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Do Cloudy Days Affect Stock Exchange Returns: Evidence from Istanbul Stock Exchange

Ekrem Tufan
Anadolu University, Open Education Faculty
A.O.F. Burosu Canakkale, Turkey
etufan@yahoo.com

Bahattin Hamarat
College Of Tourism and Hotel Management
Onsekiz Mart University, Çanakkale, Turkey

Abstract

Market anomalies in stock markets should be related to investors' trading strategies, which are based on their psychologies along with other factors. The fact that some weather variables affect investor's performance and mood can also affect market prices substantially. This paper examines the relation between cloudy days at the Istanbul Stock Exchange 100 (ISE100) Index returns and the weak form efficiency for ISE with a different approach. It has been found that cloudy days are not the cause of or have no relationship with ISE 100 Index returns and also that there exists an evidence of weak form efficiency for Turkish stock market.

Keywords: Weather effect, ISE, Kruskal Wallis and Unit Root Test.

I. Introduction

There is a systematic approach in classical economics that about people choices are rational through their data in hand and proficiencies. The theory initially suppose that people behave logical and can calculate possibilities when take their decisions. Originally as a psychological professor Kahneman's studies indicate a reverse situation and for investors

in economic decisions their intuitional could be substitute rational idea or they could be prefer to using logical way in place of probability calculation [1].

Market anomalies in stock markets should be related to investors' trading strategies, which are based on their psychologies along with other factors. The fact that some weather variables affect investor's performance and mood can also affect market prices substantially [2]. At this point, the question whether it affects investors' psychology may be asked. Consequently, weather could be one of the reasons for market anomalies, so it should be investigated to find the evidence against Efficient Market Hypothesis.

It is a reality that human psychology is affected by weather conditions. The assumptions that some mental illnesses increase in spring and that cloudy days adversely affect human psychology while sunny days cause positive effects and even the expectation that earthquake may occur when the weather is hot or when the humidity level is high according to Turkish people can be shown as a simple explanation for the relationship between psychology and weather.

There are several researches on weather effect on stock returns. Goetzmann and Zhu [3] have investigated weather effects on traders for five major U.S. cities by using individual investors account information. They have virtually reported no difference in individual's propensity to buy or sell equities on cloudy days as opposed to sunny days. However, the behaviour of market makers may be responsible for the relation between returns and weather.

In respect of humidity, sunny, cloudy, snowy and rainy days, weather effect has been tested on stock returns and liquidity in literature. For example, Hirshleifer and Shumway [4,5] have followed the same ways for 26 stock exchanges and reported that sunshine is highly significantly correlated with daily stock returns after controlling the sunshine and other weather conditions such as rain and snow, which are unrelated to returns.

Kamstra, Kramer and Levi [6] claim that there is a positive effect of sunny days on stock exchange returns. To test this effect, they have used 12 stock exchange indexes in two hemispheres, four of which belong to U.S.

Dowling and Lucey [2] have investigated weather effect on investors' mood; consequently, stock exchange returns, to use sunny, rainy days variables, humidity level and biorhythm variables for Ireland. They have reported that weather has an influence on investors' mood, thus, on determination of share prices.

With providing evidences in favour of weather effect on stock exchange returns, there are some researches that claim that there is no effect or even if there is, it can be neglected. Some samples of them are Loughran and Schultz [7], Pardo and Valor [8] and Kramer and Runde [9]. Loughran and Schultz [7] have formed some portfolios with 4.949 firms' shares, which are located in 25 cities of U.S and traded in NASDAQ Stock Exchange. They have investigated weather effect on these portfolios with respect to the investors who live in the same area with firms CEO's. They have reported that there is no cloudy days effect on portfolios returns.

Pardo and Valor [8,10] have investigated the possible relation between weather and market index returns in the context of the Spanish market. To see whether or not there is an influence of sunshine hours or humidity levels on stock prices, independent of trading system, they have used daily closing values of the Madrid Stock Exchange Index. They have reported that there is no influence of sunshine hours humidity levels on stock prices and this result is also independent of the trading system.

Another negative evidence has been given by Kramer and Runde [9]. They have investigated weather effect for Frankfurt Stock Exchange and found that short-term stock returns are not affected by the local weather conditions. Authors also claim that the fact that some studies provides evidences favouring the existence of this effect but some others do not may depend on different statistical methods that have been used.

In this study it is being investigated if the cloudy days cause Istanbul Stock Exchange 100 Index (ISE 100 Index) returns and the weak form efficiency for ISE with a different approach. The paper is organized as follows: Section I, briefly expresses the relationship between stock returns and weather and consequently Efficient Market Hypothesis. This is followed in Section II by the consideration of data and methodology while the empirical results are presented in Section III and the conclusion in Section IV.

