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The Effect of Weather Variables on Stock Returns: Evidence from Pakistan

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ABSTRACT

Behavioral Finance theorizes the impact of weather's effect on the daily stock return through its effect on the investors' mood. This study examines the effect of weather variables on Pakistani stock market. A sample of 124 non-financial firms listed on Pakistan Stock Exchange have been selected through Judgmental sampling along with the daily weather for the period from 2010-2014. Daily returns are regressed on the three weather variables; Temperature, Humidity and Precipitation (Dummy). The analysis is conducted by controlling for Firm Size, Leverage Ratio and Industry Type (Dummy). The results demonstrate no effect of weather on the daily stock returns of Pakistan Stock Exchange. The findings of this study may benefit the financial managers, investors and financial management consultants in making policies regarding investment decision. Some directions are provided for future researches that may extend the literature and improve the limitations of this study.

Key words: *Temperature, Humidity, Precipitation, Stock Exchange, Stock Return, Entrepreneurs and Financial Firms*

INTRODUCTION

The year is divided into four seasons by nature. Each season is distinct and has a distinctive impact on people's moods, habits and activities. Investors, traders and human resources in any organization, are all human beings, and their attitudes and actions are influenced by changes in the weather or season, which may be seen in trading, share price fluctuations, stock returns and other market events. The traditional theory of finance is based on the fundamental of Efficient Markets, which argues that markets are rational and reflect economic morphemes, although psychological, situational, and environmental factors influence individuals' decision-making processes (Watson 2000). In recent years, a new field of study has evolved that investigates the impact of psychological factors on the financial markets. Weather variables have been shown to have a significant impact on people's moods and behaviors in psychological studies. Numerous studies have found that an individual's sentiments, emotions and mood have an impact on their decision-making (Schwartz, 1990; Loewenstein et al., 2001). Howarth and Hoffman (1984) looked at the weather variable and discovered that temperature, humidity, and sunshine hours had an impact on mood.

Saunders (1993) pioneered research into the impact of different weather conditions on daily stock performance. He examined the cloud as a variable to see how it affected daily stock returns on the New York Stock Exchange (NYSE) from 1927 to 1989 and the American Stock Exchange (AMEX) from 1962 to 1989. He came to the conclusion that lower cloud cover is

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associated with higher returns. By focusing on the 26 foreign stock markets from 1982 to 1997, Hirshleifer and Shumway (2003) validated the findings of Saunders (1993). The combined conclusion of the two research points to investors' optimistic conduct on sunny or less overcast days, which leads to better returns, and pessimistic behaviors on cloudy days, which leads to lower returns.

These studies have paved the way for further study into the impact of weather variables in traditional financial analysis. As a result, this research aims to identify the impact of weather-related factors in Pakistan. The weather in Pakistan is harsh in nature; typically, summer lasts for six to seven months, which is a key factor in temperature. Pakistan is situated near the sea, which results in high humidity. Precipitation, on the other hand, is a crucial aspect that can cause a shift in weather, which can be nice in places like Pakistan where summers are protracted.

LITERATURE REVIEW

Finance is predicated on the notion of rationality. According to Thaler (1987), the single trait that distinguishes economics and finance from other social sciences is rational conduct. This assumption asserts that each financial choice is made based on the cost and benefit of the decision. Personal emotions and beliefs of market players have little bearing on financial decisions. Weather may affect an investor's actions, which can be translated into financial decisions and influence stock returns, according to behavioral finance theory. Individuals' actions are influenced by changes in weather factors, according to psychologists, who suggest that people are more optimistic in bright weather and cloudy on overcast or rainy days (Eagles, 1994; Rind, 1996).

As a result, individuals are happier on sunny days than on cloudy or rainy days. Lee and Wang (2011) distinguished between excellent and terrible weather. Low clouds and brilliant sunshine provide a pleasant atmosphere that makes people feel happier and more relaxed. Bad weather, on the other hand, is associated with thick cloud and limited sunlight, which makes people unhappy and less optimistic. Bell (1981) found that temperature had a detrimental impact on individual performance. According to Howarth and Hoffman (1984), humidity was inversely connected with positive human performance, whereas sunlight hours were favorably correlated. Arkes et al. (1988) stated that investors in a good mood were more willing and motivated to participate in riskier enterprises in the hope of making more money. The first study on the present research was conducted by Saunders (1993). He looked at the influence of sunny and cloudy days on the Dow-Jones Industrial Average's daily returns from 1927 to 1989, as well as stock returns from the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX) from 1962 to 1989.

