Does the Day of the Week form Still Persistent on the Chinese Stock Market?

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Authors' contributions

This work was carried out in collaboration between all authors. Author MEMK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors HYL and AL managed the analyses of the study. Author AOKM managed the literature searches. All authors read and approved the final manuscript.

Article Information

Case Study

ABSTRACT

The study investigated both of the major Chinese markets, Shanghai and Shenzhen capital markets of China for both A&B share, for the period from 1995 to 2017. The analysis uses Linear-Regression model in order to test the day of the week effect for each market, valued in both local currency and dollars. First, the stability of the seasonal pattern was unusual. Since there are institutional differences within the Chinese stock market, the similarity between the different seasonal patterns of the Chinese stock market is unlikely. Ultimately, the study asserted an inefficient Chinese stock market. Whereas, the day of week form was revealed through the investigated period, hence, Thursday displayed statistically significant negative effect for both classes of share throughout the period; Monday was negative for B share only and Tuesday negative for A share only. On the other hand, Friday and Wednesday showed a significant positive effect for class B share.

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1. INTRODUCTION

In the 21st Century the advancement of technology and globalization has made financial resources the cornerstone of development. To this end therefore, the stock market has attracted a lot of attention in our modern world. The stock market offers a unique combination of conditions that enable the quick earning of profits in the shortest time possible.

The stock market is one of the few places where this combination of technology and money exists, where one can turn thousands of dollars into millions. Consequently, bearing in mind the human natural disposition for profiteering, we can say that success is defined as making a maximum profit using the minimum time and effort. Hence, everyone is seeking the opportunity to gain abnormal positive returns in the short term within the stock market instead of investing their assets and receiving continuous stable return. This is, of course, absolutely inconsistent with the market efficiency hypothesis. This was the starting point for the infinite disagreement between the market efficient supporters and the other school of thought that sees that with well-made strategies it is possible to achieve abnormal returns within the stock market.

Market efficient hypothesis is structured with the preconception that no one is capable of obtaining abnormal returns within the stock market; the first who pointed out the efficiency market hypothesis was Bachelier in 1900 [1].

Suggesting that the concept of the market efficiency is coherent with Random walk theory was first mentioned by [2] who investigated 22 UK stocks and commodity price series. Fortuitously, the work found a random change within observed durations from one term to the next. This is quite noticeable as to distort any systematic effect it might happen; this finding denominated the Random walk theory. This study is widely spread and it is the root of later market efficient studies. Some expert and/or investors who have a solid comprehension of market price information usually use random walk model to examine the market efficiency hypothesis. The efficient market hypothesis was intensively the topic for empirical research since 1970, when [3] introduced the theoretical test of market efficiency and announced the efficient market hypothesis (EMH). Subsequently, there have been numerous studies devoted to examine the randomness of the stock price locomotion in order to demonstrate and prove the validity of the efficient market hypothesis. Since then, all kind of unusual phenomena has been widely reported in the financial literature, particularly the seasonal anomalies. The most discussed phenomena of these seasonal anomalies, calendar effects, are the January effect; day of the week effect, and; semi-month effect [4].

This study is concerned with day of the week effect. This work will be an analysis of the Chinese stock markets in Shanghai and Shenzhen for class A & B shares for the period from 1995-2017 which displays the longest period had been investigated, aiming to verify whether the Chinese stock market is efficient or not.

1.1 Day of the Week Effect

In the pattern of day of the week effect, the US is the most discussed market. Most of the studies on this subject concluded a negative Monday effect whereby, Monday is the worst performing day comparing with other days. The consensus is that Monday offers lower returns than the rest of the week and that Friday is the positive day with larger returns [5-8] reported the US stocks market for the period 1962-1978. The study found negative Monday effect whereas Monday's return was much lower than the rest of days. On the other hand Friday appeared with a positive effect due to the high returns comparing with the rest of the week [9]. In the research period 1928-1982 had findings consistent with earlier studies emphasizing the negativity of Monday return. Likewise, Friday was having positive returns.

