

Monday Irrationality of Investors in Bursa Malaysia: The Role of Psychological Biases

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Abstract: This study aims to investigate the role of psychological biases in determining the day-of-the-week Monday irrationality in Bursa Malaysia using daily data from 1 January 1999 until 30 December 2011. First, our findings proved the existence of Monday irrationality in Bursa Malaysia. Second, our analysis found significant relationships between psychological biases and Monday irrationality. Evidence was documented through the interactive model and day-by-day model. This study enriches the behavioural finance literature by falsifying the traditional utility function model. It proves that the hedonic utility and prospect theory are applicable for the case of this study. Feelings of investors are involved in trading, and they react differently on Monday because of psychological biases. This implies that investors or fund managers can beat the market by following the cycle of calendar anomalies.

Keywords: Behavioural economics, Bursa Malaysia, Monday irrationality, psychological biases

JEL classification: G02, G19, O16

1. Introduction

Monday irrationality (hereafter MI) or also known as day-of-the week anomaly is an anomalous condition in the stock market where Monday returns are significantly dispersed as compared to other trading days. It was first documented by French (1980). Based on prospect theory, MI is driven by psychological factors and might be caused by perception bias. This is consistent with prior findings in conventional finance which concluded that trading behaviour might be the explanation for MI (see Abraham and Ikenberry 1994; Wong *et al.* 2006). However, we have not come across any empirical study that investigates whether investor behaviour is the source of this anomaly, a gap that this study aims to contribute.

The five main psychological biases in finance are affection, attribution in attention, heuristics, regret, and cognitive dissonance (Brahmana *et al.* 2012a). These psychological biases have been documented as important drivers in human behaviour. For example,

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let us take the role of affection in human behaviour. Schwarz and Clore (1983) carried out a study on the role of affection in human satisfaction. Using weather as measure of affection, they found higher temperatures led to mood disorder which had a market effect on their level of satisfaction. Hansen *et al.* (2008) also found weather to be a source of behavioral disorder. Another study by Kovats and Ebie (2006) related high temperature to mental health illness. Psychological biases due to affection may also occur depending on the phases of the moon. The phase of the moon is known to affect behaviour related to generosity (Cunningham 1979), arson activity and violence (Katzeff 1981), accidents at work (Nogueira 1982), mood fluctuation (McFarlane *et al.* 1988), and quality of life (Barr 2000).

Several studies show how the two variables of attention and heuristics may lead to biased decisions. Bradley *et al.* (1999), for instance, showed how attention bias and heuristic bias affect anxiety, fear, and happiness of human beings. In fact, a number of studies show that avoiding bad news (attention bias) gives high satisfaction which is associated with increased compliance, better emotional adjustment, and reduced likelihood of litigation (see Robert *et al.* 1994; Cameron, 1996; Ptacek and Ptacek 2001).

In finance, the common proxy for attention is bad news announcement. Several economics and finance papers have used these two variables (bad news announcement and market sentiment) as proxies to investigate how they relate to investment decisions. For example, Aboody and Kasznik (2000) used bad news as a proxy for attention, and found that market volume declines if bad news is given attention. Waud (1970) also used bad news announcement as a measure, and found a significant and immediate negative response of stock prices to discount rate changes announcement. Castanias (1979) reported a variance in stock price rises around the days of most economic news events which he interpreted as a reflection of attention bias. Schwert (1981) examined the stock market reaction to the monthly CPI inflation rate announcement and used a measure of unexpected inflation news for his research. Lastly, Brahmana *et al.* (2012b) used bad news as attention bias proxy and also concluded that attention to bad news leads to investor's Monday irrationality.

Meanwhile, finance research uses market sentiment as a measure of heuristics. The sentiment can be captured by the magnitude of price movements in mimicking liquidity. Baker and Stein (2004) relied on market sentiment to capture a heuristic market. They explained that liquidity might influence investor sentiment in stock trading. Investors anticipate the market by examining the liquidity of single stocks. It implies that investors use heuristics as a rule of thumb to reduce the complexity of analysing an influx of information. Shefrin (2000), using the same measure of heuristics, argues that this trial-and-error process can result in other errors. There are also a large pool of studies that use market sentiment as a measure of heuristics (for example, Baker and Wurgler 2007; Bollen *et al.* 2011; Mian and Sankaraguruswamy 2012).

The last psychological bias is cognitive dissonance. Festinger *et al.* (1956) introduced the theory of cognitive dissonance which states that two inconsistent simultaneously held cognitions will produce a state of cognitive dissonance. Because the experience of dissonance is unpleasant, individuals will strive to reduce it by changing their beliefs. Extensive psychology research has examined the role of cognitive dissonance in human behaviour (see Baker and Nofsinger 2002; Gaulin and McBurney 2004).

Regret aversion arises because of people's desire to avoid the pain of regret resulting from a poor investment decision. To overcome regret and reduce cognitive dissonance, an investor may at times imitate the action of others in the stock markets and disregard his own beliefs and information (see Banerjee 1992; Drehman *et al.* 2005). In finance, this situation is known as herding behaviour. Many scholars believe that herding may cause aggregate volatility (Cont and Bouchard 2000), financial contagion (Cipriani and Guarino 2005), earnings surprise (Trueman 1994), instability in the market (Cipriani and Guarino 2001), bubbles (Lux 1995), and other events.

