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TESTING RANDOM WALK HYPOTHESIS FOR ISTANBUL STOCK EXCHANGE

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Abstract

The primary objective of this study is to testing weak form market efficiency of Istanbul Stock Exchange. A random walk test is performed for weakform efficiency. The testing of market efficiency of the market it was used istanbul stock exchange's daily stock returns for random walk over the period from January-1995 to January-2004. Istanbul stock exchange is the well known the growing emerging market. We used in the survey Istanbul stock exchange's ISE National-30 index companies. ISE 30 indices were tested using Dickey-Fuller unit root test. For the market efficiency, a model is used that explains the market inefficiencies. We accept that ISE is inefficient because the level of trade volume and market market capitalization of shares are mostly low. In order to test weak form efficiency hypothesis, we analyzed runs tests. It is also tested Dickey-Fuller unit root test wich is well known populer test for the testing of the market efficiency. The run test is also used as a powerful tool to test of random walk in the stock market indicies. It is concluded that both the results of Dickey-Fuller tests and the results of run tests are similar and rejected random walk in ISE.

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INTRODUCTİON

The increasing importance of stock markets, especially in emerging markets is one of the most striking features of international financial development over the past two decades. Although the most important emerging markets are in Asia and Latin America, recent years have seen a number of new stock markets in Europe countries like Turkey. The the term efficiency is used to describe a market in which relevant information is impounded into the price of financial instruments. "An 'efficient' market is defined as a market where there are large numbers of rational, profit-maximizers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants. In an efficient market, competition among the many intelligent participants leads to a situation where, at any point in time, actual prices of individual securities already reflect the effects of information based both on events that have already occurred and on events which, as of now, the market expects to take place in the future. In other words, in an efficient market at any point in time the actual price of a security will be a good estimate of its intrinsic value." (Eugene F. Fama 1965).

Informational efficiency of financial markets has attracted much interest among financial scholars and practitioners. Fama (1970) has been the first to develop the Efficient Markets Hypothesis. After more than two decades, Fama (1991) reviews the voluminous theoretical and empirical work undertaken by numerous researchers on the informational efficiency of stock markets. The market efficiency theory has been intensely studied over the last 30 years. In this theory Fama put forward the principl es of market efficiency (Fama1991). The main were consolidated in 1970 by Eugene Fama in his “Efficient Capital Mar k e t s : A Review of The o r y and Empirical Work. Thi s theory well known today as the Efficient Market Hypothesis (EMH) . Fama devided market into three which indicate the market efficiey levels : weak form, semi-strong form, and strong form.

The random walk theory asserts that price movements will not follow any patterns or trends and that past price movements cannot be used to predict future price movements.

There are three forms of the efficient market hypothesis in finance literature:

1. The "Weak" form asserts that all past market prices and data are fully reflected in securities prices. In other words, technical analysis is of no use.
2. The "Semistrong" form asserts that all publicly available information is fully reflected in securities prices. In other words, fundamental analysis is of no use.
3. The "Strong" form asserts that all information is fully reflected in securities prices. In other words, even insider information is of no use.

Securities markets are flooded with thousands of intelligent, well-paid, and well-educated investors seeking under and over-valued securities to buy and sell. The more participants and the faster the dissemination of information, the more efficient a market should be.

This study aims to test the weak-form efficiency hypothesis in İstanbul Stock Exchange using Dickey-Fuller unit root test and runs test. There are many studies wich find out İSE lacks even weak-form efficiency with using diffirent methods (Balaban-Kunter 1997; Müslümov-Aras-Kurtuluş 2002). Muradoğlu and Ünal (1994) used daily data for a sample of 20 stocks traded on the Istanbul Stock Exchange over the period from the beginning of 1988 until the end of 1991 and carried out tests of independence, randomness and normality and found equity prices did not follow a random walk.

A common test for market efficiency is to see whether a price follows a random walk a test that can be applied at the level of individual stocks, groups of stocks, or a market index. If a stock price or market index does follow a random walk, then it can be concluded that investors will be unable consistently to earn abnormal returns. This is consistent with stocks being appropriately priced at their equilibrium values. If a market does not follow a random walk, then there may be distortions in the pricing of capital and risk, which has implications for the allocation of capital within an economy.

