Economic Research-Ekonomska Istraživanja

ISSN: 1331-677X (Print) 1848-9664 (Online) Journal homepage: http://www.tandfonline.com/loi/rero20

Seasonal affective disorder and the Romanian stock market

Aurora Murgea

To cite this article: Aurora Murgea (2016) Seasonal affective disorder and the Romanian stock market, Economic Research-Ekonomska Istraživanja, 29:1, 177-192, DOI: 10.1080/1331677X.2016.1164924

To link to this article: http://dx.doi.org/10.1080/1331677X.2016.1164924

Published online: 29 Apr 2016.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA, 2016
VOL. 29, NO. 1, 177–192
http://dx.doi.org/10.1080/1331677X.2016.1164924

Seasonal affective disorder and the Romanian stock market

Aurora Murgea

Finance Department, Faculty of Economics and Business Administration, West University of Timisoara, Str. J.H. Pestalozzi, nr.16, Timisoara, jud., Timis 300115

ABSTRACT

A large number of studies conducted in economic psychology, cognitive sciences and behavioural finances support the idea that economic actions are not a result of a rational utility maximising behaviour, but seem to be driven by other factors, such as personality traits, psychological factors, gender, age and genetic heritage. In this context, capital markets are sometimes non-efficient and an anomaly-based trading strategy could be used to enhance the returns, especially in the case of emergent markets. This article analyses the presence of the Seasonal Affective Disorder (SAD) effect on the Romanian stock market, in a time span that includes calm, growth periods and volatile periods as the one of the 2008 global financial crisis. The results support the existence of a correlation between the number of hours of daylight and market returns before and after the last financial crisis, even if the effect seems to change after the crisis.

ARTICLE HISTORY
Received 25 April 2013
Accepted 1 October 2015

KEYWORDS
Stock market; mood; investment behaviour; sadness; daylight

JEL CLASSIFICATIONS
D03; D81; G01

1. Introduction

For several decades, financial decision theory was dominated by the Efficient Market Hypothesis (EMH) proposed by Eugene Fama (1970). In his view, an ideal market is considered to be the one where all the available information regarding a stock is fully reflected by its price at any given time. There are no transaction costs, information is available for free to all the players in the market and besides, they are all rational economic agents. Moreover, investors cannot outperform as they do not have access to any other private information that may help them out-profit other participants. In this scenario we deal with full disclosure, having as a side effect non-predictability. Of course, if some investors do indeed outperform, the EMH argument is luck and no other external unpredicted factor.

The latest literature brings mixed empirical evidence regarding stock market efficiency, but for the most part it does not support EMH especially for transition countries (Filip & Raffournier, 2010; Guidi, Gupta, & Maheshwari, 2011; Pele & Voineagu, 2008). A short look at the EMH's premises and hypothesis easily reveals its limitations. Information is often not freely available for every participant, the investors are not fully rational so the market has 'flaws' – human behaviour at certain times and in particular circumstances will ultimately

CONTACT Aurora Murgea aurora.murgea@e-uvt.ro

impact the course of the market. Investors are able to control their actions and to reason, but sometimes rely on intuition and heuristics. More than that, contrary with EMH, human actions are, in a significant proportion, a result of the 'animal spirit' (Akerlof & Shiller, 2009) since feelings, emotion and mood often represent very important decision determinants. The 124 systemic financial crises the world economy has suffered since 1970 (Laeven & Valencia, 2008) have proven that capital markets are not efficient and the prices are mainly determined by investors' feelings (fear, greed, enthusiasm and panic) and mimetic behaviour (the result of thousands of years of mankind's evolution).

Different persistent anomalies[1] that contradict EMH have been documented in recent decades: *fundamental anomalies* as value effect (Basu, 1977, 1983; DeBondt & Thaler, 1985, 1987; Goodman & Peavy, 1983), size and neglected firms effect (Arbel & Strebel, 1982; Banz, 1981; Reinganum, 1981), financial reports effect (Ball & Brown, 1968); *technical anomalies*; *calendar anomalies* as January effect (Rozeff & Kinney, 1976), turn-of-the-month effect (Ariel, 1987), weekend effect (French, 1980), day-of-the-week effect (Aly, Mehdian, & Perry, 2004; Kiymaz & Berument, 2003), and the Halloween effect (Bouman & Jacobsen, 2002). A new emerged category includes the so called *mood anomalies* determined by the weather parameters: number of hours of sunshine, temperature, humidity, geomagnetic storms (Cao & Wei, 2005; Dowling & Lucey, 2008a, 2008b; Saunders, 1993) and by biorhythm variables: full moon effect (Dichev & Janes, 2003), daylight saving time (DST) effect (Kamstra, Kramer, & Levi, 2000, 2002), seasonal affective disorder (SAD) effect (Dowling & Lucey, 2005; Kamstra, Kramer, & Levi, 2003).

Abnormal patterns in stock returns are very important for investors, since they could be used to build an anomaly-based trading strategy. The persistence and intensity of the anomalies, and as a result, the usefulness of these strategies, is higher for the capital markets that are not very well developed, where weak regulatory systems, slow progression on private sector development, the limited supply of institutional investors and macroeconomic uncertainty, represent serious obstacles to stock market development. For the more developed countries that have highly liquid and more efficient capital markets, recent studies have proved that the presence of capital market anomalies have been attenuated since they are already known (Schwert, 2003) and they can be offset by traders' strategies (Chordia, Subrahmanyam, & Tong, 2014).

The aim of this article is to provide further evidence and to investigate the presence of the SAD effect on the Romanian stock market. We are hypothesising that higher volatility associated with financial turmoil influenced the SAD effect on Romanian stock market and we are employing an empirical analysis in order to prove it. Main variables used to assess the correlation between the photoperiod and the returns evolution in Bucharest Stock Exchange (BSE) are dynamic growth rate of Bucharest Exchange Trading (BET) index and dynamic growth rate of daylight. Also a dummy variable for the January effect is used in order to capture the increases in returns at the beginning of the fiscal year.

The present study enriches the existing body of the literature on Romania's case, a country that was not included in any of the samples used by the previous studies. Despite the capital markets globalisation, each capital market has its own identity, its own features generated by the different cultural pattern, seasonality in incomes, admission rules and regulatory framework. The anomalies' presence and their intensity are dissimilar and, as a result, a different country scenario cannot apply. For instance, Dumitriu, Stefanescu and Nistror (2012), notice that another anomaly, the Halloween effect is present in the crisis period only in the case of Greece (from a 28 country sample) due to tourism activities and its seasonality in incomes. A strategy built for another country from the sample would not be applicable. The Romanian capital market has its own features that make it unique. It is still a very young, not very liquid market where the large institutional investors easily impose the trend. With a price earnings ratio (P/E) often below 10, Romanian stocks appear relatively cheap compared with the expected payoffs. Along with those characteristics, common also to other south European markets one could notice the distinctive investment behaviour of the domestic investors. The level of financial education is relatively low and the main sources of gathering information used by the investors is quality uncertain (Dragotă & Şerbănescu, 2010). The main investing strategy of the questioned subjects is short-term, highly speculative and determines increased market volatility. This attitude has a root in the first years of Romanian capital market existence after the communist regime had collapsed, years that induced a high degree of uncertainty regarding the Romanian authorities' capacity to regulate the financial sector[2].