Herd behaviour is generally used as a measure of cognitive dissonance (see Devenow and Welch, 1996). Several studies have found evidence of herd behaviour in the stock market (Shiller and Pound 1989; Chen *et al.* 2003; Hwang and Salmon 2004; Brahmana *et al.* 2012c). For instance, Shiller and Pound (1989) documented survey evidence of herding among institutional investors. They found that institutional investors place significant weight on the advice of other professionals on their buy and sell decisions in volatile stocks. Chen *et al.* (2003) reported on herd behaviour in the Chinese stock market. Meanwhile, Hwang and Salmon (2004) found that developed markets such as US and UK exhibit less herding behaviour than emerging market such as Korea. They attributed information asymmetry as the cause of this condition. However, it is very difficult to find an empirical paper that elaborates psychological bias holistically as the explanation for MI.

Interestingly, our preliminary data analysis shows that Monday seasonality is in line with several psychological factors such as weather fluctuation, full moon occurrences, and bad news announcements in the stock market. As shown in Figure 1, our pre-investigation shows that Monday temperatures in Malaysia are relatively higher than that of other weekdays, implying that on average, Monday is relatively hotter than other days. These plots also support Forster and Solomon's (2003) findings of weather seasonality. By using surface measurements of maximum and minimum temperatures from Global Daily Climatological Network data set, they documented that many climate stations in the world have reported a high temperature level from Saturday to Monday compared to the temperature on weekdays.

In Figure 2, we show that full moon and new moon occur more often on Mondays than on other weekdays. From Figure 2 we also notice that most bad news is released on Monday in the stock market. In short, these figures imply the existence of seasonality in weather, moon phases, and bad news announcements. There were more full moon occurrences and bad news on Monday and this was also the day that experienced higher temperatures. These are in line with the seasonality in finance, where Monday returns tend to disperse significantly compared to other trading days. It is referred to as day-of-week anomaly MI. Hence, this research hypothesises that these five psychological biases are the determinants of Monday irrationality.

These preliminary facts are in line with those of Tvede (2002) who found that some phenomenon can be explained by psychology biases such as heuristics, regret theory, mental compartments, cognitive dissonance, overconfidence, and knowledge attitude. Furthermore, Gaulin and McBurney (2005) state that behaviour and attitudes are influenced by psychology in affection and cognition. This is in line with Gray *et al.* (1994) who explained that affection (proxy of emotion) and cognition are "the same player" in human behaviour, and so there should be an integration of affection and cognition in human behaviour.