The aim of this paper is to find out a rigorous test of the random walk hypothesis on the Istanbul Stock Exchange which is the well known growing emerging market. A random walk test is performed for weakform efficiency. The testing of market efficiency of the market it was used istanbul stock exchange's daily stock returns for random walk over the period from January-1995 to January-2004. The result of our study is rejected weak form efficiency, this result are the same of the study of Ünal (1992), and Balaban (1995), however some of the other stduies conclude different result. The studies of Alparslan (1989), Kılıç(1997), Kawakatsu Morey (1999), Buğuk and Brorsen (2003) found that ISE is not rejected random walk hypothesis. The reason of the different results are related with the mostly using of different time period.

THE RUNS ANALYSİS

The runs test is a non-parametric test, in which the number is calculated and compared against its sampling distribution under the random walk hypothesis. A run is a sequence of consecutive positive or negative returns.Using the laws of probability, it is possible to estimate the number of runs that one would expect by chance, given the proportion of the population in each of the two categories and given the sample size. Too many or too few runs in the time series can be a result of autocorrelation. By comparing the total number of runs in the data with the expected number of runs under random walk hypothesis, the test of the random walk hypothesis may be constructed. It has been shown that the distribution of the number of runs converges to a normal distribution asymptotically when properly normalized (see Campbell et al. (1997) for extensive discussion). To perform the test, the sampling distribution of the total number of runs in a sample is required. The test statistic used is the standardized normal variable Z (Z ~*N(0,1))*. Positive Z indicates that there are too many runs in the sample, negative value of Z that there are less runs that one would expect if the changes were random. The important advantages of this test are its simplicity and independence of extreme values in the sample(Bradley, J. 1968).

We performed the runs test in E-View4. We first calculated daily compounded returns of all the stocks that were listed on ISE 30 Index on January -1995 to January-2004. A run test examines the tendencies for losses or gains to be followed by further losses or gains, regardless of their size. This test is performed by examining a time series of returns for a security and testing whether the number of consecutive price gains or drops shows a pattern.

A price gain is represented by a " +", a price drop is represented by a "-" and "0" shows that return is zero. A run is defined as a return sequence of the same sign.

The variance of R_{exp} is:

$$\delta^2(R_{\text{exp}}) = \frac{\sum_{i=1}^{3} n_1^2 \left[\sum_{i=1}^{3} n_1^2 + N(N+1) \right] - 2N\sum_{i=1}^{3} n_1^3 - N^3}{N^2(N-1)}$$

The sampling distribution of R_{exp} is approximately normal for large N.
The standardized Z is defined as :

$$Z = \frac{(R + \frac{1}{2}) - R_{\text{exp}}}{\delta(R_{\text{exp}})}$$

where, R is the real number of runs. The null hypothesis is that stock returns depict a random walk through time. If the absolute value of Z is greater than $Z_{(\alpha/2)}$ (such as $Z_{(\alpha/2)} = 2.576$ for $\alpha=0.01$) then the null hypothesis that stock returns follow random walk is rejected at the significance level of α.

Our hypotesis for run test shown as the following;

H0: Stock returns have correlation and follow random walk.
H1: Stock returns do not follow random walk.

At 1% and 5% significance levels, the null hypothesis of a unit root cannot be rejected except when a linear trend is included with the financial index.

DİCKEY-FULLER TEST

Dickey-Fuller statistic tests for the unit root in the time series data. Yt is regressed against Yt-1 to test for unit root in a time series random walk model, which is given as(Gujarati,1999, pp.718:719);

$Yt = r\, Y_{t-1} + ut$

If *r* is significantly equal to 1, then the stochastic variable Yt is said to be having unit root. A series with unit root is said to be un-stationary and does not follow random walk. There are three most popular Dickey-Fuller tests used for testing unit root in a series.

The above equation can be rewritten as:

$\Delta Y_t = d\, Y_{t-1} + ut$

Here d= (r- 1) and here it is tested if d is equal to zero. Y_t is a random walk if d is equal to zero. It is possible that the time series could behave as a random walk with a drift. This means that the value of Y_t may not center to zero and thus a constant should be added to the random walk equation. A linear trend value could also be added along with the constant to the equation, which results in a null hypothesis reflecting stationary deviations from a trend.