Temperature, cloud cover, wind speed, humidity, rainfall and hours of sunlight were all taken into account. Because cloud cover is positively correlated with humidity and negatively correlated with hours of sunshine, Saunders defined weather in terms of clouds; rain is also associated with clouds; and because temperature and wind speed are not important in psychological studies, he did not include these two variables in his study. He utilized the percentage of cloud cover from dawn to sunset as a proxy for weather conditions at the nearest meteorological station to Wall Street (New York). The findings revealed that when cloud cover was 100 percent, returns were lower than average, but returns were higher than average when cloud cover was less than 20 percent, and that returns were negatively related to the cloudy days and higher returns on stock in sunny days because of optimistic behaviours.

Hirshleifer and Shumway (2003) looked at the influence of sunlight on daily market index returns for 26 countries from 1982 to 1997 and found a substantial link between return

and sunshine. Rain and snow were not related with returns by controlling the sunshine effect. The outcomes of these two researches revealed that sunlight had a significant positive influence on stock returns, implying that a happy mood leads to optimism in individual behaviors. Trombley (1997) examined stock returns on the New York Stock Exchange (NYSE) from 1927 to 1992, arguing that there was no substantial association between returns and weather variable as provided by Saunders (1993). Sunny days or cloudy or rainy days did not cause reason for the change in returns.

When investors' subjective criteria or parameter fluctuate with changes in mood, according to Mehra and Sah (2002), their emotional state has an influence on equities prices. By analyzing stock returns from the German Stock Exchange from 1960 to 1990, Kramer and Runde (1997) found no link between stock return and cloudiness, as well as three other weather variables: humidity, rainfall, and air pressure. For the years 1986-2002 and 1980-2002, Keef and Roush (2002; 2005) found that temperature had a smaller impact on the prices of Government bonds, bank bills and stock indices.

Except for the pricing of government bonds and bank bills, wind speed has a strong negative influence on stock returns, according to Keef and Roush (2002). From 1992 through 2003, Keef and Roush (2007) found a negative relationship between temperature and stock returns, with no influence of wind. For the period 1970-2004, Jacobsen and Marquering (2008) found a negative relationship between temperature and stock returns for 48 countries.

Chang et al. (2006) found a negative relationship between severe temperatures, particularly very low temperatures, the considerable influence of extreme cold, and no relationship with humidity in Taiwanese stock returns from 1997 to 2003. Gerlach (2007) looked at stock returns in the United States from 1980 to 2003 and discovered that higher temperatures and wet days were associated with poorer returns, but that these effects maintained until economic news arrived. Akhtari (2011) looked at New York from 1948 to 2010 and found that daily market returns were positively associated to sunshine, albeit the strength of this finding might change with time. Temperature levels did not impact the movements of stock returns, according to Brahmana, Hooy, and Ahmad (2012).

There are considerable studies that show that temperature has an impact on one's mood, and that a change in mood has an impact on one's subsequent behaviors or actions. In eight countries, Cao and Jason Wei (2005) (2006) explored the relationship between stock market and temperature and a substantial negative impact was found in 8 and 27 countries, respectively (higher temperature caused lower returns). This relation was not stronger in summer than in winter. Goetzmann and Zhu (2005) examined weather variables such as cloud cover, rain and snow in five US cities from 1990 to 1995 and found no difference in the tendency of trading equities on cloudy days versus sunny days, but higher returns at the NYSE on sunny days, concluding that the weather had no impact on investors' trading decisions.