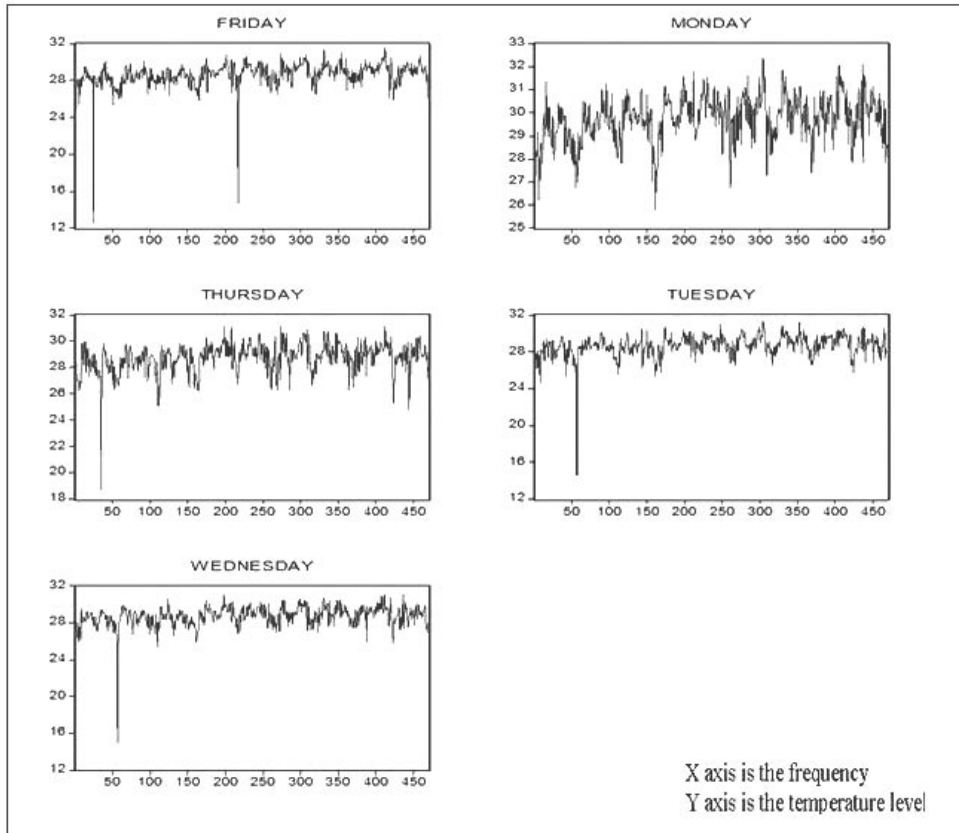


Figure 1. Frequency of average temperature on a daily basis in Malaysia

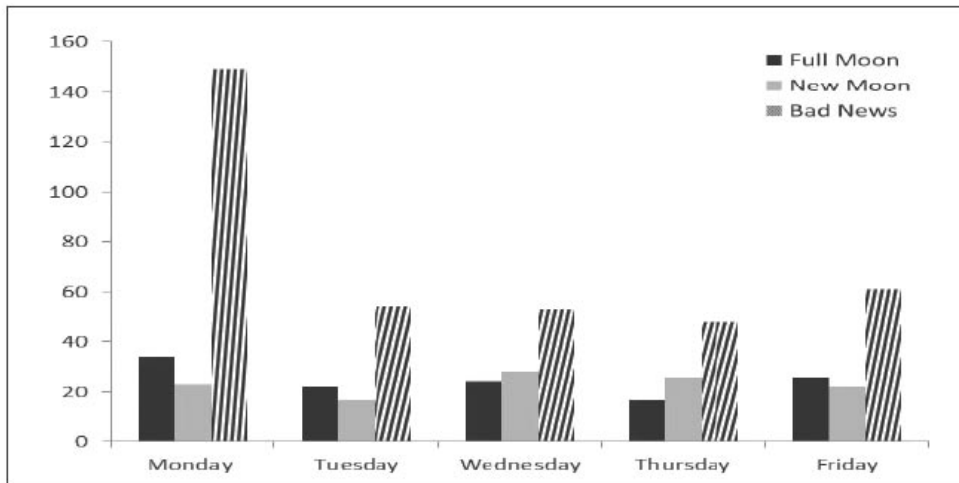


Figure 2. Frequency of new moon, full moon and bad news across day-of-the-week

This research aims to investigate the ability of the psychological biases in explaining MI. Hence, two models, the interactive model and day-by-day model, were employed. The interactive model used the interaction between dummy variable of trading day (Monday to Friday) and the psychological bias variables. This allows us to examine whether the dummy interaction can significantly affect stock returns. If there is a significant association, we surmise that psychological biases are the antecedents of MI. Meanwhile, the day-by-day model was conducted by sorting the data based on trading days. The returns, temperature, moon phase dummy, bad news, attention, and herd behaviour of one identified day were taken and tested on daily basis. For instance, we took Monday returns and tested it with temperature, full moon, bad news, attention, and herding behaviour that was recorded on Monday. We did the same with other trading weekdays.

The findings support our hypothesis that psychological biases play an important role in influencing the MI. Our interactive model showed all the four psychological biases have a significant relationship with market returns, but their interaction with daily dummy does not show any statistical significance, except those with Monday dummy. Subsequently, in our day-by-day model, the results show that these psychological biases only affect the Monday returns but not other weekday's returns, and the estimation of Monday data set (Monday model) is the only estimation that has an association between psychological biases and returns.

This paper contributes to the body of knowledge by confirming hedonic utility. It suggests that the efficiency in the market can actually be achieved if there is no psychological bias in investor trading behaviour, which is in line with Kahneman and Tversky (1979). Second, the study results confirm that affection bias and cognition bias of another investor during Monday is good for active investing decision. Investors can beat the market as long as there is no affection bias or cognitive bias in the market.

2. Data and Methodology

2.1 Empirical Model

The objective of this research is to investigate the role of psychological biases on MI. The analysis is divided into two stages. First, the existence of MI was investigated by employing French (1980) model. It is a commonly used model to investigate MI. The estimation model is shown below:

$$R_t = \alpha + \gamma_1 d_{Tue,t} + \gamma_2 d_{Wed,t} + \gamma_3 d_{Thu,t} + \gamma_4 d_{Fri,t} + \varepsilon_t \quad (1)$$

where R_t is KLCI compounding return series; $d_{Tue,t}$, $d_{Wed,t}$, $d_{Thu,t}$, $d_{Fri,t}$ are dummy for Tuesday, Wednesday, Thursday, and Friday, respectively. To avoid the dummy variable trap, only four dummy variables are included, and the intercept term is the proxy for Monday effect.

