Stock Market Anomalies: Case of Calendar Effects on the

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Abstract

The aim of this work is to analyze the effect of financial market anomalies, specifically calendar anomalies, on the behavior of financial investors in terms of decisions and profit. Analyzed in the context of Tunisian financial market into two periods; with two different political regimes, this work examines four calendar effects, which are the weekend effect, the end of the month effect, the January effect and Ramadhan one, contrary to previous studies that have focused on a single effect.

Index terms— stock market, garch, financial sector sensitivity.

1 Introduction

n era of behavioural finance, moral hazard and asymmetry of information, financial market seems to be affected by different subjective and non financial factors. In the case of this work we try to assess the impact of such elements on the financial market, specifically, calendar anomalies' effect on the stock market. In fact Kuhn (1970) initiated the term anomaly in the field of finance; in this case financial anomalies are factors far away from any central paradigm or theory. **??**ama (1970) presented the theory of weak form market efficiency, suggesting the limit of financial efficiency. Schwert (2003) highlighted through empirical investigation that these elements don't hold up over different sample period. **??**srael and Moskowitz (2011) using an analysis on US equity over 86 years and, international equity and assets, over 40 years, showed that trading costs or institutional and hedge fund ownership, affect significantly size, value, and momentum returns. Latif and al (2011) analysed market efficiency and its relevance to the different types of market anomalies, they stipulated that there is a consistent effect of these later on the market returns, the effect can be from oneperiod to other or constant over time.

Market anomalies are many; researches on this field had presented different types; we found fundamental anomalies, technical anomalies and calendar anomalies. These later are subject of our investigation.

In fact Hansen and Lunde (2003) tested the significance of this specific types, they assess, using of full universe sample, a significant effect on returns. Lim and Chia (2010) evaluated the weak form market efficiency, on the basis of 5 Asian stock market, they found different results from one market to an other; evidence of standard effect is not available. Khan and al (2012) investigated the effect of calendar anomalies on the case of Karachi stock exchange; results showed an impact on daily return and a little effect on month's one.

2 II.

3 Methodology

The purpose of this paper is to analyse the evidence of calendar effect on Tunisian Stock market, for this end we use the following elements: a) Period From 02 January 2006, to 31 July 2013. This period encompasses the Tunisian revolution that led to the closure of the stock market for two weeks. We have a total of 1875 observations, after elimination of weekends and holidays.

This period is divided into two periods: the period before the revolution (2006-2010) and period after the revolution **??**2011) **??**2012) **??**2013), in order to mitigate the availability of investigated calendar effect on these two periods.

4 b) Data

The data collected for our empirical study are daily data consisting Tunisian Stock Market Index TUNINDEX closing price. Tunindex is the main index of Tunis stock market; it is composed of fifty main market capitalization of the country. During our sample period, more precisely since 02/01/2009, the index Tunindex changed its method of calculation. Indeed, it is not weighted by market capitalization but by floating capitalization. This calculation method, already used by other major indices around the world, will ensure greater coherence between the stock market reality of companies and its translation in the indices. These data allowed us to calculate the daily performance that will be our dependent variable of the model.

5 Dependent variable: Performance

The daily performance of the index represents the dependent variable. The daily yield is calculated as the percentage of the logarithmic change in the retarded value of the index.

6 Rt = ln (vt / vt-1) * 100

With:

Vt is the Tunindex value of the day t.

Vt-1 is the lag value of Tunindex du day (t-1).

The monthly return, it is calculated as the geometric mean of the daily returns.

7 Independent variables:

The explanatory variables will be classified according to the studied calendar effect: ? Weekend effect: we have five dummy explanatory variables that correspond to each day of the week: D1, D2, D3, D4, D5. D1 = 1 if day t is a Monday, and 0 otherwise. ? The month's end effect: one explanatory variable dummy DTOM this period contains five days prior to the first day of the month and five days after, as follows: DTOM = 1 if day t belongs to the period of the month's end, and 0 otherwise. ? The January's effect: there are 12 dummy variables for each month of the year: D1, D2?D12. D1 = 1 if the month is january, and 0 otherwise. ? The Ramadan effect: one dummy explanatory variable DRAM, which is the period of the month of Ramadhan (30 or 29 days). DRAM, = 1 if we are in the month of Ramadhan, and 0 otherwise.

8 c) Descriptive Statistics

Table **??** presents descriptive statistics of daily returns of Tunindex. The total number of observations is 1875. The average yield is positive (0.03699). The standard deviation is equal to (0.5215). The series has a negative Skewess (-0.6848), which is usually typical for all stock returns. A negative Skewess implies a higher probability of generating a negative return over a symmetric distribution. Similarly, the series displays a high Kurtosis, which means that the distribution is leptokurtic (distribution that rises high enough then falls relatively abruptly), with a value that is six times greater than the reference value of a normal distribution which is equal to 3. The series shows positive returns in 1055 times and 820 negative returns during the entire study period.

