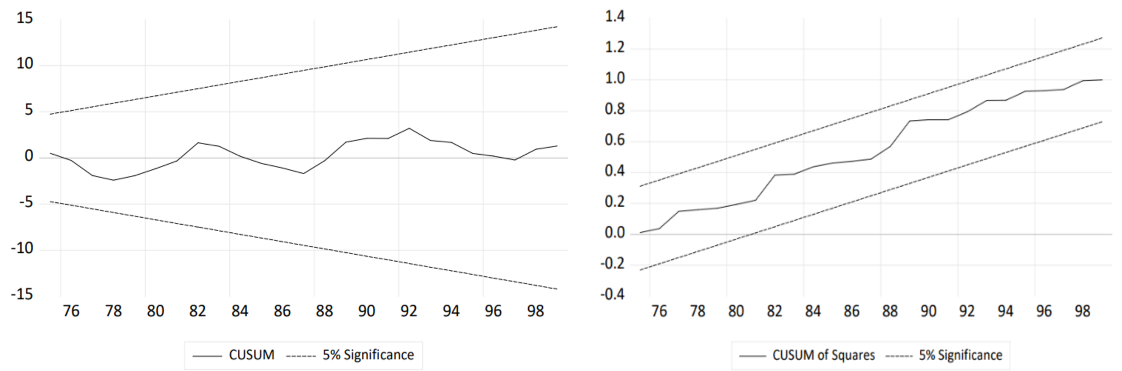

Figure 1. The results of the CUSUM and CUSUMQ tests.

The results indicated that there had been no structural instability at the confidence level of 95%.

5. Conclusions

The present study investigated the relationship between the exchange and interest rates and the Tehran stock exchange dividend and price index (TEDPIX) over the period of 1991 to 2020. The results showed that there was no significant long-run relationship between the interest rate and the TEDPIX. However, there was a positive long-run relationship between the exchange rate and the TEDPIX; thus, a 1% increase in the exchange rate resulted in a 0.63% increase in the TEDPIX. Furthermore, according to the results obtained from the error correction model, about 30% of the short-run disequilibrium in the TEDPIX was adjusted to the long-run equilibrium. One of the main reasons for a positive relationship between the exchange rate and the TEDPIX was the export-oriented nature of the publicly-traded companies on the Tehran stock exchange. Therefore, an increase in the exchange rate enhanced the potential of the companies to compete in exporting and eventually increased their profit and stock price. In addition, the direct impact of the exchange rate on the TEDPIX construed as the thermostat of the economy provided further justification to focus on the sound policy-making regarding the exchange rate.

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