Since the Romanian capital market is still insufficiently developed and has a reduced degree of efficiency[3] that allows the investors to outline and implement anomaly-based trading strategy, the present analysis could be extremely useful. Emergent countries, such as Romania, represent a by far different setting than the developed countries that have been usually considered in the previous studies. A continuous and focused analysis could shed more light for both the domestic and the foreign investors in this market and may help them get supplementary returns.

Compared with the former studies, this study has the advantage of using some very distinct time spans that allow analysing the effect in very different market conditions: a first flourishing period that ends in the middle of 2007, once the first signs of the global crisis have appeared, a second period that includes the turmoil and the crisis aftermath and the third period of slow growth both in term of liquidity and return, specific to the last two years. Those very different periods help one to see the evolution of the effect in the dynamics of, and to be able to formulate some conclusion for, the Romanian capital market.

Our empirical findings reject the hypothesis that the Romanian capital market evolution is insensitive to the SAD effect, especially for the period that precedes the crisis. The effect seems to disappear during the crisis but reappear in a different shape in the subsequent years. Overall, our empirical results provide novel evidence of the SAD effect on Romanian capital market.

The article is divided into six sections. The second section illustrates the theoretical framework for the photoperiod effect on the individual's mood. The third section presents the main findings from the financial literature that connects SAD with the capital markets. The fourth section presents descriptive findings and data. The fifth section discusses the methodology and the econometric findings. The sixth section concludes.

2. Photoperiod, mood and risk aversion

The idea of different biorhythm cycles that influence human behaviour can be traced back to the German surgeon Wilhelm Fliess in the 1890s, who proposed a 23-day male period and a 28-day female period (Hines, 1998). More recent studies identified three different biorhythm cycles: a 23-day cycle influences physical aspects such as energy, resistance to disease, endurance; a 28-day cycle influences emotions such as sadness, elation, moodiness, creativity and a 33-day cycle influences intellectual functions such as alertness, memory and reasoning ability (Thommen, 1968).

Great attention has been paid to what influence human biorhythm. Photoperiod (numbers of hours of daylight), disruption of sleeping patterns due to DST and the lunar cycle have been proved to be among the main factors. As a direct result our biological balances are influenced, the adaptation mechanisms are impaired and the appearance of different mood disorders, especially depression and anxiety, is facilitated affecting also the decision mechanism.

The photoperiod is connected with SAD, a subtype of depression characterised by changes in mood, energy, sleep, eating habits and social activities with the change of season. There are two types of SAD, evidenced by the medical literature: winter-type and summer-type. Winter-type is determined by light deficiency[4] during fall and winter, characterised by a lack of energy, oversleeping, overeating, especially carbohydrate craving. Summer-type SAD is generated by heat and humidity. Main features in this case include agitation, insomnia and weight loss. In both cases individuals become depressed and their attitude towards risk is impaired. Psychology researchers have documented a strong link between depression and risk-taking tendency. More depressed individuals have a reduced level of sensation-seeking and a reduced general willingness to take risks (Horwath & Zuckerman, 1993; Smoski et al., 2008; Tokunaga, 1993; Zuckerman, 1984). Another explanation is based on the SAD effect on investor's sentiment. According to the explanation, SAD change the investors' perceived risk and in the end, the estimate of the market risk (Kaplanski & Levy, 2009).

Winter-type SAD and summer-type SAD seems to be both more severe at extreme, higher or lower latitudes (Potkin, Zetin, Stamenkovic, Kripke, & Bunney, 1986; Rosenthal et al., 1984). Genetic type, gender and age are found to matter in SAD prevalence. For instance, Asians are more prone to summer-type SAD (Han et al., 2000; Ito et al., 1992) while for Caucasians it is more common to suffer from winter-type SAD (Magnússon & Axelsson, 1993; Soriano et al., 2007). Also, the highest propensity for SAD is found in women and younger individuals, compared with men and older individuals (Hedge & Woodson, 1996).

Two main frameworks have been proposed in recent decades in order to describe the link between mood and risk-taking: Mood Maintenance Hypothesis (MMH) proposed by Isen, Nygren and Ashby (1988) and Affect Infusion Model (AIM) proposed by Forgas (1995).

The MMH model is based on the idea that, independently of the current mood, the main goal of any individual is to achieve and maintain well-being. When in a good mood, the individual will avoid risky situations in order to preserve the good state. In the case of a bad mood situation, the individual will choose riskier alternatives hoping that the possible gains will lift his spirits. Isen et al. (1988) conducted some experiments to observe the correlation between mood and decision-making. In one of the experiments, two groups of people were targeted in a mall; one group was given a free sample note pad or clip and the other group received nothing. They then had to fill out a consumer product survey. Surprisingly the group with free samples gave a positive survey, whereas the other group did not. Isen et al. (1988) found that the positive affect induction exercises a change in decision-making and problem-solving, individuals induced with a positive mood tend to be more efficient. A change in cognitive organisation and collaboration has also been noted after the research, which improves work performance and also the ability to solve a problem quickly and efficiently. This behaviour is also well observed on the financial market.

The effect of human sentiment on the decision-making process is also supported by Forgas (1995). The AIM model suggests instead that subjects in a bad mood have a more pessimistic view of the world, perceive situations as riskier, and have, as a result, a lower propensity toward risk-taking. On the other hand, individuals in a positive affective state, who usually have a more optimistic view and perceive a safer environment, should to be more prone to risk-taking. The key assumption in the AIM model is that the effects of mood tend to be exacerbated in complex situations (high affect infusion strategies [HAIS]) that demand substantial cognitive processing, compared with little generative, constructive processing (low affect infusion strategies [LAIS]). In other words, as situations become more complicated and unanticipated, mood becomes more influential in driving evaluations and responses.

The model suggests that the information received is loaded with emotion and these sentiments eventually affect one's judgment and decision outcome. According to the model, individuals are strongly affected by emotion and mood in such way that our responses in different situations are a consequence of our psychological state. For example, if we receive a bad news, it matters a lot in which state we are currently in. If we had a very pleasant and happy day, our reaction to bad news may not be so strong, whereas if we already have bad day, our reaction to more bad news will be more stressful. So our mood in the case of receiving bad news influences our response but also the level of response. Again, if we are having a great day, hearing bad news may not impact us as much as if we are already in a bad mood and we hear more bad news.