To test the validity of market efficiency, random walk hypothesis has been tested. Unit root test has been conducted on Y_t, natural log values of indices price data by running the regression equations of the following type:

$Y_t = rY_{t-1} + u_t$

$\Delta Y_t = (r-1)Y_{t-1} + u_t$

$\Delta Y_t = dY_{t-1} + u_t$

$\Delta Y_t = \alpha + rY_{t-1} + \beta_t + u_t$

where, α is constant term and β is the coefficient of trend term. The null hypothesis for each is:

H0: d = 0

The null hypothesis that Y_t is a random walk can be rejected if calculated t is greater than the tabulated t. Calculation of t is similar to the estimation of t-statistic but this value is compared with tabulated τ statistic, whose critical values have been tabulated by Dickey & Fuller on the basis of Monte Carlo simulations. The null hypothesis that Y_t is a random walk can be rejected if calculated t is greater than the tabulated t

After analys, if r=1 there is a unit root.

H0: Y there is no unit root. (d=0)

H1: Y there is unit root. ($d \neq 0$)

I f d = 0 formula will shown as follows.

$\Delta Y = (Y_t - Y_{t-1}) = u_t$

From this formula can be defined u_t is totally random the differences also will be random. (Cook, 2001, p.36).

In this study we used following regression formula for calculating for unit root (Dougherty, 2002, p. 182). The ADF test is used to test the null hypothesis of a unit root. A unit root is a necessary condition for a random walk. The following regression is estimated for each series:

$\Delta Y_t = \beta_1 + dY_{t-1} + u_t$

$$\Delta Y = \beta_1 + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t$$

$$\Delta \boldsymbol{Y} = \beta_{\mathbf{1}} + \boldsymbol{r}\boldsymbol{Y}_{\boldsymbol{t-1}} + \alpha_{\boldsymbol{i}} \sum_{\boldsymbol{i=1}}^{\boldsymbol{n}} \Delta \boldsymbol{Y}_{\boldsymbol{t-i}} + \varepsilon_{\boldsymbol{t}}$$

$r_{i,t}$ = rate of return on stock *i* in time *t*
α = constant
β = regression coefficient (also known as beta)
$r_{n,t}$ = rate of return on market portfolio in time t
ε_t = error term

In this formula H0 hypotesiss was not changed, where Δ represents first differences and Y_i is the log of the price index. The length of n is selected with the Akaike Information Criterion (AIC) and should be large enough to achieve a white noise structure in ε_t. The ADF test statistic is the ratio of the estimated β to its calculated standard error obtained from an regression test. The null hypothesis is that β equals 0. The null hypothesis is rejected if the pseudo t statistic is larger than the critical value. The test statistic does not have a t distribution and a table of significance levels has been provided by MacKinnon (1991).

H0: Y there is no unit root. (r=0)
H1: Y there is unit root. ($r \neq 0$)

The result of Dickey- Fuller test statistics do not compare clasical normal t-table. The results compare with following statistic table that praperad Dickey-Fuller. In the following table was given the summary of Dickey Fuller statistics. (Cook, 2001, syf. 34);

Table 2.1A Dickey-Fuller Unit Root Statistics

Number of Example	%5	%1
25	7,42	10,61
50	6,73	9,31
100	6,49	8,73
250	6,34	8,43
500	6,30	8,34
	6,25	8,27

EMPRİCAL RESULTS

This part of study is given results of dicky-fuller tests and runs test.

THE RESULTS OF THE AUGUMENTED DİCKEY-FULLER TESTS

In this section, we examine daily stock returns of ISE using E-View4 software. The results of analysis are compared for the significant %5 and %1 with Dickey-Fuller Test statistic table values. If the result of the analys is significant . The descriptive statistics and results of Dickey-Fuller tests for the daily observations are presented in Table 3.1. Table present the results of Dickey- Fuller test results for no drift & no trend model, respectively. The first entry is the value of δ, which is equal to zero under null hypothesis. The value below this statistic in parenthesis is the corresponding test statistic called *t*-statistic. The test statistic is tested at 5% level of significance and a value significantly different from tabulated value is indicated. For daily returns calculated value of *t* is less than tabulated *t* value under all three hypotheses for all the indices. Augumented Dickey-Fuller Tests Results which is shown in table 3.1.