II. Data and Methodology

This study is conducted using two kinds of data from the Istanbul Stock Market (ISE) database and Istanbul/Göztepe Turkish State Meteorological Service database. The first one of these data sets includes daily closing values of the ISE 100 Index. The second data set consists of observed cloudy days variables for Istanbul. Both data sets have 3.662 observations and cover from October 26, 1987 to July 26, 2002. ISE 100 Index returns are calculated as follows:

$$R_t = V_t/V_{t-1} \quad (1)$$

Where, R_t denotes return on t day and V_t, V_{t-1} denotes closing prices on t and t-1, respectively.

The second data set is collected from Istanbul/Göztepe Turkish State Meteorological Service database and includes cloudy days variables. The service makes observation of the data three times in a day with naked eyes and ranked it from zero to ten. Zero is indicated the lowest cloudiness, which it also means the highest sunny light where ten, indicates the highest cloudiness. The observations are made at 07.00 a.m, 14.00 p.m and 21.00 p.m. everyday. In this study, we have used the observations obtained between 07.00 a.m and 14.00 p.m. to consider of ISE trading hours and formed a new series calculating arithmetic mean.

In this study, it has used Kruskal Wallis Test. In literature, researchers usually use regression method such as Loughran and Schultz [7], Goetzman and Zhu [3], Dowling and Lucey [2]. On the other hand, there are also some researchers that use parametric and non-parametric methods such as Kramer and Levi [6] and Pardo and Valor [8,10].

Two series that are used in the study can be nonstationary because of trend; consequently the relationship between them can depend on a trend. But, if both of them are stationary at the same level, then it can be said that there is a cointegration between them. So, it is indicated that the equation of regression is not spurious. There are two basic methods to test cointegration. These are Unit Root Test, which is also known Augmented Dickey Fuller

Test (ADF) and Cointegrated Regression of Durbin Watson [11]. Initially, in order to investigate stationary we have used Augmented Dickey Fuller Test. Afterwards, to search long term relationship between two series, consequently cointegration of them we thought to apply Johansen Test but on account of found stationary at the first difference we have chase from it.

To test stationary regression equation is used as follows [11]:

$$Y_t = \rho Y_{t-1} + u_t \quad (2)$$

The result of $\rho=1$ indicates that stochastic variable Y_t has a unit root. So, it means series is not stationary.

On the other hand, to search series normality we have used skewness and kurtosis coefficients and Jargue Bera Test statistics. After we have observed both series are not normal distribution, we have used Kruskal Wallis Test as a nonparametric test. Kruskal Wallis Test is tested k independent random sample comes from the population, which is investigated, assumption and $\mu_1=\mu_2.....=\mu_k$, hypothesis against these means do not equal each other.

The following regression for the whole period is run to test whether there is any statistically significant difference among ISE100 Index returns on different days of the week:

$$R_{t,ISE100} = B_1D_1+B_2D_2+B_3D_3+B_4D_4+B_5D_5+v_t \quad (3)$$

Dummy variable (Day) (D_{it}); $D1_t$, $D2_t$, $D3_t$, $D4_t$, $D5_t$

Where $D_{1t}=1$ If day t is a Monday 0 otherwise; $D_{2t}=1$ if t is a Tuesday and 0 otherwise; and so on. The OLS coefficients B_1 to B_5 are the mean returns for Monday through Friday, respectively. The stochastic disturbance term is indicated by v_t. The hypothesis to be tested is:

$$B_1=B_2=B_3=B_4=B_5.$$

We have used regression equation, which is below for Augmented Dickey Fuller Tests [11]:

$$Y_t = \rho Y_{t-1} + u_t \quad (4)$$

If we find $\rho=1$ then we say that the stochastic variable Y_t has a unit root. Consequently, series are not stationary.

In this study, as it is determined whether weather effect is influenced by stock exchange returns it is aimed that weak form of Efficient Market Hypothesis is tested with a different approach for ISE.

The paper is organized as follows: Section I, briefly express the relationship between stock returns and weather and consequently Efficient Market Hypothesis. This is followed in Section II by consideration of data and methodology while the empirical results are presented in Section III and conclusion in Section IV.

III. Empirical Results

Firstly, to find whether two series are normal distributed or not we applied descriptive statistics and Jargue Bera statistics. The results are given in Table 1.