To test the validity of AIM, researchers have gathered a group of people with the intention to manipulate their mood and observe their behaviour in certain situations. The participants were asked to watch one of three movies: happy, sad and neutral. Afterwards their risk tendency was measured. The scope of this experiment was to prove if mood does make a difference in decision-making. And it does – the participants who watched happy movies were more likely to take risky decisions, whereas the ones who watched sad movies were more risk averse. So the hypothesis was proven: 'risk-taking tendency is greater for those individuals who are in a happy mood than for those who are in a sad mood.' This behaviour can be observed everywhere – especially in gambling activities. People in a good mood show evidence of high risk-taking tendency but those in a bad mood avoid any risky activity. This scenario is also seen in investment activities on a capital market. People in a good mood take more risks. Bad mood is a clear sign of risk aversion; risk aversion affects human sentiment, decision-making and ultimately the trades on the capital market, making the market unpredictable.

Consistent with the principles of AIM, Yuen and Lee (2003), Kamstra et al. (2003), Kuvaas and Kaufmann (2004), Dolvin and Pyles (2007) and De Vries et al. (2010) found strong connections between mood and assumed risk.

Apparently contradictory, the two theories could both be considered valid. As individuals are pretty different, the relation between mood and risk-taking is influenced by several factors as gender (Fehr-Duda et al., 2011), age (Chou, Lee, & Ho, 2007), genetic heritage (Ebstein et al., 1996; Kuhnen & Chiao, 2009; Roe et al., 2009; Ronai et al., 2001), functioning of the endocrine system (Coates & Herbert, 2008; Eisenegger, Haushofer, & Fehr, 2011) and personality traits (Berkowitz et al., 2000; Chuang & Chang, 2007). Hence, the impact of changes of mood may have heterogeneous effects on the risk-taking attitude. More than that, the effect can be different for the same individual in different periods of time since supplementary distress factors could change the direction of the relationship. Since the mood has a non-equivocal impact on risk aversion one could conclude that the variables which influence mood could also impact on risk aversion and the capital markets evolutions.

3. SAD and capital markets

In financial research, several studies examined the SAD influence on general stock market participants, or more specifically, analyst's behaviour, but the results are quite mixed.

For example, Kamstra et al. (2003) investigate, on a nine country sample, the role played by SAD in the seasonal variation of stock market returns. Their results point out that seasonal depressed individuals have a tendency to sell their risky assets when the number of hours of daylight is starting to decrease during the fall and they resume their risky holdings in the winter, after the longest night of the year. The study also confirms the idea that this effect seems to be stronger in countries situated at higher altitudes where the seasonal variations are more extreme relative to the countries situated closer to the equator. The same direction of correlation is highlighted for the Irish market in Dowling and Lucey (2005), but only between the Winter Solstice and the Spring Equinox. In a further study, Dowling and Lucey (2008a) have tested other weather and biorhythm variables[5], and the SAD effect on the UK stock market and have found opposing results for the UK Small Index and the UK Main Index. For the UK Small Index, the results are consistent with the depression arising from the reduction of daylight hours, but the results are reversed for the UK Main Index. A SAD effect for small caps is also found by Dowling and Lucey (2008b) on a sample of 37 countries, but the results could be vitiated by the lack of control for the January effect which is rather important in the cases of small firms. Gerlach (2010) realised an extended analysis that confirms the results of Kamstra et al. (2003), despite the differences between those two studies: the country sample is enlarged with three more countries, a winter dummy variable replaces the fall dummy variable, the turn-of-the-year effect is introduced and the SAD hypothesis is tested starting from the predicted return influenced by macroeconomic news.

The SAD effect seems to also be present in the analyst's case (Dolvin, Pyles, & Wu, 2009). Despite the general optimistic approach in their forecast, the analysts, and especially those located in northern states confronted with fewer hours of daylight, seem to be less confident during SAD months.

However, there are several studies that found no evidence of a significant relationship in the direction described by Kamstra et al. (2003), between SAD variable and stock returns. For instance, Jacobsen and Marquering (2008), using a 48 country sample, show that a simple seasonal dummy explains better the seasonality in returns than the SAD effect[6]. Kelly and Meschke (2010) question both the psychological underpinnings of the SAD hypothesis formulated by Kamstra et al .(2003) and the idea of a more intense effect for the stock markets situated in countries where SAD is prevalent. They assert that in fact the results found by Kamstra et al. (2003) are driven by dummy variable misspecifications and the turn-of-the-year effect. 'Same week' evidence of a positive correlation between the length of the day and demand for stocks is also found in Finland (Kaustia & Rantapuska, 2011). Despite its geographical position individual trading seems to be more correlated here with the vacation period than with the SAD period. Individuals sell stock before and during the summer holidays and in December, prior to the holiday seasons. After the holiday period has passed they start buying stocks again.

The mixed results are quite normal if we consider that almost each study addresses a specific country or set of countries in a different period. The most important conclusion that can be drawn from the previous literature is that for specific countries and periods, the presence of the SAD effect was proved. This is particularly important from the investors' point of view since this effect can be used, as any other persistent anomaly, as a base for specific trading strategies. Considering all this, this study enhances the existent literature and could represent a useful tool for domestic and foreign investors in the Romanian capital market.

4. Data

Assuming market efficiency, one would be doubtful as to whether or not there could be any truth in the idea of Romanian capital markets' sensitivity to the SAD effect. In order to test the hypothesis that the Romanian capital market evolution is insensitive to the photoperiod, we use the dynamic growth rate of the BET index[7] (as a proxy for the growth rate of the Romanian capital market return), the dynamic growth rate of photoperiod (as a proxy for the SAD effect) and a dummy variable for the January effect.

For a more detailed and accurate analysis, adapted to capital market different conditions, the sample was split into three sub-periods: the rapid growth sub-period from 1 November 2000 to 30 June 2007 (S1); the crises and post-crises period characterised by a higher volatility and market instability from 1 August 2007 to 32 October 2012[8] (S2); and the slow growth period from 1 November 2012 to 31 December 2014 (S3). Our hypothesis is that the effect would be less visible on the entire sample but could appear in the growth, less volatile period of the market.