The second stage of the process is to investigate whether the five psychological biases are the determinants of MI. We employed Model (2) which is based on variable interaction model. The word 'interactive' refers to our sequential replacement of the dummy variable

$d_{D,t}$ with different trading day dummy. At the beginning of estimating Model (2), our $d_{D,t}$ is Monday dummy, where it is "1" if Monday, and "0" if other. Then, we changed

$d_{D,t}$ from Monday dummy to Tuesday dummy. We repeated the same procedure up to Friday dummy. This means that besides Monday, the model was also tested on other trading day dummies, of Tuesday, Wednesday, Thursday and Friday. This is to ensure that we have evidence to prove that psychological biases only occur on Monday but not on other trading days. In short, we estimate Model (2) five times, replacing $d_{D,t}$ for each of the trading day dummy:

$$R_{D,t} = \beta_0 + \beta_1 Temp_t + \beta_2 DMoon_t + \beta_3 Sent_t + \beta_4 Herd_t + \beta_5 DBad_t + \beta_6 Temp_t * d_D + \beta_7 DMoon_t * d_D + \beta_8 Sent_t * d_D + \beta_9 Herd_t * d_D + \beta_{10} DBad_t * d_D + \beta_{11} World_t + \beta_{12} Rec Rec_t \quad (2)$$

where D=(Monday, Tuesday, Wednesday, Thursday, Friday), $R_{D,t}$ is the KLCI returns; $Temp$ is the weather condition in Celsius; $DMoon$ is the moon dummy (D=1 if it is full moon); $Sent$ is the market sentiment value; $Herd$ is the herding value $DBad$ is the dummy variable

for bad news announcement. $d_{D,t}$ is the dummy variable of D day. In mimicking the role of psychological biases on MI, the results should show the occurrence of the effect of psychological biases only on Monday.

For robustness check, we estimated Model (3) called as day-by-day model. Model (3) was estimated on the daily sample, meaning that we estimated first the model for all Monday data, and then repeated it on Tuesday data, and so on, therefore resulting in five estimates. The model is shown as follows:

$$R_D = \beta_0 + \beta_1 Temp_D + \beta_2 DMoon_D + \beta_3 Sent_D + \beta_4 Herd_D + \beta_5 DBad_D + \beta_6 World_d + \beta_7 Rec_t + \varepsilon_d \quad (3)$$

Note that the D is the sample day. To obtain the daily sample, we have to separate the data of psychological biases and stock returns on a daily basis into five trading days. So when we estimate equation (3) on Monday data, our sample only consisted of Monday psychological biases matching with Monday stock returns. We repeated the same procedure with the data of other days. If the biases only appear on Monday data and not on other days, it shows further evidence of psychological biases on MI.

2.1 Data and Working Definition of Psychological Biases

We retrieved secondary data from four reliable sources, which are DataStream for stock market information, Malaysian Stock Exchange for news announcement, Malaysia meteorology office for temperature data, and from the website www.moonconnection.com for the calendar of moon phases (most moon research seminar papers refer to this source). Our sample was drawn from the period covering 1 January 1999 to 30 December 2011.

Temperature is basically proxied by the average values of the maximum temperature and minimum temperature recorded by all Malaysian climate stations on the same day. Existing literature are mostly based on monthly or annual but our study used daily data.

$$Temp = \frac{Temp_{min,t} + Temp_{max,t}}{2}$$

where $Temp_{min,t} = \frac{\sum_{min} Temp\ of\ stations}{number\ of\ station}$ and $Temp_{max,t} = \frac{\sum_{max} Temp\ of\ stations}{number\ of\ station}$

Moon phase is proxied by a dummy variable taking the value of 1 if there is a full moon ($DMoon=1$), while non-full moon is treated as 0. Based on astronomy and previous literature in psychology, the effect of a full moon is known to last for 2 to 3 days. Therefore, we assigned the full moon dummy on the day before the “peak” full moon, the peak of full moon, and the day after the peak full moon.

The proxy of attention bias was adapted from investment literature; we proxied sentiment of investor using the magnitude of price changes and also used news as a second measure for sentiment. We modified the model of Barber and Odean (1999) from volume based to liquidity based. This is in line with Baker and Stein (2004) who stressed that attention can be captured from investor sentiment which is reflected in liquidity. The liquidity measure was constructed as follows:

$$Attention\ Sentiment = \frac{(Closing\ Price - Bid\ Price) - (Closing\ Price - Ask\ Price)}{(Closing\ Price - Bid\ Price) + (Closing\ Price - Ask\ Price)}$$

The reaction on the news was built on the dummy variable. Our definition of bad news was according to Conrad *et al* (2002), Barberis and Thaler (2003), and Brahmana *et al.* (2012c) where the criteria of bad news are as follows: (a) announcement of decreasing profit; (b) announcement of disclaimer or adverse audit opinion; (c) announcement of suspended or delisted stock; and (d) announcement of negative economic activities. Bad news is represented by a binary variable ($DBad$) where if there is a bad news ($DBad = 1$).

Herding behaviour was calculated through indexation from time-varying rolling regression of $HERD_{it} = \alpha_t + \beta_i D_t^L + \beta_i D_t^U + \varepsilon_t$. To retrieve the index, we employed a 30-day rolling regression and recalculated the estimation model by adding the coefficient value of each variables. See Christie and Huang (1995) and Brahmana *et al.* (2012b) for detail of the herding model and herding measure.

3. Results

3.1 Evidence of MI

Table 1 depicts the estimation of Equation 1. The intercept of the model, which is the proxy of MI, was found to be significant at 1 per cent level, and so did the other days. The significant sign ($p < 1\%$) on the dummies of the other days indicates that their returns were significantly different from Monday. These findings confirmed MI in the Malaysian stock market over the period of 1999 to 2011, and provided evidence of the existence of MI in Malaysia.