In addition to evidence from the US studies, we can also view various complimentary international research on the day of the week effect. By presenting multiple countries, a varied and broader view emerges [10]. Drove an experiment in eighteen countries. The result of the work shows a large positive effect for Friday and Wednesday respectively and most of the countries showed negative Monday effect [11]. Observed the daily stock market returns for four countries (Japan, Canada, United States and Australia). This investigation revealed a clear week-end effect in all the four countries. Moreover, findings in Japan indicated highly

significant returns on the last trading day of the week, Saturday, in regard to the negative effect. Interestingly, Japan and Australia showed discrepant result with common evidence since the result showed significant low Tuesday's returns.

One of the remarkable and presentable surveys carried out by [12]. Covered almost the entire world is largest stock markets. However, there were only four countries with significant positive effect: Austria, Canada, Japan and New Zealand. From the other side Austria, Germany and Netherlands showed negative Tuesday effect returns. Only Japan had positive Tuesday returns. There was no significant negative Wednesday effect found, only some positive effect found in Hong Kong, Japan and New Zealand. In concern of Thursday, New Zealand and Netherlands had the negative Thursday's returns. The positive Thursday effect was observed in each of Japan and New Zealand, whilst the only country with positive Friday effect was New Zealand, inconsistent with Austria and Germany in regard to their negative Friday returns.

In an investigation of 10 Asian Pacific countries including the USA and UK, [13] Found five countries with the same negative effect for Monday returns, including Malaysia, Philippines and USA, though the latter presented an insignificant affect And New Zealand, however, had positive Monday returns. Australia, Japan, Malaysia, Thailand and Philippines had negative Tuesday returns, unlike New Zealand and Taiwan with positive returns. UK and USA, as well as Hong Kong, Japan, Korea, Taiwan and Australia, appeared with positive Wednesday effect. Looking to Thursday each of Australia, Malaysia, New Zealand, Philippines, Singapore and Thailand had significant Thursday effect. Apart from USA and Taiwan, all the countries had positive Friday effect. As an eye-opener, we have to appraise that each of Japan, Taiwan, and Korea has trading day Saturday. There is different effect during the week among the countries. Nevertheless, it is unacceptable to ignore that six of the countries appeared with significant positive Friday effect with highest returns during the week days.

After all of the above reviewed studies, it must be emphasized that the day of the week effect is one of most popular seasonality effect.

Regardless of all evidence mentioned above still some studies deny the existence of day of the week effect and confirm the trustiness of (EMH)

market efficient hypothesis. The following are some of those studies. [14] examined the US market utilizing robust econometric methods and a GARCH model for the period from 1963 to 1983 through some US indices. The study result shows beyond doubt that the week-end effect was smaller than the prior believed and the evidence appears to rely on the evaluation testing methods. However, the finding shows that the effect disappeared by 1979. Additionally, one of the noticeable evidence against the day of the week effect was carried out by [15] utilizing five countries indices, US, UK, Japan, Canada and Australia, describing an unexpected significant low Monday effect which seems to follow the market declines. Indeed, Monday effect virtually disappears when the market has formerly risen.

Within all this body of the evidence and findings, this study intended to discover the truth and affirm validity of the market efficient hypothesis. More precisely, the present study was designed to explore whether the Chinese stock markets are fully efficient or not. Undeniably, there have been some noteworthy studies on this subject [16-18]. Nevertheless, there are still obvious contradictions among their conclusions. Regardless, for the reason(s) causing those inconsistencies of their results, it might be differences in the tools employed in the empirical work or due to the adjustment of the samples etc. In this paper, the prolonged period from 1995-2017 comparing to the previous studies might give us vast insight into the case. Otherwise, through this study appropriate explanation of the inconsistency of others findings may be found. Chinese stock market might be among the recently established stocks market, nevertheless, the Chinese stock market has developed incredibly to be regarded as the fourth largest stock within three decades [19]. The Chinese stock market consists of two official stock markets operating independently in the mainland China. The Shanghai Stock Exchange (SSE) based in Shanghai is one of the financial centers of China, [20] established on November 26th, 1990, and started operating on December 19th of the same year. It is a non-profit organization. The Shanghai stock market bases its development on the principle of legitimacy, regulation, and self-disciplines. Both SSE and Shenzhen stock market (SZSE) is governed by the Chinese Securities Regulatory Commission (CSRC). Shenzhen stock market was founded on 1st December 1991. Self-regulated, SZE supervises securities trading and also fulfill duties which set up laws, regulations, rules and policies. These

are the major tasks, besides providing the platform and facilities for the security trading.