Table 1. Descriptive Statistics

	Observations	Mean	Standard Deviation	Skewness Coefficients	Kurtosis Coefficients	Jargue- Bera Prob.
ISE100 Index Return	3,663	1.002	0.032	0.256 (0,0)	6.173 (3,0)	1577.339* (0.000)
Cloudy Days	3,663	4.705	3.458	0.036 (0,0)	1.613 (3,0)	294.095* (1.374)

Not (*): Significant at α=1%.

As it could seen in Table 1. both series are not normal distributed. Skewness coefficient observed larger than calculated value for ISE100 Index return series and cloudy days values, (0.256>0) and (0.036>0) respectively. Similarly kurtosis coefficient for ISE100 Index return series observed larger than calculated value (6.173>3) and series is leptokurtic. For cloudy days kurtosis coefficient observed (1.613<3) and series is

platykurtic. Jargue Bera statistics results support descriptive statistics where return; 1577.339, p=0.000 and cloudy days; 294.095, p=1.374, so both series are not normal distributed.

We have investigated series stationary by using ADF Unit Root Test. The null hypothesis is H_0: $\delta=0$, $\rho=1$. Under the null hypothesis that $\rho=1$, the conventionally computed t statistic is known as the τ (tau) statistic whose critical values have been tabulated by Dickey and Fuller on the basis of Monte Carlo Simulations [11]. The results of ADF Unit Root Test for cloudy days can be seen in Table 2.

Table 2. ADF Test Statistics for Cloudy Days

Level, intercept and (lag)1	
ADF Test Statistics (F Value)	-27.9754706673
%1 Critical Value*	-3.43524075459
%5 Critical Value	-2.86284839275
%10 Critical Value	-2.56749317117

*MacKinnon critical values for rejection of hypothesis of a unit root.

Our null hypothesis is $\delta=0$, which is to say that $\rho=1$, or unit root. Computed absolute value of the τ statistic exceeds the McKinnon DF absolute critical τ values at 1%. So, we failed to accept the null hypothesis that the series is non-stationary and I(0).

Same process has been repeated for ISE 100 Index returns and the null hypothesis is H_0: $\delta=0$, $\rho=1$. The results can be seen in Table 3.

Table 3. ADF Test Statistics for ISE 100 Index

Level, intercept and (lag)1		
ADF Test Statistics (F Value)		-40.1736545207
	%1 Critical Value *	-3.43524075459
	%5 Critical Value	-2.86284839275
	%10 Critical Value	-2.56749317117

*MacKinnon critical values for rejection of hypothesis of a unit root.

For ISE 100 Index returns, computed absolute value of the τ statistic exceeds the McKinnon DF absolute critical τ values at 1%. So, we failed to accept the null hypothesis that the series is non-stationary. Consequently, we have failed to accept null hypothesis that series are non-stationary and I(0).

Since it has been found stationary, I(0), we have not applied cointegration test for both series which investigate long-term relationship between variables. After we have found that series is stationary, we have applied Kruskal Wallis Test results of which are given in Table 4.

Table 4. Kruskal Wallis Test Statistics for ISE100 Index

Group	N	Median	Sum rank	Z
1	1,118	1.002	1830.6	-0.05
2	346	0.999	1738.2	-1.73
3	253	0.998	1722.0	-1.71
4	290	0.988	1783.0	-0.82
5	292	1.001	1855.0	0.39
6	259	1.004	1931.4	1.57
7	283	1.002	1862.5	0.50
8	287	1.004	1932.8	1.68
9	404	1.001	1822.5	-0.19
10	131	1.003	1907.4	0.83
Toplam	3,663		1832.0	

H = 12,05 DF = 9 P = 0,210

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As it could seen Table 4. Kruskal Wallis test statistics has found (12.05) while p value (0.210). Consequently, we have failed to accept null hypothesis, which supports returns of the days of the week are equal.

IV. Conclusions

In this study it is being investigated if the cloudy days cause ISE 100 Index returns and the weak form efficiency for ISE a different approach. It has been found that cloudy days do not cause ISE 100 Index returns and also that there existed evidence of weak form efficiency for Turkish stock market.

It is considered in this study how investors trade at ISE living in different cities or countries,. It can be claimed that although investors live in different cities or countries and trade at ISE, trading strategy decisions are not being affected by weather conditions of Istanbul. The fact that, traders whose trading volume is highest, usually live in Istanbul in Turkey. On the other hand, even if they live in different cities or countries, market professionals such as brokers and dealers who live in Istanbul are affecting their trading decisions.

We can claim that there is no cloudy day effect on ISE100 Index returns. This study supports preceding study's results, which was written by Tufan and Hamarat [12]. Consequently, investors cannot make up an active strategy by using cloudy days variables for Turkey. In this study, we also failed to accept that Turkish stock market is not efficient in the weak form of efficiency.

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