3.2 Psychological Biases and MI

Table 2 documents the results of the interactive models for each day. The R-squared range of the model is 0.0789 to 0.0877. The biggest R-squared was on Monday, whereas Wednesday had the smallest one implying that Monday regressors can explain the market much better than other days. The data also fitted the model as the F-test showed

Table 1. Estimates of the day-of-the week effect for KLCI daily data

| Model (1) | Monday | Tuesday | Wednesday | Thursday | Friday |
|--------------------|------------------------|-----------------------|----------------------|-----------------------|-----------------------|
| Coefficient | -0.1212 (0.0042)*** | 0.1954 (0.0011)*** | 0.1433 (0.0168)** | 0.1828 (0.0023)*** | 0.2197 (0.0020)*** |
| R-Squared | 0.0579 | | | | |
| F-Statistic | 4.2554 | | | | |
| Prob (F-Statistic) | (0.0020)*** | | | | |

Note: Figures within parenthesis are probability values; *, **, and *** denote 10%, 5%, and 1% statistical significance.

significant results. The world effect was the one of control variables in the model with world returns as the proxy. The results showed the presence of world effect on the model estimations indicating a market integration or spill-over effect.

Meanwhile, temperature had a significant relationship with the returns of every trading day at a 5 per cent significance level. The magnitude of the relationship averaged around 4 per cent as the coefficients were spread between 0.0409 and 0.0436. This is in line with the tropical weather hypothesis whereas the temperature of a tropical country tends to be similar throughout the year. Hence, this result is in line with Keef and Roush (2004), and Dowling and Lucey (2005) who found the effect of temperature on the market returns. The interaction result between the day and the temperature documented a significant relationship only on Monday, not for other trading days. It also shows a negative sign on that particular day (Monday). This result surmises that temperature is the determinant of Monday irrationality.

In terms of full moon effects, this research documented a significant relationship between moon phase and market returns with a negative coefficient value. This implies that the full moon contributed to the deterioration of stock prices of Malaysian firms. The interaction between moon phase and the day-dummy is significant at 1 per cent level only for Monday, and not for other days. This indicates that the full moon phase does affect investor behaviour on Mondays, consequently resulting in negative performance.

The role of sentiment on MI was found to be significant on the models of Monday, Thursday, and Friday. However, it was only Monday sentiments that had an effect on return with coefficient value being -0.21. This result concludes that investor sentiment does influence MI.

Table 2 also shows the results of the effect of bad news announcement on investor behaviour. First, bad news has a significant relationship with market returns, with market returns being reduced significantly. If bad news was announced, investors responded by regarding it as a bad signal to do trading on that day. It is in line with previous findings of Hirshleifer *et al.* (1994), and Brahmana *et al.* (2012b). Meanwhile, in terms of interaction a significant relationship was seen with Monday's market returns which was not observed in other days implying that MI of the Malaysian stock market is moderated by the announcement of bad news.

Lastly, Table 2 documents also the role of cognitive dissonance (herding behaviour) on MI. While other factors have a significant effect on MI, herd behaviour showed no significant relations. Initially, herd behaviour only affected Tuesday, Wednesday, and

Table 2. The results for the interactive model

The equation of the model is:

$$R_{M_t} = \alpha_i + \beta_1 Temp_t + \beta_2 Temp_t * Day_t + \beta_3 Moon_t + \beta_4 Moon_t * Day_t + \beta_5 Sent_t + \beta_6 Sent_t * Day_t + \beta_7 DBad_t + \beta_8 DBad_t * Day_t + \beta_9 Herd_t + \beta_{10} Herd_t * Day_t + \beta_{11} World_t + \beta_{12} Rec_t + \varepsilon_t$$

where Temp is temperature; Moon is full moon dummy; Sent is sentiment; DBad is bad news dummy; Herd is herd behaviour; World is world returns; Day is the day dummy. If it is Monday model, the Day dummy becomes Monday dummy, and so on.