Table 3.1 Augumented Dickey-Fuller Tests Results

Stocks	Number of noise	Obs*R-Squared	Obs*R-Squared Statistcs Value	ADF Test Value
AKBNK	7	13.32246	0.064631	-17.17977
AKENR	6	12.38671	0.053877	-18.88574
AKSA	0	0.057237	0.810918	-47.67832
AKGRT	10	16.31141	0.091058	-14.40472
ALARK	0	1.015366	0.313621	-42.26739
ARCLK	19	29.58315	0.057349	-10.06957
BEKO	4	0.000000	1.000000	-19.89261
DOHOL	10	25.51450	0.004451	-12.53768
DYHOL	10	20.80495	0.022495	-9.763638
ENKAI	5	0.000000	1.000000	-18.50023
EREGL	5	0.000000	1.000000	-19.29961
FINBN	17	0.000000	1.000000	-5.997139
FROTO	5	6.305894	0.277582	-19.41777
GARAN	6	0.000000	1.000000	-15.93721
HURGZ	0	0.008553	0.926316	-45.65394
IHLAS	10	27.41624	0.002237	-11.45453
ISCTR	0	1.153313	0.282857	-46.36926
KCHOL	4	8.621705	0.071283	-20.95210
MIGRS	0	0.416662	0.518607	-41.13081
NETAS	10	11.93931	0.289139	-13.19901
PTOFS	0	0.444127	0.505137	-35.43606
SAHOL	11	0.000000	1.000000	-9.164268
SISE	0	0.133604	0.714725	-42.33129
TNSAS	3	0.000000	1.000000	-17.32972
TOASO	0	1.632383	0.201374	-46.82980
TRKCM	8	23.16608	0.003157	-14.47645
TCELL	0	0.002005	0.964283	-18.10857
TUPRS	0	1.757047	0.184993	-43.90820
VESTL	0	0.681651	0.409019	-46.83434
YKBNK	12	0.000000	1.000000	-13.31167

Augumented Dickey-Fuller Tests Results which is shown in table 3.1 These values compare with the following parmeters:

Parameter estimate is significant at 1%.	-3.4363
Parameter estimate is significant at 5%	-2.8634
Parameter estimate is significant at 10%	-2.5678

Dickey-Fuller test results are not significant for 1% -5% and 10% parameters. Because of this results our H0 hypothes is rejected (“H0: δ=0” is rejected for all stocks). The rejection of H0 Hypotesis show us that the stock’s regression equations does not consist unit root. Therefore, the random walk hypothesis is rejected because of there is not autocorrelation of daily increments in the stock market index.

Runs Test

The run test is an another approach to detect the statistical independencies which means randomness. In the following table tere are price differences of stocks. If there is a stock return the sign will be “+”, if there is a loss, the sign will be “-“, if there is not, neither loss nor gain the sign will be “0”.

Table 3.2 Run Test Results

Definition	+	-	0
AKBNK	977	1150	122
AKENR	389	471	33
AKSA	976	1152	80
AKGRT	1011	1137	83
ALARK	977	1153	97
ARCLK	1038	1162	49
BEKO	1008	1170	58
DOHOL	1036	1161	52
DYHOL	646	691	22
ENKAI	988	1140	83
EREGL	1008	1172	63
FINBN	986	1177	84
FROTO	1015	1136	98
GARAN	1018	1154	69
HURGZ	1046	1143	60
IHLAS	912	1027	74
ISCTR	1029	1136	74
KCHOL	1021	1169	59
MIGRS	985	1145	117
NETAS	1010	1143	96
PTOFS	1010	1113	94
SAHOL	734	834	56
SISE	1004	1167	76
TNSAS	793	936	73
TOASO	1011	1183	55
TRKCM	1011	1129	109
TCELL	416	458	14
TUPRS	1012	1134	84
VESTL	1002	1172	75
YKBNK	1025	1161	55

The expected runs, observed runs, standard deviations and run test statistics are given in the following table 3.2.

Table 3.2 Runs Tests Results:

Stocks	Expected Runs	Observed Runs	Standard Deviation	Runs Test Statiscs
AKBNK	1230,91	1587	22,57	15,75
AKENR	474,90	592	14,34	8,13
AKSA	1173,63	1515	22,62	15,07
AKGRT	1191,31	1520	22,79	14,3
ALARK	1198,20	1515	22,60	13,99
ARCLK	1169,48	1541	23,16	16,01
BEKO	1168,87	1526	23	15,52
DOHOL	1172,22	1574	23,14	17,34
DYHOL	701,22	910	18,12	11,48
ENKAI	1179,60	1478	23	13,14
EREGL	1176,85	1558	22,96	16,57
FINBN	1195,67	1532	22,78	14,74
FROTO	1213,83	1574	22,79	15,77
GARAN	1183,18	1535	23	15,31
HURGZ	1181,00	1516	23,10	14,54
IHLAS	1074,13	1369	21,66	13,59
ISCTR	1188,27	1559	22,92	16,15
KCHOL	1177,30	1524	23,05	15,01
MIGRS	1226,66	1553	22,6149	14,40
NETAS	1211,42	1577	22,7965	16,01
PTOFS	1195,12	1573	22,6691	16,64
SAHOL	863,024	1145	19,4751	14,45
SISE	1190,73	1542	22,8871	15,32
TNSAS	964,89	1217	20,3755	12,34
TOASO	1171,90	1571	23,0499	17,31
TRKCM	1223,48	1531	22,7288	13,56
TCELL	457,67	617	14,6386	10,84
TUPRS	1191,91	1543	22,7901	15,38
VESTL	1190,32	1552	22,8947	15,83
YKBNK	1170,34	1536	23,0582	15,83