Hu (2008) used bin test, regression analysis, and copula modelling on a sample of 25 international stock markets to investigate their association. The outcomes showed a statistically vital negative association for individual countries, with greater temperatures resulting in poorer returns, but this analysis was unable to uncover a meaningful combined influence of temperature across markets. To investigate the relationship between temperature and the stock market, copula modelling (with time-varying and constant dependency) was utilized. After adjusting for auto-correlation, normality, and the GARCH effect, the findings of the copula model revealed their negative relationship. Shu (2008) looked at weather-related variables in Taiwan from 1995 to 2004 and found a significant correlation between them.

Floros (2008) investigated the influence of temperature on stock market returns by looking at the stock markets of five European nations (Austria, Greece, France, Belgium and UK). This study used daily stock market returns and temperature data from five European nations as its sample. The GARCH results revealed a negative relationship between temperature and stock market return in Austria, France, and Belgium, as well as negative but not significant positive stock relations in Greece and the United Kingdom. For the Korean stock exchange, Yoon and Kang (2009) found no significant relationship between cloud and return for Korean stock exchange from 1990-2006.

Dong and Tremblay (2014) studied the impact of sunshine, temperature, wind, and rain on daily returns in 49 countries from 1973 to 2012, and found that pleasant weather was positively connected to returns. Sunshine had a positive impact on international returns. Windy or rainy days were negatively connected to returns in cold countries, but positively related in warm countries (September). In the case of warm countries, rainy or chilly days in summer, spring and warm days in winter were all positively connected to returns. Furthermore, it had been found that in both cold and mild places, the chilly temperature in the winter was a motivator for risk taking, which resulted in higher returns. These findings revealed that weather had a greater impact on people's induced individual behaviors.

Kang et al. (2009) analyzed the effect of temperature, humidity, sunshine and cloud cover on Hong Kong Stock Exchange and Shenzhen Exchange from 1999-2008 and found the results as returns at Hong Kong Stock Exchange were not responsive to change in weather while returns at Shenzhen index had shown significant effects of weather, inferring that the Shenzhen Exchange was less efficient relative to Hong Kong Stock Exchange. Lu and Chou (2012) considered the Shanghai Stock Exchange (SSE) of China to examine the relation between stock index returns and weather-related mood factors and found that variations in mood due to variations in weather did not affect the index return. From 1999 to 2008, change in weather might affect the trading activities, but not the return.

Temperature, precipitation, cloud cover, humidity, wind speed, visibility barometric pressure, dummy of Monday was used by Fruhwirth and Sogner (2011) (2012) to study the influence of weather variables on stock returns, US corporate bonds, risk free interest rates and volatility index. Furthermore, Fruhwirth and Sogner (2012) developed an asset pricing model to test prior study findings that the weather had an impact on the mood that could be seen in asset prices, and discovered that good weather resulted in higher predicted asset returns and lower asset volatility.

Mirza et al., (2012) examined the impacts of temperature on markets in Pakistan (Karachi Stock Exchange and Islamabad Stock Exchange) and revealed negative influence of temperature on returns of stock market. According to Goetzmann et al. (2013), weather-based variables that affect mood have an impact on mispricing perception and institutional investors' trading decisions. They looked at survey and trade data and discovered that individual companies and the Dow Jones Industrial Index were expensive, which raised the likelihood of institutions selling on cloudier days. They looked at investor mood using stock level measurements and discovered that pessimism had a detrimental or negative impact on daily market returns.

An analysis of relevant literature was conducted after taking into account the important work of some researchers. Psychological studies are also taken into account. Bell (1981); Howarth & Hoffman (1984); Eagles (1994); Rind (1996) have found that weather has an impact on people's moods and behaviors. Individuals' productivity is influenced by the weather (Connolly 2008)). Weather has an effect on people's happiness and sadness, despair and life

satisfaction, productivity and opportunity cost, financial decisions, and mental health, according to psychological studies. Weather has an impact on investors since they are humans. Investors' mental states may be influenced by changes in the weather, which can be shown in their financial decisions. Weather variables may be some affecting aspects that influence investors, and behavioral finance focuses on this issue that some effecting factors that influence the investors' mood and behaviors that can affect the pattern of trading.

