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ANALYSIS OF THE RELATIONSHIP BETWEEN STOCK EXCHANGE INDEX AND THE EXCHANGE EXCHANGE METHOD: THE EXAMPLE OF TURKEY

Abstract

Exchange rates are one of the most important factors that affect the decisions and plans of all companies, especially those that engage in large and intense international trade. And the stock market is one of the channels in which the general economic situation of the countries and the effects of the political decisions taken on the economy are best monitored. This study aimed to analyze the relationship between stock market indices and exchange rates. The VAR method was used in the study to achieve this aim. For this purpose, the variables included in the analysis were investigated with the help of stationarity analysis ADF unit root tests. After ensuring the stationarity of the variables at the same level, the Granger causality test based on the VAR model was applied. In the study, the relationship between stock market indices and exchange rates was analyzed using monthly data from January 2008 to October 2021.

Keydwords: Exchange Rate Stock Index, VAR Method, Granger Causality Analysis

BORSA ENDEKSİ İLE DÖVİZ KUR ARASINDAKİ İLİŞKİNİN VAR YÖNTEMİ İLE ANALİZİ: TÜRKİYE ÖRNEĞİ

Abstract

Döviz kurları büyük ve yoğun uluslararası ticaret yapan şirketler başta olmak üzere bütün şirketlerin kararlarında ve planlarında etkili olan çok önemli faktörlerden biridir. Ve borsa ülkelerin genel ekonomik durumlarının ve alınan siyasi kararların ekonomi üzerindeki etkilerinin en iyi izlendiği kanallardan biridir. Bu çalışmada Borsa endeksleri ile döviz kurları arasındaki ilişkinin analiz edilmesi amaclanmıştır. Söz konusu amaca ulaşabilmek için çalışmada VAR yöntemi kullanılmıştır. Bu amaçla analize dahil edilen değişkenleri durağanlık analizi ADF birim kök testleri yardımıyla araştırılmıştır. Değişkenlerin aynı seviyede durağanlığı sağlandıktan sonra VAR modeline dayalı Granger nedensellik testi uygulanmıştır. Çalışmada Ocak 2008 – Ekim 2021 aylık verileri kullanarak borsa endeksleri ile döviz kurları arasındaki ilişki analiz edilmiştir.

Anahtar Kelimeler: Döviz Kuru Borsa Endeksi, VAR Yöntemi, Granger Nedensellik Analizi

1.INTRODUCTION

Stock market indices and exchange rate fluctuations have been one of the main factors affecting economic activity. Changes in exchange rates affect the international competition and trade balance and affect the income levels and stock prices of the countries. The increase in the exchange rate causes the goods produced in the country to become cheaper for the citizens of other countries, and the stock prices to increase. In this study, the US dollar and the European currency Euro were selected from the most used exchange rates in Turkish financial markets.

In this study, the relationship between stock market indices and exchange rates was analyzed with the VAR method. And it has revealed the existence of the relationship between different stock market indices and exchange rates in Turkey's rapidly growing markets. In the study, BIST100, Dollar/TL, Euro/TL, GBP/TL variables were used for the period of January 2008 – October 2021. The causality relationship between the variables was investigated with the Granger causality test based on the VAR model. In the VAR model, some assumptions must first be provided. After determining the appropriate lag length in the model established for this purpose, the LM probability test and AR unit-roots were tested. After providing all the assumptions in the model, the causality relationship between the variables was investigated.

2.Literature Review

In the literature, the relationship between exchange rates and share prices was first tried to be explained by Franck and Young (1972). In the study, the data of the years 1967 - 1971 were used. As a result of the study, no unsystematic relationship was found between exchange rates and their shares.

Aggarwall (1981) examined whether there is a relationship between the exchange rate and share prices in the US markets for the period 1974-1978. In this study, a positive relationship was found between share prices and exchange rates. The change in the exchange rate changes the profitability of the firm and affects the stock prices. This effect is stronger in the short run than in the long run.

Gao (2000) examined 80 US multinational companies and found that the unexpected decrease in the exchange rate of American multinational companies caused an increase in their stock prices.