As shown in the table 3.2. the numbers of observed runs are more than number of the expected runs. Therefore our H0 Hpyotesis "H0: Stock returns have correlation and follow random walk" was rejected. However, H1 hypotesis which is "H1: Stock returns do not follow random walk" accepted. Means that the between of the returns of stocks on ISE 30 have positive coreletion. The results are independence statistically at 5% significance level. Because of that the null hypothesis are rejected for the ISE 30 stock prices.

CONCLUSİON

The study examines the behavior of stock prices in the ISE 30 index. The data consists of 30 stocks included in the ISE 30 index covering the period commencing January 1,1995 through January 1, 2004. The daily returns of stock priceon national 30 indexes between January 1,1995 and January, 2004 are examined. The primary goal of the paper was to analyze the weak form efficiency of the ISE 30 index. In this study, we focused on a question concerning weak form efficiency on the İSE 30 index. To answer this question, two tests were conducted that provided answer of weak form efficiency question. We perform two test for testing weak form efficiency, the first test was Augumented Dickey-Fuller Test, the other one was the run test.

The hypothesis of the randomness of the stock returns are rejected for stock price index changes at all frequencies using both Augumented Dickey-Fuller Test and Run Tests. The rejection of null hypothesis that the market is not weak form efficient can be interpreted. The rejection of null hypothesis of random walk can be interpreted by the mean reverting tendency of stock market prices. The traders that make their living by analysing historical returns of the stocks and using this information to project future returns may be able to earn abnormal profits.

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APPENDIX

Table 5. Sample test results for AKBNK

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	1.906889	Probability		0.064609
Obs*R-squared	13.32246	Probability		0.064631
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 04/26/04 Time: 20:20				
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004168	0.006562	0.635176	0.5254
AKBNK(-1)	-1.288472	2.009470	-0.641200	0.5215
RESID(-1)	1.285672	2.009578	0.639772	0.5224
RESID(-2)	0.034807	0.028346	1.227933	0.2196
RESID(-3)	-0.016317	0.021094	-0.773550	0.4393
RESID(-4)	-0.035027	0.021084	-1.661330	0.0968
RESID(-5)	-0.058893	0.021095	-2.791778	0.0053
RESID(-6)	-0.009022	0.021127	-0.427046	0.6694
RESID(-7)	0.011983	0.021138	0.566899	0.5708
R-squared	0.005924	Mean dependent var		1.25E-18
Adjusted R-squared	0.002373	S.D. dependent var		0.042573
S.E. of regression	0.042523	Akaike info criterion		-3.473566
Sum squared resid	4.050312	Schwarz criterion		-3.450683
Log likelihood	3915.025	F-statistic		1.668528
Durbin-Watson stat	2.000511	Prob(F-statistic)		0.101101

ADF Test Statistic	-17.17977	1% Critical Value*		-3.4363
		5% Critical Value		-2.8633
		10% Critical Value		-2.5677
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(AKBNK)				
Method: Least Squares				
Date: 04/26/04 Time: 20:21				
Sample(adjusted): 9 2250				
Included observations: 2242 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
AKBNK(-1)	-1.055185	0.061420	-17.17977	0.0000
D(AKBNK(-1))	0.061530	0.057061	1.078322	0.2810
D(AKBNK(-2))	0.084568	0.052231	1.619123	0.1056
D(AKBNK(-3))	0.069093	0.047015	1.469599	0.1418
D(AKBNK(-4))	0.035014	0.041791	0.837834	0.4022
D(AKBNK(-5))	-0.023270	0.036217	-0.642522	0.5206
D(AKBNK(-6))	-0.032334	0.029827	-1.084058	0.2785