Some studies have looked into the impact of weather on stock returns; however, their findings are equivocal. According to the studied literature [Saunders (1993); Mehra and Sah (2002); Hirshleifer & Shumway (2003); Cao & Jason Wei (2005,2006); Chang et al. (2006); Keef & Roush (2002, 2005, 2007); Gerlach (2007); Chang et al. (2008); Jacobsen & Marquering (2008); Akhtari (2011); Dong & Tremblay (2014)]. While some empirical investigations [Trombley (1997); Kramer & Runde (1997); Goetzmann and Zhu (2005); Yoon & Kang (2009); Fruhwirth & Sogner (2011, 2012); and Lu & Chou (2012)] found no effect of weather on stock returns.

Three explanations for the study are suggested by the literature. The first is psychological data [Saunders (1993); Hirshleifer & Shumway (2003)] that links weather factors to mood and their effects on stock returns. Second, evidence on the relationship between weather variables and stock returns is inconclusive and disputed, and third, Mirza et al., (2012) investigated the effect of weather variables in Pakistan by evaluating temperature. This study includes some additional weather factors in order to add to the literature on weather effects in Pakistan. From 2010 to 2014, this research examines the association between three major weather variables: temperature (high), humidity (high), and precipitation, and daily stock returns of non-financial companies listed on the PSX.

As temperature has a negative influence on individual performance (Bell 1981), this study hypothesizes that an increase in temperature has a negative effect on stock returns [Cao & Wei (2005, 2006); Chang et al. (2006); Keef & Roush (2007); Jacobsen & Marquering (2008); Hu (2008)]. As humidity is negatively associated with negative affect on human performance (Howarth & Hoffman 1984), it has a negative impact on stock returns (Shu 2008). Rain reduces the level of life satisfaction (Pray 2011); therefore, it has a negative impact on stock returns [Gerlach (2007)]. Investors are people; therefore, the weather can influence their mood, which can lead to changes in stock return patterns (Goetzmann et.al 2013). The study tests for the following hypothesis based on literature ground.

H_1: Temperature negatively affects the stock returns.
H_2: Humidity negatively affects the stock returns.
H_3: Precipitation negatively affects the stock returns

METHODOLOGY

This study uses judgmental sampling to enable the sample units that are most appropriate for attaining the study's goals. The sample is selected based on the data's availability and completeness (Worthington, 2009). It took into account all non-financial companies listed on the Pakistan Stock Exchange, and then classified them according to the number of trading days. There were around 400 non-financial companies, which were divided into categories based on their trading days. The total number of trade days was 1155. (1-January-2010 to 30- August-2014). Total non-financial companies are classified into 12 groups based on trading days for this purpose.

The first group spans 1 day to 100 days, the second spans 101 days to 200 days, the third spans 201 days to 300 days, the fourth spans 301 days to 400 days, the fifth spans 401 days to 500 days, the sixth spans 501 days to 600 days and so on to 1100 days to 1155 days. Only firms with a minimum of 1000 trading days were examined in the study. The non-financial companies in this study were selected from a sample of 1000-1155 trading days. The number of trading days at the Pakistan stock market has been used to select a sample of 124 non-financial listed companies.

These businesses are considered regardless of their industry. The sample includes 1155 trading days from 124 non-financial companies listed on the Pakistan stock exchange, for a total of 137643 company days. The data for daily closing share prices have been collected from the official website of the Pakistan Stock Exchange[2]. The daily weather variables data for Karachi is sourced from the official website of the Wunder ground[3]. The panel data is used for this study from the period from 1-January-2010 to 30- August-2014 for stock returns and weather variables.

Theoretical Framework

This study tests the relationship of three most prominent weather variables as Temperature (High), Humidity (High) and Precipitation with daily stock returns of the non-financial firms listed on PSX from 2010-2014. The literature suggests that weather variables have effects on the individuals' mood [Bell (1981); Schwarz & Clore (1983); Howarth & Hoffman (1984); Schwarz (1990); Eagles (1994); Rind (1996)]. The effect of temperature [Cao & Wei (2005, 2006); Chang et al. (2006); Keef & Roush (2007); Jacobsen & Marquering (2008); Hu (2008); Dowling & Lucey (2008)], humidity (Shu 2008) and precipitation (Dowling & Lucey (2005) Gerlach (2007)), is negative on the daily stock returns.