1.2 Studies Discussed the Chinese Stock Market

The EMH has been the researcher's orientation for decades since 1960s. The Chinese stock market attracted noticeable part of those studies; the Chinese market examined with multiple methodologies (Table 1). [21-23] used serial correlation tests, whereas [24-26] applied unit root test. Nevertheless, [27] indicated that serial correlation and unit root are less robust than the Variance Ratio (VR), particularly in the existence of heteroscedasticity. Therefore, in [17] carried out a survey employing variance ratio (VR) test hoping to analysis and emphases one of the contradicting initial studies result.

[12,28-32] used the individual Lo-Mackinlay VR test. Surprisingly, still the studies did not find unanimity in the weak form of efficiency for the Chinese stock market. Regardless of the disagreement among the studies still t is not preferable to utilize the multiple variance ratio tests.

A common known shortfall of the VR test is that the standard (individual and multiple) VR tests is restricted to asymptotic approximation, are biased (sharp size distortions and weaken power) and are right-skewed with finite samples, resulting in deceptive statistical conclusion. Thus, in this study the statistics program, SPSS, will be used to expand the domain of the analysis. Thereafter, we can enhance the chance of the correctness of the conclusion.

We contributed to the literature by re-examining the weak form of the EMH, in order to conduct our test. The Chinese stock market daily data for both classes of (A) share and (B) share was used. Likewise, there have been some studies testing the Chinese market efficiency in recent past. Extending the existing studies, this work will cover more extensive period than all the prior studies, covering the Chinese stock market from 1995-2017 for both (A) and (B) share. Otherwise, multiple econometric test method will be applied.

2. DATA AND SUMMARY STATISTICS

This research involves secondary data. Data were collected from 1995 to 2017 from Shanghai and Shenzhen stock market. The research design is cause and effect design as effect of days was investigated in this research using statistical models. Data were classified into two

parts according to the type of the stock whether it is a share or b Share.

The data used in this study is the daily closing price for both the Shanghai and the Shenzhen stock markets for class A & B share from [35,36] since SSE composite index is the first index in Shanghai stock market and it is considered to be the representative Index of the Chinese stock market. Therefore, it has been selected as proxy for this study. In concern of Shenzhen stock market, component Index was used. After collecting the data from the indices, subsequently for the test demands we converted the data from daily closing price into long returns in order to reduce the fluctuation of the index price, while the returns have more settled trends which are more appropriate for study and the outcome of the analysis.

Thereby, this study will use the data of the indices (composite, component) as source of the empirical test using daily long returns, calculated by the formula (2.1)

$$R_t = (LnP_t - LnP_{t-1}) \times 100 \qquad (2\text{-}1)$$

- R_t is the returns in the period T
- P_T is the daily closing share price index at the particular time T
- P_{t-1} is the daily closing share price for the preceding period
- Ln is the natural logarithm

2.1 Statistical Method and Hypotheses

Statistical product and service solution an IBM acquired product in 2009 [37,38] was utilized on the study the model to detect possible seasonal variations in the monthly and quarterly frequency of 2003 the Shanghai and Shenzhen market index of A shares, First, the time-varying coefficient models allows the exclusion of the seasonal pattern changes over time, the time of the atypical values, the temporary or permanent changes have been duly taken into account.

2.2 Set up a Statistic Test

The statistic test is test computed from the random sample, the sample will be taken from the concern populations in the hypothesis test and then used for evaluating the probability of the truth or falsity of the null hypothesis [39]. Otherwise, the statistic tests it is the tool to determine the rejection or the acceptance of the null hypothesis.