D(AKBNK(-7))	-0.020207	0.021166	-0.954685	0.3398
C	0.003422	0.000921	3.715601	0.0002
R-squared	0.498371	Mean dependent var		8.50E-06
Adjusted R-squared	0.496574	S.D. dependent var		0.060005
S.E. of regression	0.042575	Akaike info criterion		-3.471089
Sum squared resid	4.047621	Schwarz criterion		-3.448147
Log likelihood	3900.090	F-statistic		277.3118
Durbin-Watson stat	2.000257	Prob(F-statistic)		0.000000

Tablo 5.2. Daily stock returns' explanatory statistics

	AKENR	AKBNK	AKSA	AKGRT	ALARK	ARCLK	BEKO
MEAN	0.000742	0.003235	0.002379	0.003238	0.002396	0.003059	0.002190
MEDIAN	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
MAX	0.216216	0.350838	0.409836	0.250000	0.189189	0.243902	0.238089
MIN	-0.142857	-0.202532	-0.175000	-0.380435	-1.000000	-0.178571	-1.000000
STD. DEV.	0.033991	0.042568	0.040085	0.044736	0.044496	0.043560	0.052643
SKEWNESS	0.727851	0.905564	0.829529	0.066717	-4.908760	0.415607	-5.971335
KURTOSIS-3	7.536432	8.148331	10.05123	7.808457	118.6474	5.298088	120.5032
JARQUE-BERA	846.4569	2792.390	4851.499	2157.718	1254460.	559.8870	1302546.
PROB.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUM	0.663943	7.278238	5.279267	7.246292	5.355230	6.883278	4.907683
SUM SQ. DEV.	1.032909	4.075256	3.563960	4.476843	4.423077	4.267340	6.207593
OBSERV.	895	2250	2219	2238	2235	2250	2241

Tablo 5.2. Daily stock returns' explanatory statistics (Devam)

	EREGL	*FINBN*	FROTO	GARAN	HURGZ	IHLAS	ISCTR

MEAN	0.002801	0.001050	0.003231	0.002648	0.003842	0.002016	0.003553
MEDIAN	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
MAX	0.224490	0.214286	0.210526	0.248134	0.241379	0.224138	0.256692
MIN	-0.200000	-1.000000	-0.740816	-1.000000	-0.208333	-0.169231	-0.432432
STD. DEV.	0.041729	0.051163	0.046084	0.051311	0.049300	0.048291	0.045551
SKEWNESS	0.429127	-5.091153	-1.442171	-2.926496	0.432802	0.530598	0.312153
KURTOSIS-3	5.631982	106.4232	34.52361	68.86346	5.089289	5.967389	9.339276
JARQUE-BERA	717.2157	638101.8	93942.86	408987.8	479.4748	833.8348	3790.491
PROB.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUM	6.291145	1.488748	7.269119	5.943724	8.644180	4.061942	7.966848
SUM SQ. DEV.	3.909305	3.709201	4.776190	5.908036	5.466063	4.696631	4.649752
OBSERV.	2246	1418	2250	2245	2250	2015	2242

Tablo 5.2. Daily stock returns' explanatory statistics (Devam)

	PTOFS	**SAHOL**	**SISE**	**TNSAS**	***TOASO***	**TRKCM**	**TCELL**

MEAN	0.001094	0.002057	0.002646	0.002828	0.002427	0.002874	-0.002590
MEDIAN	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
MAX	0.250000	0.200000	0.214286	0.229167	0.255319	0.212766	0.196721
MIN	-1.000000	-1.000000	-1.000000	-1.000000	-0.202381	-0.378378	-1.000000
STD. DEV.	0.064054	0.048739	0.047644	0.050714	0.044705	0.041027	0.072209
SKEWNESS	-6.610982	-5.060258	-3.850641	-3.914091	0.449084	0.182717	-8.734296
KURTOSIS-3	109.4271	112.9859	90.60325	88.30315	5.798643	9.291475	123.4691
JARQUE-BERA	1066768.	826504.6	724706.4	550648.8	809.9163	3723.394	550734.4
PROB.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUM	2.435623	3.345473	5.951688	5.092529	5.459952	6.467437	-2.310476
SUM SQ. DEV.	9.128948	3.860146	5.102941	4.629417	4.494795	3.785557	4.645802
OBSERV.	2226	1626	2249	1801	2250	2250	892