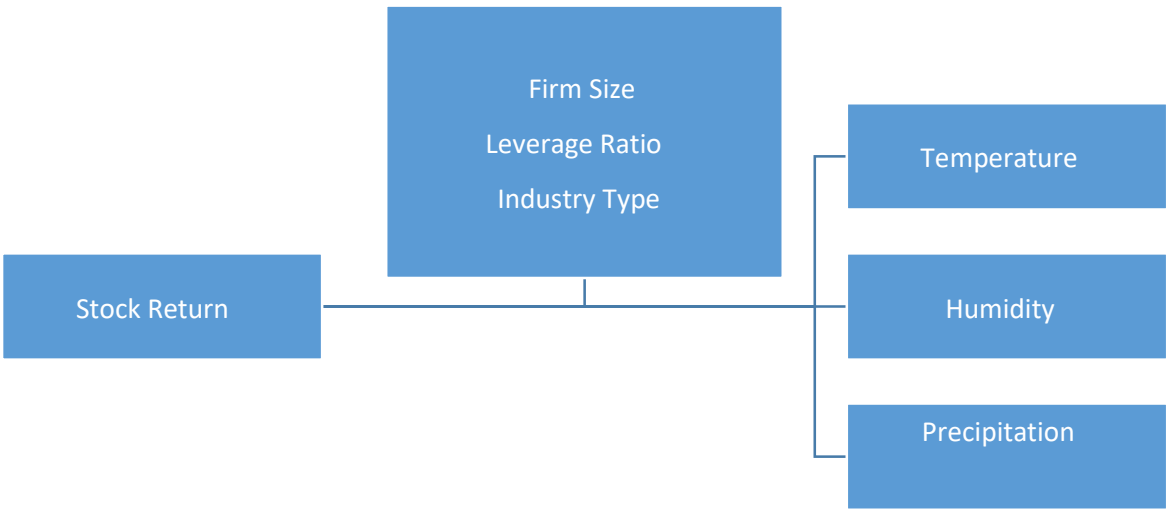

Figure 1: Theoretical Framework

[2] http://www.psx.com
[3] http://www.wundergrounds.com

Statistical model

$R_t = \alpha + \beta_1 Temperature_t + \beta_2 Humidity_t + \beta_3 D_1 Precipitation_t + \beta_4 Size_t + \beta_5 Leverage\ Ratio_t + \beta_6 D_2 Industry\ type_t + \varepsilon_i$

Where,

R_t shows the daily stock return at Karachi Stock Exchange on day t.

$Temperature_t$ shows the Temperature on day t.

$Humidity_t$ represents Humidity on day t.

A dummy for precipitation is used, as **DPrecipitation,** if it is rain then 1 and if it is not rain then 0 on day t.
$Size_t$ represents the firm size (Log of Assets of the firm on day t).

Leverage $Ratio_t$ represents the leverage of the firm (Debt to Asset Ratio).

Industry $type_t$ represents the specific sector (Coded the sectors).

Variables

Stock returns are considered as a dependent variable in this study. The daily stock returns were calculated using the closing share prices of 124 companies (PSX). The independent variables are temperature (high), humidity (high), and precipitation (given as a dummy variable). The data was collected on a daily basis and used as is, as provided on the Wunder Grounds website. The temperature data is expressed in degrees Celsius (^{0}C). The humidity data was expressed as a percentage of the relative humidity in the air. The data set includes a millimeter measure of rain, but it was treated as a dummy variable in this study, therefore the data is presented as follows:

If there is rain=1
If there is no rain =0

The equation accounts for the possible effects of company size, leverage and industry type to rule out any influence on the explanatory variables in this study. The size of a company is determined by the log of assets. The Debt to Asset Ratio has used as a proxy for the leverage ratio. The industry type dummy is created by coding the specific sector. The data for firm size and leverage ratio are from the related firms' annual Balance Sheet reports have been taken.