In this study the T-test is use to evaluate the null hypothesis. A presumption for the T-test is the

Table 1. Efficient market hypotheses (EMH) for China stock markets

Studies	Studied period	Methodologies	Conclusions
[21]	1992-1993	Serial correlation	Result shows 92 kind of stock appeared to flow the random walk hypothesis, and shanghai stock Market has reached the weak form of the efficiency
[22]	1992-1995	Serial correlation	The study concluded existence of the weak form of the efficiency for both (A) and (B) shares
[24]	1993-1996	Dickey-Fuller unit root	The study asserted inefficient Shanghai and Shenzhen stock markets
[30]	1990-1993	Lo-Mackinlay	Inefficient for both Shanghai and Shenzhen including both shares (A) & (B)
[29]	1990-1997	Lo-Mackinlay	Not efficient markets
[33]	1990-2006	Regression	Inefficient Shanghai for (A) share with high volatility
[34]	1995-2016	Rolling sample& GARCH (1.1)	Inefficient markets

both population should have the same mean return, just in case the two comparative populations are essentially belong to same origin. And the F-test is utilized to estimate whether the standard deviation is significantly different or not, prior to the T-test to test the significance of the difference between the average returns. The formula is:

$$(R_{it} = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \alpha_5 D_{5t} + \varepsilon_t \qquad (2\text{-}2)$$

$$\varepsilon_t \approx N(0, ht) \qquad (2\text{-}3)$$

Here Sp^2 is the collected variance, n_1 is the number of the observation in population1 and n_2 is number of observations in population2, $(\mu_1 - \mu_2)$ is the difference between the two population means, $(X_1 - X_2)$ is the difference between sample means [40] Finally in our case SPSS is used to acquire the statistic results of T-test with significant level of 0.05 also the F-test with the same significant level.

The OLS model employed in this study is as follows.

Where,

- R_{it}= the log return of the market index (ASPI);
- D1t = dummy variable for Monday (D1t =1 if the observation is on Monday, otherwise 0);
- D2t = dummy variable for Tuesday (D2t =1 if the observation is on Tuesday, otherwise 0);
- D3t = dummy variable for Wednesday (D3t =1 if the observation is on Wednesday, otherwise 0);
- D4t = dummy variable for Thursday (D4t =1 if the observation is on Thursday, otherwise 0);
- D5t = dummy variable for Friday (D5t =1 if the observation is on Friday, otherwise 0);
- ε_t = an error term and assumed to be independently and identically distributed.

The strength of the linear association between two variables is quantified by the *correlation coefficient*. Given a set of observations (x_1, y_1), (x_2, y_2), (x_n, y_n), the formula for computing the correlation coefficient is given by

$$r = \frac{1}{n-1} \Sigma \left(\frac{x-\bar{x}}{s_x}\right)\left(\frac{y-\bar{y}}{s_y}\right) \qquad (2\text{-}4)$$

- R = the daily returns
- N= Number of observations
- x = the closing price of the current day
- $\bar{x}$ = the closing price of the previous day
- y = Today's interest in the closing price
- $\bar{y}$ = the interest of the initial day
- s_x= Standard deviation of the price
- s_y= standard deviation of the interest

2.3 Hypotheses

2.3.1 Day of the week effect

H_0= Suggest that all days perform equally.
H_1= Monday has the lower return compared to the rest of the week days.

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H_2= Friday reflect the day with the highest return than the rest of the week.

3. RESULTS

3.1 Days Effect

3.1.1 Demonstration of average percentage returns of (A) share 1995-2017

The Fig. 1 shows the mean return of the weekdays for class (A) share for the entire investigated period, as it's clearly shown the mean returns of Monday is negative, but yet Monday is not the lowest returns. Thursday occupied the highest negative returns throughout the studied period, For the same period, the series of negative performance included Tuesday for the second level following Thursday. On the other hand, each of Wednesday and Friday show positive average returns for the whole period. Moreover, Friday represented the top positive return among all the days followed by Wednesday.

3.1.2 Elucidation of Anova outcome of the week effect for Shanghai and Shenzhen market class (A) share 1995-2017

Although, Tuesday appeared with not statistically significant negative return, Thursday had the greatest negative performance. Thursday's mean return was statistically significant -175.4%. Likewise, Monday was found with negative return throughout the investigated period. However, Monday was insignificant. On the other hand, Friday shows the most positive returning days with insignificant statistic mean return of 11.79%. Wednesday displayed the second highest returning day with mean 0.213%. Notwithstanding, Wednesday was not statistically significant.