Period 1 represents the first years of Romanian capital markets' activity. Despite the reserved starting point (the market was still very young since the BSE opened in 1997, just three years before) in the following years, until the peak in 2007, the capital market had grown. The investors were overconfident in the assets traded on the market, which led to the over evaluation of market prices. Prices boomed right before the recession, reaching almost astronomical values, but the market kept moving forward. The constant growth gave investors a feeling of safety, of optimism. The favourable market conditions helped investors to overcome their fears and risk aversion so they increased their risky investments. The second period includes the latest financial crisis and its aftermath. Before the global recession investors were too optimistic and most assets and resources were overvalued, the situation changed dramatically as soon as vulnerabilities started to appear in the system. The crisis also changed the investors' behaviour since pessimism and uncertainty took over, thus leading to massive risk aversion across the entire world. The third period represents the recovery of the Romanian market after the global crisis that dominated the world for several years. Prices are slowly going up, the market is starting to recover and provide better results for investors.

In order to construct the dynamic growth rate for the previously mentioned two main variables we have used BET's closing prices[9] and the number of hours of daylight for Romania's latitude and longitude[10], from 1 November 2000 to 31 December 2014, as follows:

$$DGR\_BET_t = \ln\left(\frac{BET_t}{BET_{t-1}}\right) \tag{1}$$

Table 1. Descriptive statistics.

	S1		S2		S3	
Descriptive statistics	DGR_BET	DGR_DAYL	DGR_BET	DGR_DAYL	DGR_BET	DGR_DAYL
Mean	0.001786	0.000257	-0.000501	-0.000308	0.000293	-0.000128
Median	0.001213	0.000000	0.000126	-0.00108	0.000233	-0.000462
Maximum	0.145765	0.041451	0.128466	0.328744	0.014821	0.116750
Minimum	-0.119018	-0.017944	-0.11824	-0.351172	-0.016830	-0.106675
Std. Dev.	0.015194	0.005853	0.020053	0.014276	0.003335	0.007303
Skewness	0.425155	0.254956	-0.388227	-1.924059	0.007350	1.852817
Kurtosis	13.02781	4.821082	9.039051	481.1997	5.607316	207.0341
Jarque-Bera	6874.380	242.7448	2080.723	12,835,214	152.3955	933511.8
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	2.908674	0.418452	-0.674201	-0.41519	0.157790	-0.068966
Sum Sq. Dev.	0.375821	0.055768	0.541278	0.274322	0.005971	0.028636
Observations	1629	1629	1347	1347	538	538

Source: Author's E-views estimation.

$$DGR\_DAYL_t = \ln\left(\frac{NOD_t}{NOD_{t+1}}\right) \tag{2}$$

DGR_BET = dynamic growth rate of BET calculated based on BET closing prices

DGR_DAYL = (dynamic growth rate of photoperiod) calculated based on the numbers of hours of daylight (NOD)

To avoid spurious results, we checked the stationary for both time series and none of them have unit roots (results are presented in Appendix 1, Tables A1, A2 and A3 for all the data sets).

The main descriptive statistics for the entire sample and the three subperiods are presented in Table 1.

5. Methodology and econometric findings

The starting point in our model is the assumption that investors in the Romanian stock market are indeed influenced by SAD in their financial decisions and that the effect direction, intensity and psychological motivation are different in calmer periods compared with more volatile periods.

Starting from this alleged assumption, we have chosen to use naive ordinary least squares (OLS) models both for the entire sample and for sub periods.

To discover whether the relationship is significant and robust we test the following benchmark specification:

$$DGR\_BET_t = \alpha + \sum_{i=1}^{n} \beta_i DGR\_BET_{t-i} + \sum_{j=0}^{m} \delta_j DGR\_DAYL_{t-j} + D\_JAN_t + \varepsilon_t \tag{3}$$

where DGR_BET_{t-i} and DGR_DAYL_{t-j} are lagged variables

In order to mitigate the potential influence of the January effect we have included the dummy variables D_JAN_t. The January effect refers to the appearance of abnormally high

Table 2. Regression results for S1.

Variables	Coefficients
C	0.001464***(0.000380)
DGR_BET(-1)	0.106973***(0.024691)
DGR_DAYL	0.149478(0.082936)
DGR_DAYL(-1)	-0.217373***(0.082834)
D_JAN	0.006006**(0.002436)

Source: Author's E-views estimation.
Included observations: 1628 after adjustments.
standard error in ().
*significant at 10% level,
**at 5% level,
***at 1% level.

returns in the beginning of the year especially in the case of small-capitalisation stocks (Haugen & Jorion, 1996). A potential explanation could be the «selling hypothesis», a strategy intended to limit the impact of taxation. At the end of the year investors are selling their losing shares to lower the taxable incomes. The resulting amounts are reinvested at the beginning of the year which increases demand and puts pressure on prices (Starks, Yong, & Zheng, 2006). In order to take into account these abnormal returns (both lower returns in the end of the year and higher returns at the beginning of the year) we have constructed a dummy variable that takes next values:

$$D\_JAN \cdot \begin{cases} \text{1 for trading days around the} \\ \text{end of the year, in both senses} \end{cases} \tag{4}$$

The results obtained for the first sub period confirm the initial assumptions and fit the Romanian capital market scenario before the crisis (see Table 2). Still extremely young, the market and trends are not very stable in that period and the market memory is quite short[11]. The January effect is present on the market in the same sense with the one described by the literature. If one looks at the daylight influence in this period, short-term reverse reactions of the market than the one hypothesised by Kamstra et al. (2003) can be noticed. The change in daylight seems to be inverse correlated with market returns[12]. This reaction is consistent with the MMH, proposed by Isen et al. (1988). The MMH model has as main pillar – the idea that, independently of the current mood, the main goal of any individual is to achieve and maintain well-being. As a result, in a good mood state, the individual will avoid risky situations in order to preserve the initial disposition. The presence of this inverse correlation compared with the one noticed by previous literature for other countries opens the way for a SAD-based strategy, similar with the one described by Kamstra et al. (2003). Kamstra et al. (2003) have used in this example a strategy that involved swapping the investments between Sweden and Australia in order to benefit from the higher returns associated with the longer photoperiod in both countries (when the season change in Europe and the winter comes the investor would have to move his resources to Australia where the summer starts). Considering the opposite effect on the Romanian capital market, when the daylight starts to increase, the investors could switch Romanian market with any other country where daylight is positively correlated with the returns (despite its latitude). When the season changes again, a reverse resource movement would be able to bring more return than a non-SAD strategy.

Table 3. Regression results for S2.

Variables	Coefficients
C	-0.000491(0.000556)
DGR_BET(-1)	0.094753***(0.027192)
DGR_DAYL	0.050359(0.038377)
DGR_DAYL(-1)	-0.031062(0.038379)
D_JAN	0.001682(0.002855)

Source: Author's E-views estimation.
Included observations: 1,346 after adjustments.
standard error in ().
*significant at 10% level,
**at 5% level,
***at 1% level.