| | [Day=Monday] | [Day=Tuesday] | [Day=Wednesday] | [Day=Thursday] | [Day=Friday] |
|--------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Constant | -1.0274 [-2.1014]** | -1.0113 [-2.0557]** | -0.9982 [-2.0155]** | -1.0151 [-2.0593]** | -1.0015 [-2.0353]** |
| Temp | 0.0409 [2.4938]** | 0.043 [2.5684]** | 0.0436 [2.5908]** | 0.0415 [2.4646]** | 0.0412 [2.4583]** |
| Temp*Day | -0.2754 [-3.1566]** | -0.0053 [-0.7483] | -0.0104 [-1.5496] | 0.003 [0.4254] | 0.0024 [0.3158] |
| Moon | -0.238 [-5.5659]** | -0.3304 [-7.1222]** | -0.3268 [-7.0344]** | -0.3453 [-7.3798]** | -0.3215 [-6.9587]** |
| Moon*Day | -0.3602 [-3.0595]** | 0.0929 [0.9648] | 0.0738 [0.7563] | -0.1624 [-1.7383]* | 0.0464 [0.4766] |
| Sent | -0.214 [-1.9781]** | 0.0609 [1.1523] | 0.0608 [1.1364] | 0.0991 [1.7820]* | 0.0972 [1.8394]* |
| Sent*Day | -0.2118 [-2.6020]** | 0.1005 [0.8518] | 0.1049 [0.9219] | 0.0816 [0.7953] | -0.0819 [-0.7037] |
| DBad | -0.2437 [-3.9256]** | -0.3533 [-5.6316]** | -0.3444 [-5.4711]** | -0.356 [-5.7641]** | -0.3347 [-5.5587]** |
| DBad*Day | -0.3028 [-3.7732]** | 0.1564 [1.4165] | 0.0547 [0.4333] | 0.1658 [1.2284] | 0.0299 [0.2012] |
| Herd | -0.009 [-1.3066] | -0.016 [-1.9044]* | -0.0162 [-1.8403]* | -0.0124 [-1.4694] | -0.0158 [-1.8675]* |
| Herd*Day | -0.0249 [-0.9903] | 0.0123 [0.7562] | 0.0121 [0.8146] | -0.0069 [-0.4112] | 0.0105 [0.6334] |
| World | 0.0903 [5.4937]** | 0.0921 [5.6489]** | 0.0924 [5.6535]** | 0.0927 [5.6779]** | 0.0931 [5.6450]** |
| Rec | 0.1427 [4.4698]** | 0.1462 [4.5734]** | 0.1435 [4.4355]** | 0.1438 [4.4320]** | 0.1424 [4.4051]** |
| R ² | 0.0877 | 0.0808 | 0.0789 | 0.0793 | 0.0792 |
| Adj R ² | 0.0837 | 0.0768 | 0.0749 | 0.0753 | 0.0752 |
| F-statistic | 22.1626 | 20.2710 | 19.7463 | 19.8679 | 19.8353 |

Note: * significant at 10% level. ** significant at 5% level. *** significant at 1% level. Data outside the parenthesis are coefficient values. Data within parenthesis are t-statistic values.

Friday at a 10% significance level. However, the interactive relationship between herd behaviour and each day showed no significant effect on MI.

In short, our findings conclude that psychological biases are the determinants of MI. The weather, full moon, attention bias, and heuristic bias of investors influence the trading style of investors on Monday. The interactive models prove this observation as the interaction is significant only on the Monday model.

3.3 Regression with Separate Day Series

Given that psychological biases and interaction with Monday dummy do affect market returns, we examined in detail the day-by-day model to test if the independent variables are factors of MI. This is important as a robustness check; further it gives a clearer picture of the trading behaviour on Monday.

Table 3 documents the estimations of Equation 3. There are several important additional points to note in our findings. First, the world effect on the market is seen at 1 per cent significance level, except for the Tuesday model. Second, is there an influence from a recession period? The results document that the world recession period did not influence the Malaysian market significantly. Table 3 shows also that the R-squared of the model varies from 3.96 to 11.9 per cent The highest R-squared is seen on Monday and the smallest one on Thursday. Also, the data fit the model as the F-test was significant for all models.

The results of the Monday model confirmed the hypotheses of psychological factors influencing the returns. Temperature, full moon, sentiment, and bad news were found to

Table 3. Results for day-by-day model

The equation of the model is

$$R_{D_{day,t}} = \alpha_t + \beta_1 Temp_{D_{day,t}} + \beta_2 Moon_{D_{day,t}} + \beta_3 Sent_{D_{day,t}} + \beta_4 DBad_{D_{day,t}} + \beta_5 Herd_{D_{day,t}} + \beta_6 World_{D_{day,t}} + \beta_7 Rec_{D_{day,t}} + \varepsilon_t$$

where Temp is temperature; Moon is full moon dummy; Sent is sentiment; DBad is bad news dummy; Herd is herd behaviour; World is world returns; Rec is recession dummy; The data is retrieved on a day-by-day basis. If it is Monday, the variable is Monday variable and so on.

| | [D=Monday] | [D=Tuesday] | [D=Wednesday] | [D=Thursday] | [D=Friday] |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Constant | -0.0011 [-1.8555] | 0.0001 [0.1904] | -0.0002 [-0.3958] | -0.0006 [-1.2942] | -0.0007 [-1.3175] |
| Temp | -0.0159 [-1.8869] | 0.0045 [0.7601] | -0.0009 [-0.1573] | 0.0111 [1.7816] | 0.0116 [1.6628] |
| Moon | -0.6254 [-5.4611] | -0.1591 [-1.3042] | 0.0092 [1.0623] | -0.0508 [-0.4257] | 0.0131 [0.1173] |
| DBad | -0.3309 [-2.9413] | -0.0387 [-0.4120] | 0.0842 [1.6107] | -0.1533 [-1.2574] | -0.2037 [-1.3915] |
| Sent | -0.3099 [-3.5203] | 0.1177 [1.1730] | 0.1654 [1.5824] | 0.0031 [0.0346] | -0.027 [-0.2561] |
| Herd | -0.0343 [-1.3781] | -0.0042 [-0.3153] | -0.0046 [-0.3824] | -0.0207 [-1.3623] | -0.0069 [-0.4504] |
| World | 0.1397 [3.1452] | 0.028 [0.7017] | 0.1016 [2.7323] | 0.0948 [2.6728] | 0.0921 [3.2499] |
| Rec | 0.1578 [0.7691] | -0.2853 [-1.5520] | 0.279 [1.2838] | -0.2204 [-0.9691] | -0.112 [-0.9415] |
| R ² | 0.1194 | 0.0432 | 0.0447 | 0.0396 | 0.0687 |
| Adj R ² | 0.1172 | 0.0408 | 0.0423 | 0.0372 | 0.0664 |
| F-statistic | 53.7232 | 17.9109 | 18.5616 | 16.3352 | 29.2372 |