DISCUSSION AND ANALYSIS

To determine the link between weather-related factors and daily stock returns of non-financial enterprises listed on the Pakistan Stock Exchange, this study employed regression analysis [Hirshleifer & Shumway (2003), Goetzmann & Zhu (2005), Cao & Wei (2005, 2006), Fruhwirth & Sogner (2012)]. In Table 1, the variables are regressed. Because of the issue of multi-collinearity, the weather variables employed in this study may be connected to one another, resulting in skewed results. Because cloud cover is positively connected with humidity and negatively correlated with hours of sunshine, Saunders (1993) defined weather in terms of clouds. Rain is likewise linked to clouds. Because temperature is positively connected to

weather, Cao & Wei (2005, 2006) defined weather in terms of temperature related with the cloud cover, rain and humidity. As a result, this research examines the topic of multi-collinearity among weather variables (Table 2). Furthermore, heteroskedasticity and auto-correlation are examined (Table 1).

The effect of weather variables (Temperature, Humidity, and Precipitation) on daily stock returns is very small, as evidenced by the R-Square value of 0.000616 roughly zero, implying that weather factors have no effect on the Pakistan Stock Exchange. This finding is consistent with the findings of the Trombley (1997), Kramer and Runde (1997), Goetzmann and Zhu (2005), Yoon and Kang (2009), Fruhwirth and Sogner (2011) (2012) and Lu and Chou (2012) as no effect of weather on stock returns. The value of constant is 0.00244204 (Table 2), shows the value of average daily returns and significant at 1%. The t-ratio is 2.6768 is significant, directing that if these weather variables do not exist than the returns are 0.00244204 on average.

The coefficient (β_1 Temperature) of Temperature (High) is -0.000322342 (Table 2), shows the negative and significant at 1% relation with stock returns.The t-ratio 2.6773 directing towards significant negative relation between Temperature and Returns. Any unit increase in the temperature decreases the stock return by -0.000322342 but temperature has slighter impact on daily returns. It directs towards the acceptance of the H_1, there is negative relation between temperature and stock returns. The negative relation of Temperature and Return is consistent with the findings of Cao and Wei (2005, 2006), Chang et al. (2006), Keef and Roush (2007), Jacobsen and Marquering (2008), Hu (2008). The effect of Temperature on Return is slighter in case of (Karachi) Pakistan.

The Humidity (High) has shown significantly negative but slighter effect on daily returns. The β_2 ($Humidity_t$) is -2.78458e 05 (Table 2) is significant at 1%, shows unit increases in the level of Humidity in air decreases the return by -2.78458e 05. The t-ratio is -3.1368 directing towards significant negative relation between Humidity and Returns. The negative relation of Humidity with daily returns is consistent with the findings of the Shu (2008). It directing towards the acceptance of the H_2, there is negative relation between humidity and stock returns. The effect of Humidity on Return is slighter in case of (Karachi) Pakistan.

This study has also considered the Dummy of Precipitation (as if Rain=1, if not Rain=0). The effect of Precipitation (on rainy day) is 0.00215576 (Table 2), is positive but little effect of Precipitation on daily returns. The value of constant is 0.0061312; it shows that on average the stock return on non-rainy day is 0.00244204. The value of the precipitation coefficient ($\beta_3 DPrecipitation_t$) is 0.00215576 shows that stock returns on rainy day is 0.00215576 more than the non-rainy day. The stock returns on rainy day (0.00244204+0.00215576= 0.004598) and significant at 1%. The t-ratio is 2.6481 directing towards significant positive relation between Precipitation and Returns.

The literature has suggested negative relation of Precipitation with daily returns (Gerlach (2007)). The findings regarding effect of Precipitation are not consistent with the literature. The findings are directing towards the rejection of the H_3, that there is negative relation between precipitation and stock returns. The effect of Precipitation on Return is slighter in case of (Karachi) Pakistan. The reason may be that Pakistan is a warm country where the rainy days lead to good mood. Another reason is that rainy days fewer happen in Karachi, therefore the impact is slighter. The control variables as size of the firm, leverage ratio and dummy of industry type are also regressed on stock returns.