Table 4. Regression results for S3.

Variables	Coefficients
C	0.000188(0.000143)
DGR_BET(-1)	0.043314* (0.023197)
DGR_DAYL^2	-0.273307(0.187351)
DGR_DAYL(-1)^2	-0.395706**(0.187685)
D_JAN	0.004279***(0.000876)

Source: Author's E-views estimation.
Included observations: 537 after adjustments.
standard error in ().
*significant at 10% level,
**at 5% level,
***at 1% level.

In the second period, as expected, both SAD and the January effect are not strong and significant enough (see Table 3) and the return is driven by some other forces. The recession struck every area of the economy and the investors' confidence was strongly affected. The investors' trade behaviour became more risk averse because of the harsh times of the recession. This could suggest that in the more volatile periods generated by an economic turmoil the investors are less influenced by mood and other psychological variables and more influenced by economic determinants. One could notice that the crisis seems to highly impact on the correlation between SAD and the stock market.

It is interesting to notice that in the last period, when the main turbulence had gone, both the SAD effect and the January effect reappeared. It is true that for the SAD effect the relationship changed shape and it is no more any linear than it was in the first decade. The market became more stable and efficient, macroeconomic disequilibria were corrected and the latest returns attracted more foreign investors. In this context the investment climate and behaviour have changed. Market participants seem to be sensitive to former daylight variations that generate a decrease in market returns (see Table 4). A SAD strategy could be employed in this case too. The January effect also reappeared on the market.

Overall, one could notice that despite the periods of turmoil, when the effect seems to disappear as a result of highly disturbed market fundamentals and huge increase in risk aversion, the changes in the photoperiod are able to generate abnormal market returns due to the shifts in mood and as a consequence in risk aversion.

6. Conclusions

The evidence in this article supports the existence of the effect of SAD on Romanian capital market in growth and calm periods, even when we control for another well-known market season, such as the January effect. In those periods decreases in daylight induce depression but this depression generates a further desire to invest because individuals simply hope that the future wins will be able to lift their spirits (the situation is somehow similar with that of a lotto player who continues to play after a loss, even if he is depressed about it, just because he hopes that the future gains will compensate his earlier loss). Supporting our argument is the fact that photoperiod has been shown in numerous medical and psychological studies to have a profound effect on individual's mood, and in turn, mood has been found to be related to risk aversion.

In the crisis period both effects are insignificant due to the major changes in capital markets. The investors seem to be too depressed by the dramatic decrease in all the market assets to notice the differences in light or any other seasonality.

The conclusion of this study could be extremely useful for the investors who prefer an emergent market, such as Romania, for their resources. Despite the higher risks and lower liquidity, emergent markets represent a very good place to employ anomaly-based strategies and to gain more money than in a developed market. Among the emergent markets, Romania has the advantage of some really cheap stocks compared with the generated payoffs, a stable economic environment and not least, a specific direction of the SAD effect that allows for using a SAD-based strategy as suggested previously.

Notes

1. Following Twersky and Kahneman's (1986) definition, an anomaly is a deviation from an actually accepted paradigm that is too comprehensive to be ignored, too systematic to be considered a common error and too fundamental to be accommodated with the normative system.
2. Open-end-funds have been created before the capital market so there were no places to invest the collected resources, despite the huge returns promised by the fund managers. The collapse of the SAFI open-end-fund and several Ponzi Games as the CARITAS had deeply shaken the investors trust. Thousands of Romanian investors lost their homes and all their retirement funds. Romanian investors became suspicious of their relationship with the financial system and preferred to use their resources mainly in the short-term to avoid a higher degree of risk.
3. For more details one could see: Pele and Voineagu (2008), Filip and Raffournier (2010) and Guidi et al. (2011).
4. The lack of light determines serotonin deregulation in the brain that can cause several brain anomalies (for further details see Cohen et al., 1992; Liotti & Mayberg, 2001).
5. The tested variables are: temperature, precipitation, wind, geomagnetic activity (as weather variables) and SAD, DST changes (as biorhythm variables).
6. It should be noted that the employed methodology, data and results of their study are contested by Kamstra et al. (2009).
7. BET index is the most representative for the Romanian market according to BSE representatives. It was launched on September 1997, being the first index developed by BSE. The index traces the performances of the 10 most liquid stocks listed on the BSE and it is calculated as a free float capitalisation weighted index.
8. The initial signs of the financial international crises started to be visible from July 2007, when a loss in confidence in the value of securitised mortgages in the US led to a liquidity crises

that prompted important capital injection into financial markets by the United States Federal Reserve, Bank of England and European Central Bank.
9. Closing prices are provided by BSE and are available on their web page: www.bvb.ro.
10. Number of hours of daylight are provided by Astronomical Applications Department of the US Naval Observatory and are available on their web page: http://aa.usno.navy.mil.
11. As one can see the BET dynamic returns are more dependent by yesterday's values than those of the day before. Also the reverse sign in the coefficients of DGR_BET (-1) and DGR_BET (-2) could signify a small degree of market stability.
12. A depressed individual in a period with less daylight will take more risk.

Disclosure statement

No potential conflict of interest was reported by the author.

ORCID

Aurora Murgea http://orcid.org/0000-0001-6529-5338

References

Akerlof, G. A. & Shiller, R. J. (2009). *Animal spirits: how human psychology drives the economy and why it matters for global capitalism*. Princeton: Princeton University Press.

Aly, H. Y., Mehdian, S. M., & Perry, J. M. (2004). An analysis of day-of-the-week effects in the Egyptian stock market. *International Journal of Business*, 9, 301-308. Retrieved from http://ssrn.com/abstract=551101

Arbel, A. & Strebel, P. (1982). The neglected and small firm effects. *The Financial Review (July), 17*, 201–218. doi:http://dx.doi.org/10.1111/j.1540-6288.1982.tb00065.x.

Ariel, R. A. (1987). A monthly effect in stock returns. *Journal of Financial Economics, 18*, 161–174. doi:http://dx.doi.org/10.1016/0304-405X(87)90066-3.

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting numbers. *Journal of Accounting Research*, 6, 159-178. Retrieved from: http://www.jstor.org/stable/2490232

Banz, R. W. (1981). The relationship between return and market value of common stock. *Journal of Financial Economics, 9*, 3–18. doi:http://dx.doi.org/10.1016/0304-405X(81)90018-0.

Basu, S. (1977). Investment performance of common stocks in relation to their price-earnings ratios: a test of the efficient markets hypothesis. *The Journal of Finance, 32*, 663–682. doi:http://dx.doi.org/10.1111/j.1540-6261.1977.tb01979.x.