Morley (2002) tested the relationship between stock returns and exchange rates in his study on European Union countries. As a result of the research, there is a more precise correlation between stock prices and the exchange rate for England, while talking about the relationship, this relationship is lower for the Netherlands. There is little evidence of a relationship between Italy and France. The situation for Germany looks very unstable.

Kasman (2003) in his study on Turkish financial markets, using daily data of National 100, finance, industry, and service sector indices, revealed that there is a long-term stable relationship between stock indices and exchange rate. In addition, it has been determined that the causality relationship is only from the exchange rate to the industry sector index.

Tabak (2006), according to the data of Brazil 1994 – 2000 In this study, share Karaca (2005) examined the relationship between the interest rate and the exchange rate in Turkey in a study covering the 1990-2005 period by using the ARDL boundary test. As a result of the study, a positive and significant relationship emerged between the two variables.

There is no long-run relationship between stocks and exchange rates. However, he suggested that there is a non-linear causality relationship from exchange rates to stock prices.

Doğan and Yalçın (2007) research on growth in Turkey on stock prices and exchange rates, and are confident that exporting, with the dollar exchange rate, will increase the art, decline, decline, profitability, and local value.

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Altıntaş and Tombak (2011) examined the relationship between stock prices and macroeconomic variables in a study using quarterly data covering the 1987 – 2008 period in Turkey. They found that there is a positive and significant relationship between stock prices and real exchange rates in the long run. However, a one-way short-run causality relationship was found from real exchange rate to stock prices.

İşcan (2011) conducted a study in Turkey between December 2001 and December 2009 and investigated the interaction between stock prices and US Dollar and Euro exchange rates. According to the results obtained, there is no long-term relationship between the two variables. In addition, with the Granger causality test applied, causality from stock prices to exchange rates were determined. this study supports the portfolio approach.

Paramati and Gupta (2013) examined the relationship between stock market return, interest rate, and exchange rate with the VAR model and Granger causality using data from the 1992-2011 period in India. According to the results of the study, a two-way causality relationship was determined between the interest rate and the exchange rate. In addition, a unidirectional causality relationship has emerged from the exchange rate and interest rate to the stock market return.

Moore and Wang (2014) examined the relationship between stock market returns and real exchange rates in developed and developing Asian countries with the DCC model. According to the result, a negative relationship was determined between the two variables. They also revealed that there is a dynamic relationship between both variables and the current account balances of the countries in question.

Beşel and Yardimoglu (2016), in their study, examined the relationship between consumer confidence index and exchange rate, oil prices, and unemployment for the sample of Turkey in the time of 2005:01-2014:10, using the Toda-Yamamoto causality analysis with monthly data. According to the results of the analysis, the relationship between the exchange rate and the consumer confidence index is unidirectional from the exchange rate to the consumer confidence index.

Alacahan and Yavuz (2017) examined the relationship between consumer confidence index and exchange rates by using data for the period 2008:01 and 2015:04. As a result of the applied Johansen cointegration analysis, it was revealed that there is a one-way causal relationship from the exchange rate to the consumer confidence index. In addition, in the study, it is determined that there is a long-term cointegration relationship between the exchange rate and the consumer confidence index.

Eyüboğlu and Eyüboğlu (2018) compared 24 different indices in Borsa Istanbul by using daily data for January 2011 and May 2016 in a study they conducted. They investigated the long-run relationship between dollar and euro exchange rates. According to the results of the study, a long-term relationship has emerged between the BIST Textile Leather index and the Euro and Dollar rate, and only between the Trade and Technology indices and the dollar rate.

3. Methodology

3.1. Vector Autoregression Model

The VAR model was developed by C. Sims in 1980. The var model is an economic model used to examine the relationship between variables. The VAR model is simultaneous as the variables are accepted as endogenous (Gujarati & Porter, 2012, p. 784).

There are certain stability conditions to build a good VAR model. And this stability condition has three. The presence of inverse roots in the circle, the absence of serial correlation, the absence of a variable variance problem.