The size factor has shown -9.08858e-05 effect on returns; as by unit increases in size decreases the return by -9.08858e-05. The size has negative effect on the stock returns but insignificant. The leverage ratio has shown 6.08422e-05, positive effect on returns but insignificant; as the firms, unit increase in leverage increases the returns by 6.08422e-05. Therefore, the evidence suggests that more leveraged firms are more profitable. The dummy of Industry type shows negative effect on returns. The effect is -1.08527e-05; shows that difference in industry type decreases the stock returns by -1.08527e-05.

Overall, the results are significant at 1% but very weak (approximately zero) effect of weather variables (Temperature, Humidity and Precipitation) on the daily stock returns of the 124 non-financial firms listed on the Pakistan Stock Exchange. These findings are consistent with the findings of the Trombley (1997), Kramer and Runde (1997) Goetzmann and Zhu (2005), Yoon and Kang (2009), Fruhwirth and Sogner (2011) (2012) and Lu and Chou (2012) as no effect of weather on stock returns. The correlation values among the weather variables were less than 0.6, which indicate no multi-collinearity issue among the weather variables (Table 1). The Durbin-Watson value is 1.9 approximately 2, indicates there is no problem of Autocorrelation (Table 2). The study has used the GRETL statistical software for obtaining the results.

In summary, the findings of this study indicate that seasonal fluctuations in weather variables do not have a significant influence in affecting stock returns. The temperature and humidity have a slight negative relationship with stock returns. Precipitation has a positive effect since Pakistan is a hot nation where rainy days bring happiness, but it has a little effect on stock returns. Another factor is that rainy days are less common in Karachi; therefore precipitation has a less effect. The findings of this study are not consistent with the phenomena that good mood is linked with the higher returns.

The reasons might be because economic concerns and events are more applicable in Pakistan. Individuals have to work to make a living. Change in weather affects the daily needs and life style of the individuals but this impact is not seen on stock returns. The control variables as firm size, leverage ratio and industry type have also considered but they are also showing slighter and insignificant effect on stock returns. Therefore, this study is an addition to the empirical literature but it does not add to the theoretical perspective regarding effect of weather variables on the stock markets in Pakistan.

Table 1

Correlation Matrix for Independent Variables:
Correlation coefficients, using the observations 1:00001 - 3:45881

5% critical value (two-tailed) = 0.0053 for n = 137643

Temperature	**Humidity**	**Precipitation**	**Size**	**Leverage ratio**	**Industry type**	
1.0000	0.0294	-0.0111	-0.0178	0.0014	-0.0066	**Temperature**
	1.0000	0.1166	-0.0074	-0.0029	-0.0159	**Humidity**
		1.0000	-0.0083	0.0048	-0.0102	**Precipitation**
			1.0000	0.1210	-0.0269	**Size**
				1.0000	0.0088	**Leverage ratio**

					1.0000	**Industry type**

Table 2

Model 2: Fixed-effects, using 137643 observations
Included 3 cross-sectional units
Time-series length = 45881
Dependent variable: returns

	Coefficient	**Std. Error**	**t-ratio**	**p-value**
Constant	0.00244204	0.000912307	2.6768	0.00743 ***
Temperature	-3.22342e05	1.20399e-05	-2.6773	0.00742 ***
Humidity	-2.78458e 05	8.87719e-06	-3.1368	0.00171 ***
Precipitation	0.00215576	0.000814086	2.6481	0.00810 ***
Size	-9.08858e-05	5.67956e-05	-1.6002	0.10955
Leverage ratio	6.08422e-05	0.00049232	0.1236	0.90165
Industry type	-1.08527e-05	1.90938e-05	-0.5684	0.56977
Mean dependent variable	0.000531	**S.D. dependent variable**		0.040277
Sumsquared resid	223.1504	**S.E. of regression**		0.040266
R-squared	0.000616	**Adjusted R-squared**		0.000558
F(8, 137634)	10.61254	**P-value(F)**		5.08e-15
Log-likelihood	246841.8	**Akaike criterion**		-493665.6
Schwarz criterion	-493577.1	**Hannan-Quinn**		-493639.1
rho	0.050454	**Durbin-Watson**		1.989084

Test for differing group intercepts –
Null hypothesis: The groups have a common intercept
Test statistic: F (2, 137634) = 24.2889
With p-value = P (F (2, 137634) > 24.2889) = 2.8401e-011