Basu, S. (1983). The relationship between earnings' yield, market value and return for NYSE common stocks: further evidence. *Journal of Financial Economics, 12*, 129–156. doi:http://dx.doi.org/10.1016/0304-405X(83)90031-4.

Berkowitz, L., Jaffee, S., Jo, E., & Troccoli, B. T. (2000). On the correction of feeling- induced judgmental biases. In J. P. Forgas (Ed.), *Feeling and thinking: the role of affect in social cognition* (pp. 131–152). New York, NY: Cambridge University Press.

Bouman, S., & Jacobsen, B. (2002). The Halloween indicator, 'sell in may and go away: another; another puzzle. *American Economic Review*, 92, 1618-1635. Retrieved from http://www.jstor.org/stable/3083268

Cao, M. & Wei, J. (2005). Stock market returns: A note on temperature anomaly. *Journal of Banking and Finance, 29*, 1559–1573. doi:http://dx.doi.org/10.1016/j.jbankfin.2004.06.028.

Chordia, T., Subrahmanyam, A., & Tong, Q. (2014). Have capital market anomalies attenuated in recent era of high liquidity and trading activity? *Journal of Accounting and Economics, 58*, 41–58. doi:http://dx.doi.org/10.1016/j.jacceco.2014.06.001.

Chou, K.-L., Lee, T. M. C., & Ho, A. H. Y. (2007). Does mood state change risk taking tendency in older adults. *Psychology and Aging, 22*, 310–318. doi:http://dx.doi.org/10.1037/0882-7974.22.2.310.

Chuang, S.-C. & Chang, C.-L. (2007). The effects of mood and openness-to-feeling trait on choice. *Social Behavior and Personality: an international journal, 35*, 351–358. doi:http://dx.doi.org/10.2224/sbp.2007.35.3.351.

Coates, J. M. & Herbert, J. (2008). Endogenous steroids and financial risk taking on a London trading floor. *Proceedings of the National Academy of Sciences, 105*, 6167–6172. doi:http://dx.doi.org/10.1073/pnas.0704025105.

Cohen, R. M., Gross, M., Nordahl, T. E., Semple, W. E., Oren, D. A., & Rosenthal, N. E. (1992). Preliminary data on the metabolic brain pattern of patiens with Winter Seasonal Affective Disorder. *Archives of General Psychiatry, 49*, 545–552. doi:http://dx.doi.org/10.1001/archpsyc.1992.01820070039006.

De Vries, M., Holland, R. W., Corneille, O., Rondeel, E., & Witterman, C. L. (2010). Mood effects in dominated choices: Positive mood induces departures from logical rules. *Journal of Behavioral Decision Making, 25*, 74–81. doi:http://dx.doi.org/10.1002/bdm.716.

DeBondt, W. F. M. & Thaler, R. H. (1985). Does the stock market overreact? *The Journal of Finance, 40*, 793–805. doi:http://dx.doi.org/10.1111/j.1540-6261.1985.tb05004.x.

DeBondt, W. F. M. & Thaler, R. H. (1987). Further evidence on investor overreaction and stock market seasonality. *The Journal of Finance, 42*, 557–581. doi:http://dx.doi.org/10.1111/j.1540-6261.1987.tb04569.x.

Dichev, I. D. & Janes, T. D. (2003). Lunar cycle effects in stock returns. *The Journal of Private Equity, 6*, 8–29. doi:http://dx.doi.org/10.3905/jpe.2003.320053.

Dolvin, S. D. & Pyles, M. K. (2007). Seasonal affective disorder and the pricing of IPOs. *Review of Accounting and Finance, 6*, 214–228. doi: http://dx.doi.org/10.1108/14757700710750865.

Dolvin, S. D., Pyles, M. K., & Wu, Q. (2009). Analysts get SAD too: the effect of seasonal affective disorder on stock analyst's earnings estimates. *Journal of Behavioral Finance, 10*, 214–225. doi: http://dx.doi.org/10.1080/15427560903372809.

Dowling, M. & Lucey, B. M. (2005). Weather, biorhythms, beliefs and stock returns – Some preliminary Irish evidence. *International Review of Financial Analysis, 14*, 337–355. doi:http://dx.doi.org/10.1016/j.irfa.2004.10.003.

Dowling, M. & Lucey, B. M. (2008a). Mood and UK equity pricing. *Applied Financial Economics Letters, 4*, 233–240. doi:http://dx.doi.org/10.1080/17446540701720584.

Dowling, M. & Lucey, B. M. (2008b). Robust global mood influences in equity pricing. *Journal of Multinational Financial Management, 18*, 145–164. doi:http://dx.doi.org/10.1016/j.mulfin.2007.06.002.

Dragotă, V.,& Şerbănescu, V. (2010). Some Issues Concerning Romanian Investors. Behaviour. Results of a Survey. *Theoretical and Applied Economics*, 18, 5-16. Retrieved from http://www.researchgate.net/profile/Victor_Dragota/publication/228359298_Market_Informational_Efficiency_and_Investors'_Rationality_Some_Evidence_on_Romanian_Capital_Market/links/0a85e53597d7c9aba4000000.pdf

Dumitriu,R., Ştefănescu, R., & Nistor, C.(2012). The Halloween effect during quiet and turbulent times. *Proceedings of the 18 th International conference "The knowledge-based Organization"*, Sibiu. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2043757

Ebstein, R. P., Novick, O., Umansky, R., Priel, B., Osher, Y., Blaine, D., & Belmaker, R. H., (1996). Dopamine D4 receptor (D4DR) exon III polymorphism associated with the human personality trait of Novelty Seeking. *Nature Genetics*, 12, 78–80. doi:http://dx.doi.org/10.1038/ng0196-78.

Eisenegger, C., Haushofer, J., & Fehr, E. (2011). The role of testosterone in social interaction. *Trends in Cognitive Sciences, 15*, 263–271. doi:http://dx.doi.org/10.1016/j.tics.2011.04.008.

Fama, E. F. (1970). Efficient capital markets: a review of theory and empirical work. *The Journal of Finance, 25*, 383–417. doi:http://dx.doi.org/10.1111/j.1540-6261.1970.tb00518.x.

Fehr-Duda, H., Epper, T., Bruhin, A., & Schubert, R. (2011). Risk and rationality: the effects of mood and decision rules on probability weighting. *Journal of Economic Behaviour & Organization, 78*, 14–24. doi:http://dx.doi.org/10.1016/j.jebo.2010.12.004.

Filip, A. & Raffournier, B. (2010). The value relevance of earnings in a transition economy. The case of Romania. *The International Journal of Accounting, 45*, 77–103. doi:http://dx.doi.org/10.1016/j.intacc.2010.01.004.