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A simple VAR model consisting of two variables, X and Z, can be represented as follows (Çakmak, Aksu, & Başar 2002, p.35-36).

$$x_t = a_{10} + \sum_{t=1}^{p} a_{11.i} + X_{t-1} + \sum_{t=1}^{p} a_{12.i} Z_{t-1} + \varepsilon_{it}$$

$$z_t = a_{20} + \sum_{t=1}^{p} a_{21.i} + X_{t-1} + \sum_{t=1}^{p} a_{22.i} Z_{t-1} + \varepsilon_t$$

3.1.1- Determining the Appropriate Lag Length in the VAR Model

One of the first things to do in VAR analysis is to determine the lag length. When a longer-than-expected lag length is determined in the VAR analysis, the variables have higher values than they are. and autocorrelation errors occur (Kadılar, 2000).

3.1.2- AR Roots Table

Whether a model exhibits a stationary structure is tested with the AR Roots Table. If all modules are inside the unit circle, it can be said that the calculated VAR model has a stable and stable structure. On the contrary, if at least one of the eigenvalues of the Coefficient matrix is outside the unit circle, the calculated VAR model does not have a stable and stable structure. (Hendry and Juselius 2000, p.10).

3.1.3- Autocorrelation Test

Autocorrelation, or self-correlation, is the expression of similarity between observed values as a function of time delay. The Lagrange Multiplier (LM) test developed by Breusch, and Godfrey was used to test whether there is an autocorrelation problem in the model created for Granger causality analysis. The Lagrange multiplier test is an alternative test to Ramsey's Reset test used to determine the modeling line (Gujarati and Porter 2014, 438).

The reasons for autocorrelation are:

- Some explanatory variables not included in the model
- Incorrect selection of the mathematical form of the model
- Measurement error in the explained variable
- Data processing
- Incorrect determination of the error term

3.1.4- Granger Causality Test

Granger causality analysis was developed by Granger in 1969 and tests whether there is a relationship between the current value of one variable and the past values of the other variable. In causality tests between two variables such as X and Y, four different results emerge (Mert and Çağlar, 2019: 340).

- y is the Granger cause of x
- x is the Granger cause of y.
- There is no Granger causality relationship between x and y.
- There is a feedback process between x and y (Bidirectional Granger causality)

Granger causality analysis is done using the following two equations.

$$Y_t = \sum_{i=1}^{m} a_i Y_{t-i} + \sum_{j=1}^{m} \beta_j X_{t-j} + u_{1t}$$

$$X_t = \sum_{i=1}^{m} \lambda_i X_{t-i} + \sum_{j=1}^{m} \delta_j Y_{t-j} + u_{2t}$$

In the equation, m delay length ،u1t and u2t error It shows that the terms are independent of each other (Granger 1969, 431).

4. Findings

January 2008 – October 2021 monthly data were used in the study. Variables included in the analysis; BIST100, Dollar/TL, Euro/TL, GBP/TL variables. The study aims to analyze the mutual relationship between the stock market index and exchange rates. For this purpose, the variables included in the analysis were investigated with the help of stationarity analysis ADF unit root tests. After ensuring the stationarity of the variables at the same level, the Granger causality test based on the VAR model was applied. In the VAR model, some assumptions must first be provided. After determining the appropriate lag length in the model established for this purpose, the LM probability test and AR unit-roots were tested. After providing all the assumptions in the model, the causality relationship between the variables was investigated. In addition, variance decomposition results of the variables were examined. As can be seen from Table 1, the series of the variables whose natural logarithms are taken are stationary.

Table 1. ADF Unit Root Test Results for Level and Log Values of Variables

	Level				**Log**			
	Fixed		Fixed and Trending		Fixed		Fixed and Trending	
Variable	**t-statistics**	**Possibility**	**t-statistics**	**Possibility**	**t-statistics**	**Possibility**	**t-statistics**	**Possibility**
BIST100	-1.472609	0.6703	-2.277196	0.4435	-11.34467	0.0000	-11.47514	0.0000
DOLLAR /TL	-2.494159	0.1750	-2.643777	0.1524	-11.43609	0.0000	-11.48724	0.0000
Euro/TL	-2.879494	0.1491	-3.122617	0.1022	-16.10874	0.0000	-16.19957	0.0000
GBP/TL	-3.469933	0.0927	-3.142739	0.09975	-12.64410	0.0000	-12.88036	0.0001

The appropriate delay number of 7 for the VAR model established in the study was determined with the help of AIC, FPE, LR tests.