Table 3

Hypotheses and Results

Hypotheses	**Results**
H_1: Temperature negatively affects the stock returns.	Accepting the **H_1**
H_2: Humidity negatively affects the stock returns.	Accepting the **H_2**
H_3: Precipitation negatively affects the stock returns.	Rejecting the **H_3**

CONCLUSION AND RECOMMENDATIONS

In each year, the four seasons are unique and have a varied impact on people's moods, behaviors and actions. Any corporation's investors, traders, or human resources are human

beings, and their attitudes and activities are influenced by changes in the weather or season. The Efficient Market is the premises of traditional finance theory, but there are additional behavioral elements that impact investors' moods, behaviors, and actions. Many psychological studies show that bright sunny days and temperatures are associated with a positive mood, whereas cloud cover and rainy days are associated with increased productivity. Various studies on behavioral finance indicate the effect of weather-related factors on daily stock prices, markets and investor trading patterns. The objective of the present research is to look at the impact of weather-related factors on daily stock returns in Pakistan. The said study is prompted by the weather in Pakistan, contested results of prior studies and the lack of previous research on the issue in the setting of Pakistan.

The non-financial companies listed on the Pakistan Stock Exchange form the study's sample frame. The daily stock prices for 124 non-financial listed corporations at PSX selected using a judgmental sample approach, are acquired from the Pakistan Stock Exchange for the period 2010-2014. The weather variables (Temperature (High), Humidity (High), and Precipitation) are taken into account for Karachi, with data collected from Wunder Grounds. The regression method was used to find the comprehensive relationship between weather variables and daily stock returns of non-financial companies listed on the Pakistan Stock Exchange.

Temperature has a negative influence on H_1 acceptance, and it is considerable at 1% but has a minor effect on daily returns. Humidity has a negative effect on H_2 acceptance, which is considerable at 1% but has a smaller effect on daily returns. Precipitation has a positive effect on H_3 rejection, which is significant at 1%. It also has a positive effect on daily returns, although the effect is low. The results show a very weak relationship between stock returns and weather variables, with no effect of weather variables on daily returns (Temperature (High), Humidity (High), and Precipitation). Overall, the results are significant at 1%; however the influence of weather variables of the 124 non-financial companies listed on the Karachi Stock Exchange is very modest, with approximately no effect. Furthermore, the control variables are taken into account in this study; however they have no significant effect on the returns.

The present research is a vast field of study. This field of research has not been adequately discussed in Pakistan. Only three weather variables were evaluated in this study: temperature (high), humidity (high) and precipitation. With a larger data set and a longer time span, more research can be done on the effects of temperature (low), humidity (low), and precipitation, as well as temperature (high), humidity (high), wind, cloud cover and sunlight.

The present research has a very important role for every business because change in weather is actually change by nature and affects everybody lives in it. Investors are human beings live in the system provided by the nature and affected by the change in season that will subsequently affect their decision regarding the investment decisions.

In Pakistan weather is extreme in nature and it affects may not be consistent because change in weather brings a lot of variation in the behaviors of the investors and ultimately the capital market. If changes in weather conditions have effect on the investors' mood then these changes may alter investor's aptitude as risk taker or risk averse. The study contributes to the existing literature by providing the knowledge related to weather effects in developing countries, as developing countries are rarely addressed in this regard.

The findings of this study may benefit the financial managers, investors and financial management consultants in making policies regarding investment decision. Management will have benefit to know the investors regarding their feelings and emotions due to variations in

the season and their significance in the performance of the business. It will also help students and new researchers who want to conduct further research on the topic of weather variables and stock market return and their subsequent effect on the firm performance with respect to Pakistan.

The limitation of the study is that this study considers the effect of prevailing weather effects of Karachi (Pakistan) on Pakistan Stock Exchange while investors across Pakistan participate in the stock market. The results of this study are limited to Pakistani non-financial firms listed on Pakistan stock exchange. The findings of this study are limited because of the data time span, as daily stock returns data for five years is not seemed sufficient to take a broader view of the findings.

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