Note: Data outside the parentheses are coefficient values. Data within parentheses are t-statistics.

negatively influence Monday returns. Meanwhile, herd behaviour did not have an effect on Monday returns. This is in line with the results shown in Table 2 implying that the Monday returns were driven by four psychological biases, namely, temperature and full moon (affection bias), and sentiment and bad news (cognition bias).

The Tuesday findings affirm the hypotheses.⁴ Temperature, full moon, bad news, sentiment, and herd behaviour were not significant to influence Tuesdays' returns. This result strengthens the interactive model where the psychological biases only occurred on Monday and not on Tuesday.

Wednesday model had the same conclusion as the Tuesday model with none of the psychological biases of Wednesday having a significant influence on Wednesday's trading behaviour. These findings support our hypothesis.

Thursday model had a similar conclusion with temperature and bad news of Thursday having a positively insignificant effect on Thursday's returns. Meanwhile, full moon, sentiment, and herd behaviour were negatively unrelated to trading behaviour on Thursday. Therefore, it is noted that the psychological biases of Thursday have no effect on Thursday's trading behaviour.

Lastly, the Friday model estimation confirmed the hypothesis where psychological biases are the determinants of MI as Friday's psychological biases did not have any significant influence on Friday's returns. This supports the conclusion that psychological biases only influence Monday trading behaviour.

4. Discussion

First, we will discuss the effects of the full moon on MI. The interactive model confirms our hypothesis as the regressors were significant only on Monday. The day-by-day model also reconfirms the hypothesis as only the full moon on Monday did have an effect on Monday returns. These results are in line with the findings of previous studies of Yuan *et al.* (2006), and Sivakumar and Satyanarayan (2009). Our findings also confirm the Cacioppo and Gardner (1999) hypothesis which addresses feeling and emotion as physiological and biological issues constructing a biased decision. The effect of the full moon is to induce affection on the part of investors leading to biased decisions. It is surmised that given the hedonic utility of investors, a full moon has an emotional effect on investors who then follow their feelings in making decision to achieve their value function and that melancholic and bad mood tend to dip the price of stocks.

Second, our findings also show the effect of temperature on MI, using the interactive model and day-by-day model. These results are similar to the findings of Saunders (1996), and Brahmana *et al.* (2012b) on the relationship between weather and equity returns.

The infusion of temperature-induced mood on investor behaviour can be examined by using the AIM model of Forgas (1995). When the temperature was averagely and relatively high, investors experienced the direct access stage of the infusion. This stage of infusion transformed the effect of high temperature on biological processes in the

⁴ The main hypothesis is "psychological factors have effects on MI". To confirm it, the psychological biases have to be significant on Monday returns only. The psychological biases should not be significant on other trading day's returns.

human body as a motivational process. Having this temperature-influenced motivation, investors experienced heuristic infusion resulting in biased decisions. Lastly, the infusion proceeded to substantive processes, where temperature effects led to disordered investor behaviour. Such feelings cloud judgment which could lead to assimilation error (Tvede 2002). Assimilation error means that the investor misinterprets the information or just ignores the information. Emotional investors affected by temperature, might experience this assimilation error, leading to irrational behaviour on Monday. The assimilation error is one possible explanation as to how temperature can affect investor's MI.

Findings on heuristic bias also come to the same conclusion as the affection bias findings. Findings of sentiment (heuristic bias) support the hypothesis, which is in line with previous studies, such as those of Baker and Wurgler (2007) and Kaplanski and Levy (2009). Tvede (2002) linked this investor sentiment with a false consensus, which states that investors tend to overestimate how much others agree with them. There is a tendency for investors to assume that their opinions or decision are 'normal' and that there is already a consensus on it.

MI is widely known by market participants. Investors believe that the market has tendency to be down on Monday. If it is triggered by a low opening price, investors believe it will be another Monday effect. Hence, they follow their sentiment and generate MI.