Table 2: Delay Length

Lag	LR	FPE	AIC	SC	HQ
0	NA	4.86e-09	-7.790548	-7.713014*	-7.759061*
1	2.518105	5.05e-09	-7.752599	-7.364929	-7.595161
2	2.356672	5.28e-09	-7.708233	-7.010427	-7.424845
3	1.552497	5.82e-09	-7.612770	-6.604827	-7.203432
4	2.679892	5.90e-09	-7.600302	-6.282223	-7.065013
5	4.846716	5.09e-09	-7.751545	-6.123330	-7.090306
6	3.646964	4.76e-09	-7.823221	-5.884870	-7.036032
7	6.439902*	3.56e-09*	-8.119907*	-5.871419	-7.206768
8	1.434516	3.91e-09	-8.032136	-5.473513	-6.993047

It is seen that the LM probability value (probe: 0.7422) in the model with a lag length of 7 is greater than 0.05. Therefore, the H0 hypothesis that there is no autocorrelation should be accepted (Table 3).

Table 3: LM Autocorrelation Test Results

Delays	LM-Statistics	Possibility
1	2.181966	0.1491
2	1.825307	0.3093
3	1.864100	0.2877
4	2.992008	0.0184
5	2.059587	0.1946
6	1.386962	0.6084
7	1.202526	0.7422
8	2.561239	0.0597

As seen in Figure 1, the points represent the roots of the variables and are located inside the unit circle. This shows that the established VAR model is stationary.

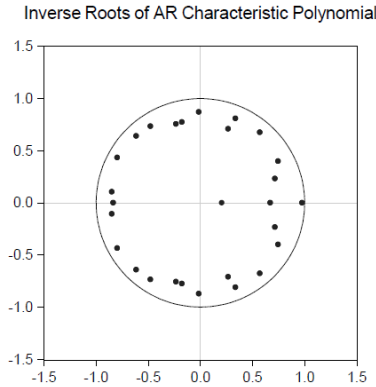

Figure 1. AR Unit Roots

The results obtained from the Granger causality analysis are shown in Table 4. Accordingly, a unidirectional causality relationship was found from the BIST100 index to DOLLAR/TL and GBP/TL variables. The results obtained from the analysis also show that there is a one-way relationship from the EURO/TL variable to the BIST100 variable. However, in the study, it was determined that GBP/TL is the cause of DOLLAR/TL and DOLLAR/TL is the cause of EURO/TL.

Table 4: Granger Causality Test Results

Parameters	Df	Possibility
EURO/TL → BIST100	7	0.0002
BIST100 → DOLLAR/TL	7	0.0117
GBP/TL → DOLLAR/TL	7	0.0041
DOLLAR/TL → EURO/TL	7	0.0233
BIST100 → GBP/TL	7	0.0065

* The values in the table are only those of the variables that are significant at the 1.5% and 10% levels. related to causality consequences. Of: Delay Length.

Table 5 shows the variance decomposition results of the variables. Accordingly, when we examine the changes for the BIST100 index, it is seen that 100% of the variance is explained by the variable itself in the first period, and this ratio continues to be high as the period progresses. However, it is seen that the BIST100 variable is mostly explained by the Euro/TL variable with approximately 9%. When we

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examine the changes in the dollar/TL variable, it is seen that the variance in the first period is explained by the variable itself with 98%. 10. As of the period, the variables that explain the Dollar/TL variable the most are BIST100 with 10.8% and GB/TL with 9.4%, respectively. According to the variance decomposition table of the Euro/TL variable, it is seen that 91.9% of the variance in the first period is explained by the variable itself. As the period progresses, 59% of the variance of the Euro/TL variable is explained by the variable itself, while 29.7% is explained by the Dollar/TL variable. In this context, it has been determined that the rate of explanation of the changes in the variance of the Euro/TL variable by the Dollar/TL variable is high. In the first period, 34.5% of the variance of the GBP/TL variable is explained by the variable itself, while 64.2% is explained by the Dollar/TL variable. As the period progresses, it is seen that the effect of the Dollar/TL variable in explaining the changes in the variance of the GBP/TL variable is high.