In regard to the instability or risky days, Tuesday displayed the highest risk, on term of volatility with standard deviation 212. 909. Friday exhibited the second riskiest day after Tuesday with the standard deviation 176.83. Interestingly, Wednesday is the second lower volatility behind Monday the lowest risky day with standard deviation 169.74.
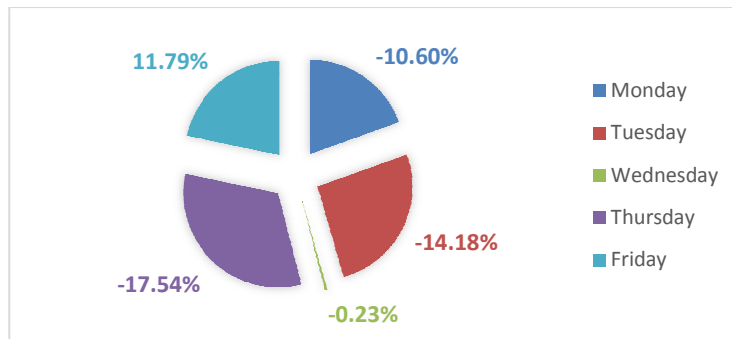

Fig. 1. Average daily percentage return for the day of the week 1995-2017 for (A) share

Table 2. The daily return and day of the week effect for Shanghai and Shenzhen market class a share 1995-2017

Days	Number	Mean	SD	F-test	Sig	T-test	Df	P-value
Monday	1888	-10.60%	168.760	1.445	0.229	-1,202	10315	0.229
Other days	8433	-5.43%	184.000			-1,271	2983.162	0.241
Tuesday	2084	-14.18%	212.909	5.223	0.022	-2,285	10318	0.022
Other days	8237	-4.04%	172.734			-2,020	2814.885	0.044
Wednesday	2230	0.213%	169.733	2.937	0.87	1,714	10313	0.087
Other days	8091	-7.66%	184.768			1,798	3809.337	0.72
Thursday	2065	-17.5%	174.149	10.306	0.001	-3,210	10316	0.001
Other days	8256	-31.9%	183.339			-3,311	3,303,930	0.001
Friday	2054	11.7%	176.823	24.818	<0.001	4,982	10315	<0.001
Other days	8267	-0.49%	182.547			5,078	3228.427	0

P-value: 2tailed P-value for T-test, significant level a=0.05

3.1.3 Demonstration of average percentage returns of (B) share 1995-2017

In Fig. 2 concerning the daily returns for class B share there is a noticeable result; Monday overtakes Thursday in terms of the negative average returns, meanwhile Thursday remains the second most negative day. On the other hand, Wednesday override Friday in terms of the positive return days. Thereby, each of Wednesday and Friday represents the positive effect days. Interestingly Tuesday involve to this group for class B share interferes with the result of a share. However, it did not prove yet whether the effect is significant in regard to B share or not

3.1.4 Elucidation of Anova outcome of the week effect for Shanghai and Shenzhen market class (A) share 1995-2017

In the Table 3 unexpectedly, Wednesday has the significant positive mean return of 0.443 for the period from 1995-2007 in the top overall. Hence, Friday mean return was negative in accordance

with B share. However, Friday effect was not significant. On the other hand, Monday overtakes Thursday. Monday occupied the lowest returning days, with significant level of 0.017 for the P-value. Subsequently, Thursday comes in the second position after Monday effect for B share with significant negative mean return of 0.156.

Considering the risky days, Wednesday is the day with the highest fluctuation described by standard deviation of 2.74, Tuesday follows Wednesday although Tuesday was not statistically significant with standard deviation 2.59. Tuesday also followed Wednesday in terms of the positive return with average positive return of less than 0.01%, the second highest return throughout all the duration.

4. DISCUSSION

Friday's average performance is higher than the average return on the other days of the week and Mondays represent the (worst) performing day.
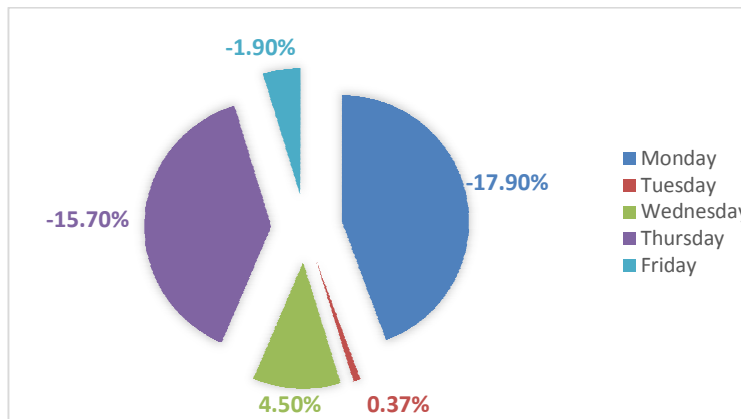
Fig. 2. Average daily percentage return for the day of the week 1995-2017 for B share