Forgas, J. P. (1995). Mood and judgment: the effect infusion model (AIM). *Psychological Bulletin, 117*, 39–66. doi:http://dx.doi.org/10.1037/0033-2909.117.1.39.
French, K. (1980). Stock returns and the weekend effect. *Journal of Financial Economics, 8*, 55–69. doi:http://dx.doi.org/10.1016/0304-405X(80)90021-5.
Gerlach, J. R. (2010). Daylight and investor sentiment: a second look at two stock market behavioural anomalies. *Journal of Financial Research, 33*, 429–462. doi:http://dx.doi.org/10.1111/j.1475-6803.2010.01275.x.
Goodman, D. A. & Peavy, J. W., III (1983). Industry relative price-earnings ratios as indicators of investment returns. *Financial Analysts Journal, 39*, 60–66. doi:http://dx.doi.org/10.2469/faj.v39.n4.60.
Guidi, F., Gupta, R., & Maheshwari, S. (2011). Weak-form market efficiency and calendar anomalies for eastern europe equity markets. *Journal of Emerging Market Finance, 10*, 337-389. doi:http://dx.doi.org/10.1177/097265271101000304
Han, L., Wang, K., Cheng, Y., Du, Z., Rosenthal, N. E., & Primeau, F. (2000). Summer and winter patterns of seasonality in Chinese college students: A replication. *Comprehensive Psychiatry, 41*, 57–62. doi:http://dx.doi.org/10.1016/S0010-440X(00)90132-9.
Haugen, R., & Jorion, P. (1996) The january effect: still here after all these years. *Financial Analysts Journal* 52, 27 – 31. Retrieved from http://www.jstor.org/stable/4479893
Hedge, A. L. & Woodson, H. (1996). Prevalence of seasonal changes in mood and behavior during the winter month in central Texas. *Psychiatry Research, 6*, 265–271. doi:http://dx.doi.org/10.1016/0165-1781(96)02838-7.
Hines, T. M. (1998). Comprehensive review of biorhythm theory. *Psychological Reports, 83*, 19–64. doi:http://dx.doi.org/10.2466/pr0.1998.83.1.19.
Horwath, P. & Zuckerman, M. (1993). Sensation seeking, risk appraisal and risky & behaviour. *Personality and Individual Differences, 14*, 41–52. doi:http://dx.doi.org/10.1016/0191-8869(93)90173-Z.
Isen, A. M., Nygren, T. E., & Ashby, F. G. (1988). Influence of positive affect on the subjective utility of gains and losses: It is just not worth the risk. *Journal of Personality and Social Psychology, 55*, 710–717. doi:http://dx.doi.org/10.1037/0022-3514.55.5.710.
Ito, A., Ichihara, M., Hisanaga, N., Ono, Y., Kayukawa, Y., Ohta, T., & Ozaki, N., (1992). Prevalence of seasonal mood changes in low latitude area: Seasonal pattern assessment questionnaire score of Quezon City workers. *Japanese Journal of Psychiatry and Neurology, 46*, 249. doi:http://dx.doi.org/10.1111/j.1440-1819.1992.tb00854.x.
Jacobsen, B. & Marquering, W. (2008). Is it the weather? *Journal of Banking and Finance, 32*, 526–540. doi:http://dx.doi.org/10.1016/j.jbankfin.2007.08.004.
Kamstra, M. J., Kramer, L. A., & Levi,M. D.(2000).Losing sleep at the market: the daylight saving anomaly. *American Economic Review, 90*, 1005-1011. Retrieved from http://www.jstor.org/stable/117321
Kamstra, M. J., Kramer, L. A., & Levi, M. D. (2002). Loosing sleep at the market: the Daylight Saving Anomaly: Reply. *American Economic Review*, 92,1257-1263. Retrieved from http://www.jstor.org/stable/3083314
Kamstra, M. J., Kramer, L. A, & Levi, M. D.(2003). Winter blues: a SAD stock market cycle. *American Economic Review*, 93, 324-343. Retrieved from http://www.jstor.org/stable/3132178
Kamstra, M. J., Kramer, L. S., & Levi, M. D. (2009). Is it the weather? Comment. *Journal of Banking and Finance, 33*, 578–582. doi:http://dx.doi.org/10.1016/j.jbankfin.2008.09.013.
Kaplanski, G., & Levy, H., (2009). Seasonality in perceived risk: a sentiment effect. Unpublished manuscript. Retrieved from http://dx.doi.org/10.2139/ssrn.1116180
Kaustia, M., & Rantapuska, E. (2011). Does mood affect trading behaviour? Unpublished manuscript. Retrieved from http://dx.doi.org/10.2139/ssrn.1875645
Kelly, P. J. & Meschke, F. (2010). Sentiment and stock returns: The SAD anomaly revisited. *Journal of Banking and Finance, 34*, 1308–1326. doi:http://dx.doi.org/10.1016/j.jbankfin.2009.11.027.
Kiymaz, H. & Berument, H. (2003). The day of the week effect on stock market volatility and volume: International evidence. *Review of Financial Economics, 12*, 363–380. doi:http://dx.doi.org/10.1016/S1058-3300(03)00038-7.
Kuhnen, C. M. & Chiao, J. Y. (2009). Genetic determinants of financial risk taking. *PLoS ONE, 4*, e4362. doi:http://dx.doi.org/10.1371/journal.pone.0004362.

Kuvaas, B. & Kaufmann, G. (2004). Impact of mood, framing, and need for cognition and decision makers' recall and confidence. *Journal of Behavioral Decision Making, 17*, 59–74. doi:http://dx.doi.org/10.1002/bdm.461.

Laeven, L., & Valencia, F. (2008). Systemic banking crises: a new Database. *IMF Working Paper WP/08/224*, Washington DC. Retrieved from http://ssrn.com/abstract=1278435

Liotti, M. & Mayberg, H. S. (2001). The role of functional neuroimaging in the neuropsychology of depression. *Journal of Clinical and Experimental Neuropsychology (Neuropsychology, Development and Cognition: Section A), 23*, 121–136. doi:http://dx.doi.org/10.1076/jcen.23.1.121.1223.

Magnússon, A. & Axelsson, J. (1993). The prevalence of seasonal affective disorder is low among descendants of icelandic emigrants in Canada. *Archives of General Psychiatry, 50*, 947–951. doi:http://dx.doi.org/10.1001/archpsyc.1993.01820240031004.

Pele, D.,& Voineagu, V.,(2008). Testing market efficiency via decomposition of stock return. Application to Romanian Capital Market. *Romanian Journal for Economic Forecasting, 3*, 63-79. Retrieved from http://www.ipe.ro/rjef/rjef3_08/rjef3_08_4.pdf

Potkin, S. G., Zetin, M., Stamenkovic, V., Kripke, D., & Bunney, W. E., (1986). Seasonal affective disorder: prevalence varies with latitude and climate. *Clinical Neuropharmacology, 4*, 181-183. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3567938

Reinganum, M. R. (1981). Misspecification of capital asset pricing: empirical anomalies based on earnings' yields and market values. *Journal of Financial Economics, 9*, 19–46. doi:http://dx.doi.org/10.1016/0304-405X(81)90019-2.