Table 5: Variance Decomposition Table of Variables

Variance Decomposition Table for BIST100 Period	BIST100	DOLLAR/TL	EURO/TL	GBP/TL
1	100.0000	0.000000	0.000000	0.000000
2	97.92784	1.004054	0.122777	0.945331
3	95.66814	1.377751	0.227772	2.726335
4	94.39755	1.343934	0.514134	3.744381
5	89.24234	1.367693	5.832494	3.557470
6	85.64883	1.679352	8.931312	3.740509
7	84.98722	1.945608	9.372084	3.695084
8	81.31281	4.762608	8.971501	4.953083
9	80.98104	4.858974	8.976645	5.183338
10	80.23485	5.017884	9.614592	5.132674
Variance Decomposition Table for DOLLAR/TL Period	BIST100	DOLLAR/TL	EURO/TL	GB/TL
1	1.838730	98.16127	0.000000	0.000000
2	3.166696	95.49521	0.067870	1.270221
3	6.341563	91.18782	1.130953	1.339665
4	6.757636	87.93695	1.100930	4.204481
5	9.662038	84.13430	1.058372	5.145289
6	9.837681	83.93075	1.096582	5.134990
7	9.778127	82.40501	1.872496	5.944368
8	10.68212	78.62944	1.894721	8.793717
9	10.89476	77.77779	1.854982	9.472473
10	10.89921	77.76122	1.865158	9.474410
Variance Decomposition Table for EURO/TL Period	BIST100	DOLLAR/TL	EURO/TL	GBP/TL
1	5.587722	2.443859	91.96842	0.000000

2	5.479372	3.438531	91.05939	0.022705
3	5.999826	3.761785	87.95339	2.284996
4	6.278541	3.912072	87.33751	2.471873
5	6.603503	5.308737	85.60113	2.486633
6	6.508623	5.479519	84.39862	3.613242
7	5.821060	15.69660	75.02971	3.452633
8	4.741137	30.26974	60.51582	4.473303
9	4.734172	30.19979	60.52935	4.536690
10	6.454652	29.77676	59.26928	4.499309
Variance Decomposition Table for GBP/TL Period	BIST100	EURO/TL DOLLAR/TL		GBP/TL
1	1.206073	64.24577	8.04E-06	34.54815
2	3.840818	62.19065	0.157001	33.81153
3	6.523301	59.80441	1.825995	31.84629
4	7.606357	58.49215	1.785728	32.11577
5	9.078001	56.46564	1.979338	32.47702
6	8.861720	56.54021	2.144456	32.45362
7	8.985105	56.15138	2.337298	32.52621
8	11.21927	54.58754	2.329942	31.86325
9	11.29888	54.69187	2.257372	31.75188
10	11.23658	54.63470	2.407678	31.72104

CONCLUSION

The study aims to analyze the mutual relationship between the stock market index and exchange rates. For this purpose, BIST100, Dollar/TL, Euro/TL, GBP/TL variables were used from January 2008 to October 2021. The variables included in the analysis were investigated with the help of stationarity analysis ADF unit root tests. The causality relationship between the variables was investigated with the Granger causality test based on the VAR model. According to the results obtained from the Granger causality analysis, a unidirectional causality relationship was found from the BIST100 index to DOLAR/TL and GBP/TL variables. The results obtained from the analysis also show that there is a one-way relationship from the EURO/TL variable to the BIST100 variable. However, in the study, it was determined that GBP/TL is the cause of DOLAR/TL and DOLAR/TL is the cause of EURO/TL. These results are like many studies in the literature that detect the existence of a relationship between stock market indices and exchange rates.

In the study, it is appropriate not to separate the evaluations by variance. Accordingly, the post-BIST100 is most often described in the way you describe it. The most explaining the dollar/TL assignment is islet100 with 10.8%, BIST100 with 9.4% GB/TL. While the variants of Euro/TL are determined by the variance and explained by 29%, it is explained by the 29% of TL. In this context, it has been determined that the variables in the variance of Euro/TL are like being explained from Dollar/TL.

Although the study has important contributions, the limitations create various opportunities for evaluation for future studies. In particular, the effect of the exchange rate on financial investment

instruments and their mutual relationship can be evaluated by using different methods depending on the economic development level of the country.

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