Table 3. The daily return and day of the week effect for Shanghai and Shenzhen market class B share 1995-2017

Days	Number	Mean	SD	F-test	Sig	T-test	Df	P-value
Monday	2034	-0.17%	2.0056303	5.654	0.017	-2.378	6173	0.017
Other days	7242	-0.40%	2.2294224			-2.465	4445.467	0.014
Tuesday	1043	0.014%	2.5877890	1.33	0.249	1.153	9278	0.249
Other days	8237	-0.77%	2.0368730			0.959	1210.957	0.338
Wednesday	2081	0.45%	2.7382490	4.646	0.031	2.156	6196	0.031
Other days	7195	-0.081%	2.2023696			2.199	4404.163	0.028
Thursday	2066	-0.16%	2.0083699	4.595	0.032	-2.144	6189	0.032
Other days	7210	-0.032%	2.2202128			-2.216	4518.824	0.027
Friday	2056	-0.019%	2.0511087	0.979	0.322	0.990	6184	0.322
Other days	7220	-0.07%	2.2108905			1.615	4388.951	0.310

P-value: 2tailed P-value for T-test, significant level a=0.05

This calendar exception is not limited to the US stock market, while there are seasonal anomalies of Chinese stock market found correspondence with earlier studies, significant negative Monday effect was detected for class B share agreeing with most of the USA studies [5-7,9]. Thursday appeared significantly negative for both share; this result is consistent with [12] in accordance with Japan finding.

The study has rejected the null hypothesis due to the existence of the day of the week effect, hence Friday showed a significant positive effect for B share and that does not agree with that null hypothesis which believes that the performance of all days is equal. Furthermore, the current study concluded that each of Thursday, Monday and Tuesday are statistically significant. Therefore, the null hypothesis rejected relying on our findings.

Friday is significantly positive in China stock market class B share, as well as the majority of the earlier findings. However, our study has contradicted most of the previous research. Hence, the analysis has revealed significant positive Wednesday effect for class B share unlike [41] as the study concluded that there is no Wednesday significant effect. Interestingly, the study disagreed with the literature findings, such as [42] since there was no significant January effect found in the Chinese stock market for the entire period. Although, August, June and March exhibited positive return through the whole duration, but no one was significant.

Our study conflicts with [43,44] since the second half of the month showed higher return than that of the first half.

In the 1920s to determine the impact of Mondays, early studies seem to manipulate the electronic database. Many researchers have equity securities to provide an explanation for the negative performance on Monday, but no one seems to plead entirely satisfactorily against this phenomenon due to misuse or interpretation of statistical methods due to the microstructure of the market. The same rational price explanation has also had uneven success experience. While the flow pattern of information seems logical, the empirical results to check these processes did not provide promising results. The most consistent finding depends on the flow patterns of various trader change orders.

5. CONCLUSION

In summary, the performance of the stock exchanges of China appeared inefficient in terms of day of the week effect. In addition, sufficient evidence has been found to reject the null hypothesis. Due to the impact of the day, investors can wait until Monday, Tuesday and Wednesday to buy stocks, sell shares on Thursday and Friday to obtain abnormal returns. In addition, it can be concluded, China does not have a weak form of stock exchanges; investors can get abnormal returns of trading strategies based on past information. We can conclude each of Tuesdays and Monday has negative return. Moreover, Thursday, showed significant negative returns on statistical occurrence for both shares, Friday showed significant positive return on class B share and high occurrence statistics show the Chinese indexes have significant day of the week form during the investigated period 1995 – 2017.

According to the day of the week effect a few possible explanations may be that more positive economic news appears on the weekend, investors show and certainly promising investment behavior, resulting in a positive performance on Friday. On the other hand, for most of the negative economic news from the beginning of the week, investors are trying to sell their negative return on Monday and Thursday.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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