Roe, B. E., Tilley, M. R., Gu, H. H., Beversdorf, D. Q., Sadee, W., Haab, T. C., & Papp, A. C. (2009). Financial and psychological risk attitude associated with two single Nucleotide Polymorphisms in the Nicotine Recceptor (CHRNA[4]) Gene. *PLoS One, 4*: e6704. doi:http://dx.doi.org/10.1371/journal.pone.0006704.

Ronai, Z., Szekely, A., Nemoda, Z., Lakatos, K., Gervai, J., Staub, M., & Sasvari-Szekely, M. (2001). Association between novelty seeking and the −521 C/T polymorphism in the promoter region of the DRD4 gene. *Molecular Psychiatry, 6*, 35–38. doi:http://dx.doi.org/10.1038/sj.mp.4000832.

Rosenthal, N. E., Sack, D. A., Gillin, J. C., Lewy, A. J., Goodwin, F. K., Davenport, Y., Wehr, T. A.(1984). Seasonal affective disorder. A description of the syndrome and preliminary findings with light therapy. *Archives of General Psychiatry, 41*, 72–80. doi:http://dx.doi.org/10.1001/archpsyc.1984.01790120076010

Rozeff, M. S. & Kinney, W. R. (1976). Capital market seasonality: The case of stock returns. *Journal of Financial Economics, 3*, 379–402. doi:http://dx.doi.org/10.1016/0304-405X(76)90028-3.

Saunders, E. M.(1993). Stock prices and Wall Street weather. *The American Economic Review, 83*, 1337-1345. http://www.jstor.org/stable/2117565

Schwert, W. G. (2003). Anomalies and Market Efficiency. In G. M. Constantinides, M. Harris, & R. M. Stultz (Ed.) Handbook of the Economics of Finance,1 (pp. 939–974). Amsterdam: Elsevier North Holland.

Smoski, M. J., Lynch, T. R., Rosenthal, M. Z., Cheavens, J. S., Chapman, A. L., & Krishnan, R. R. (2008). Decision making and risk aversion among depressive adults. *Journal of Behavior Therapy and Experimental Psychiatry, 39*, 567–576. doi:http://dx.doi.org/10.1016/j.jbtep.2008.01.004.

Soriano, J. J., Ciupagea, C., Rohan, K. J., Neculai, D. B., Yousufi, S. M., Guzman, A., & Postolache, T. T. (2007). Seasonal variation in mood and behaviour in Romanian postgraduate students. *The Scientific World JOURNAL, 7*, 870–879. doi:http://dx.doi.org/10.1100/tsw.2007.127.

Starks, L. T., Yong, L., & Zheng, L. (2006). Tax-loss selling and the january effect: evidence from municipal bond closed-end funds. *The Journal of Finance, 61*, 3049–3067. doi:http://dx.doi.org/10.1111/j.1540-6261.2006.01011.x.

Thommen, G. S. (1968). *Biorhythm*. New York, NY: Universal Publishing.

Tokunaga, H. (1993). The use and abuse of consumer credit: Application of psychological theory and research. *Journal of Economic Psychology, 14*, 285–316. doi:http://dx.doi.org/10.1016/0167-4870(93)90004-5.

Twersky, A. & Kahneman, D.(1986). Rational choice and the framing of decision. *The Journal of Business, 59*, S251-278. Retrieved from http://www.jstor.org/stable/2352759

Yuen, K. S. L. & Lee, T. M. C. (2003). Could mood state affect risk-taking decisions? *Journal of Affective Disorders, 75*, 11–18. doi:http://dx.doi.org/10.1016/S0165-0327(02)00022-8.

Zuckerman, M. (1984). Sensation seeking: A comparative approach to a human trait. *Behavioral and Brain Sciences, 7*, 413–471. doi:http://dx.doi.org/10.1017/S0140525X00018938.

Appendix

Table A1. Unit root tests for S1.

	Augmented Dickey-Fuller test		
Variable	*Intercept*	*Intercept and trend*	*None*
DGR_BET	-36.00247***	-36.00048***	-35.57473**
DGR_DAYL	-4.213610***	-4.210748***	-4.204477***
	Elliott-Rothenberg-Stock DF-GLS test		
	Intercept	*Intercept and trend*	
DGR_BET	-35.90480***	-35.93033***	
DGR_DAYL	-2.866598***	-3.663462***	
	Phillips-Perron test		
	Intercept	*Intercept and trend*	*None*
DGR_BET	-35.95678***	-35.95008***	-35.91001***
DGR_DAYL	-34.11263***	-34.11911***	-34.07249***

Source: Author's E-views estimation.
*significant at 10% level,
**at 5% level,
***at 1% level.

Table A2. Unit root tests for S2.

	Augmented Dickey-Fuller test		
Variable	*Intercept*	*Intercept and trend*	*None*
DGR_BET	-33.24826***	-33.28151***	-33.24188***
DGR_DAYL	-5.517860***	-5.511264***	-5.508296***
	Elliott-Rothenberg-Stock DF-GLS test		
	Intercept	*Intercept and trend*	
DGR_BET	-33.19593***	-33.24772***	
DGR_DAYL	-5.221720***	-5.413238***	
	Phillips-Perron test		
	Intercept	*Intercept and trend*	*None*
DGR_BET	-33.29559***	-33.34123***	-33.26227***
DGR_DAYL	-34.32599***	-34.31552***	-34.33347***

Source: Author's E-views estimation.
*significant at 10% level,
**at 5% level,
***at 1% level.

Table A3. Unit root tests for S3.

	Augmented Dickey-Fuller test		
Variable	*Intercept*	*Intercept and trend*	*None*
DGR_BET	-53.20020***	-53.29489***	-53.12371***
DGR_DAYL	-5.612002***	-5.629340***	-5.613110***
	Elliott-Rothenberg-Stock DF-GLS test		
	Intercept	*Intercept and trend*	
DGR_BET	-52.51761***	-53.23020***	
DGR_DAYL	-4.012981***	-4.926887***	
	Phillips-Perron test		
	Intercept	*Intercept and trend*	*None*
DGR_BET	-53.29914***	-53.29786***	-53.33855***
DGR_DAYL	-70.97462***	-70.93824***	-70.97762***

Source: Author's E-views estimation.
*significant at 10% level,
**at 5% level,
***at 1% level.