How does this sentiment become a part of MI? Why do investors have this psychological bias? If we take a closer look at investor characteristics, the rationalisation becomes very clear. For instance, it might be caused by 'unconflicted adherence' (Mann 1992). Unconflicted adherence means that the decision maker self-righteously decides to continue whatever he or she has been doing and ignore information about the risk of losses. Investors tend to hold on to what they believe because they are over confident of their experience and knowledge. Epstein and Garfield (1992), analogously with Mann (1992), addressed conflicted investors as the personality that might affect individual trading approaches. Conflicted investors cannot be relaxed about trading activities, therefore they cannot settle down on a clear opinion about the market. They panic if they receive information affirming their belief. They will ignore others who have different opinions. Epstein and Garfield (1992) also addressed overly cautious investors who ride on sentiment. These investors are paranoid about losing more money. Their pessimistic sentiment does not allow them to rely on market information. They would rather follow their sentiment and make biased decisions.

The above is similar to attention bias where the proxy is bad news announcement. Our findings show how bad news announcements are one of the determinants of MI. This is in line with several studies (Daniel *et al.* 1998; Odean 1998; Boyd 2001; Huo *et al.* 2006) which address how investors bring the bad news to their attention. We analysed the role of bad news sentiment on MI by the pragmatism perspective. In pragmatism⁵, the bad news sentiment could occur every week in the same way. Pragmatism shows that the belief in bad news, upon inculcation by an investor, would be difficult to dispose of. It has been proven and described well in a study by Odean (1998).

⁵ William James (1907) made pragmatism famous with his book "Pragmatism". It describes the process of how news can influence logical thinking.

With regard to the relationship between bad news and MI, pragmatism explains how investors accord similar treatment to bad news based on old opinions and bad news based on new opinions. Attention given to old opinions is entrenched and transformed into a belief. Individuals (in our case, investors) hold the stock of old opinions and resist changing their belief. When they encounter a new experience that overcomes the old opinions, their mind restores their previous experience and matches it with the stock of old opinions. They would never change their belief in these old opinions until a desire arises within the individual as a result of the failure of the old opinion to satisfy. Finally, when the new bad news comes, investors already have their own beliefs. This process causes biased decision making as not all bad news actually speedily transforms into poor performance of the stock.

In the cognition process, this relationship (bad news as the source of MI) entails the sense process until the memory stage. The cognition process is not similar to emotion as the cognition process stops with the cognition coding process. At the sense process stage, bad news is received by our ears (listening) or eyes (reading). Bad news is transformed into the neural system by encoding it as stimuli. This stimulus is brought to the cognitive process where transformation converts it as awareness. This awareness of bad news is stored in our memory as the stock of opinions (refer to pragmatism) which reconstructs panic and leads to an irrational decision.

The under-reaction hypothesis can also be used to explain our findings. Investors might also under-react to behaviour of others and make a decision not to follow them. Edwards (1968) called this conservatism. In conservatism, investors are slow to update their old beliefs in the face of new evidence or mimic other strategies. Conservatism is in line with the findings of several studies on under-reaction in Malaysia such as those of Hameed and Ting (2000) and Chan *et al.* (2000).

5. Conclusion

Much research on MI suggests investor behaviour as the explanation of investor irrationality. Thus, rarely is found an empirical paper that investigates irrational behaviour. Motivated by a psychological approach, this paper fills the gap in anomalies literature by exploring the determinants of market irrationality. In essence this research examined whether psychological biases, namely, weather, moon phase, bad news attention, heuristical market sentiment, and herd behaviour are the determining factors for MI.

Based on evidence drawn from the interactive model and day-by-day model which showed the psychological biases to be significantly associated with Monday returns only, this research concludes that there are significant relationships between psychological biases and MI.

This research implies that human beings are sensitive to a stimulant, and that stimulants cause a biased decision. Weather and moon have an intuitive effect on investors leading to a mood which they would follow rather than the fundamentals. If a Monday were to have a higher temperature and if this is compounded by the occurrence of a full moon, compared to other days, investors will have a mood disorder on Monday. Following their hedonic utility would lead them into irrationality. Their intuitive trading rules are based on their association to information formed at a subconscious level.

In terms of cognition bias, this research noted that attention bias (bad news announcement) and heuristic (sentiment) (but not cognitive dissonance (herding)), were also important in constructing MI. If there were bad news announcements or poor market sentiment, investors would feel insecure, and tended to follow their cognition biases (hedonic decision).

This study enriches behavioural finance literature, especially in falsifying the traditional utility function model. It proves that hedonic utility and prospect theory have a role in explaining MI. Investors tend to involve feeling and psychology in trading, and react differently on Mondays because of psychological biases. This implies that traditional finance has to incorporate psychology into their theories.⁶

Further, this study contributes to practitioners in several ways. First, investors or fund managers can beat the market by following the cycle of calendar anomalies. Second, with regard to mastering the seasonality on Monday, investors or fund managers have to refer to the stimuli offered by psychological biases such as moon phase, temperature level, sentiment, and bad news. Additionally, the study suggests that moon phase and current temperature on that day be included in the equity analysis report. Perhaps the most promising avenue for further research is the examination of other anomalies using the psychological approach.

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⁶ A good example is the behavioural portfolio theory. See Hersh Shefrin and Meir Statman (2000) who published an article entitled “Behavioral Portfolio Theory” in the *Journal of Financial and Quantitative Analysis*. They took mental accounting into the portfolio model to explore its implications.

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