We present in Figure **??**, the daily values of Tunindex and stock performance of the index during the period 02/01/2006 -31/07/2013.

During the first years of the sample period, the Tunisian stock market was relatively stable. Then there was a period of rapid growth of Tunindex which peaked during the period December 2010-January 2011. The daily yields were stable at the beginning of the sample period, but they have experienced greater volatility at the end of 2010 to reach negative values with the end of the period (year 2013). This high volatility during the year 2011 can be explained by the Tunisian revolution.

i. Weekend effect Table 2 shows the average daily returns for each of the five days of the week. The table shows that the only day that displays a negative return is Tuesday, (-0.0036), then Monday with a weak value equal to (0.0158). In contrast, the average return on Friday is positive and important equal to (0.1387). This proves that most of the cumulative average returns are generated during the second half of the week, from Wednesday to Friday.

Moreover, the volatility of returns (std. Dev) is important at the beginning of the week, especially on Monday and it decreases to its lowest level on Friday.

These results may indicate that the weekend effect is present in the Tunisian stock market but it occurs more precisely on Tuesday. Thus, we can clearly understand that the weak and negative returns occur during the first part of the week (Monday to Tuesday) and positive returns during the second part of the week (Wednesday to Friday).

ii. The month's end effect **??**able 3 and 4 show that, the average yield during the first week of the month (0.0931) is higher than the other weeks of the month and twice high. Similarly, the number of positive returns during the period the month's end is 1.5 higher than the number of negative returns.

We can conclude that there is an end of the month effect on the Tunisian stock market.

iii. The January's effect Many previous studies have verified the presence of end of year's effect, also known as the effect of January. According to this, the stock returns are higher in January compared to other months

of the year. Table **??** and 6 show the average monthly returns for each of the 12 months of the year. As we can see, the average yield of January is positive but it is not the highest. On the other hand, we can also notice seasonality in months; the variances of January and February are higher compared to the rest of the month. We can therefore conclude that there is a January effect on the Tunisian stock market appearing during the first part of the month.

9 iv. The Ramadan effect

Several studies have shown that market activity increases during the month of Ramadan in Arab countries, and yields during this month are higher compared to other months. Indeed, from Table **??** shows that the average yield for the month of Ramadan is twice as high as the rest of the year. This effect can be explained by the change in the social mood. Indeed, during the holy month investors tend to be more optimistic that affects their investment decisions. To better study this effect, we have scaled the month of Ramadan in three dozen days, see Table **??**.

We note that the performance of the first ten days is significantly higher than the rest of the month. As against, the lower yield has occurred during the second decade of the month. This reconfirms the existence of Ramadan effect on the Tunisian stock market.

10 d) Estimation

We empirically analyze the four effects and their impact on the dynamics of financial markets and investor decisions. The Ramadan effect was not treated well at the previous empirical studies due to lack of data. To achieve our aim, we will study these effects on the whole chosen period from 02/01/2006 until 31/07/2013 then we'll divide it into two periods: This comparison of the two periods will allow us to check whether the anomalies detected before the revolution still exist after the revolution and vis-versa, and see if the behavior of investors after the revolution has an impact on changes in share prices on the Tunisian market.?

Most previous studies on the calendar anomalies have used the model of ordinary least squares (OLS) using dummy variables as proxy for abnormalities. Using conventional MCO in this manner can have two major drawbacks. First, the error term can cause a problem autocorrelation and heteroscedasticity. Second, the variance of the error term may not be constant in time. Both disadvantages can invalidate the assumptions of the OLS estimate.

Given these concerns, we will use the model autoregressive conditional heteroscedasticity, GARCH (1,1), to test the effects. ARCH models were first proposed by Engle (1982), they are widely used in financial modeling of time series with an instantaneous volatility timedependent.

The ARCH model was, subsequently generalized by **??**ollerslev (1986) to propose the GARCH model. Most studies use the GARCH (1, 1) model which allows a general representation of processes of conditional volatility.

11 i. The weekend effect

To test for the weekend effect on the Tunisian stock market, the GARCH (p, q) has the following form: Where From this equation, we can deduce the GARCH (1,1) that we will use in the following: Whith: R t : return on day t a t : the average yield for each day of the week D it : dummy variable for the 5 days of the week The rejection of the null hypothesis implies that the average daily returns (at) are significantly different from each other. It follows that there is seasonality in daily returns between the different days of the week.

In this context, we postulate the following hypothesis:

Hyp1: There is a weekend effect on the Tunisian stock market.

12 ii. End of the month Effect

To examine the effect of the end of the month, the same form of the GARCH (1, 1) will be maintained: With: R t : return on day t a 1 : the average return period of rest of the month a 2 : the average return of the late period of the month D TOM : dummy variable which corresponds to the end of the period of the monthR t = a 1 D 1t + a 2 D 2t + a 3 D 3t + a 4 D 4t + a 5 D 5t + ? ? 2 + ? t ? 2 t = ? 0 + ? i ? 2 t-1 + ? i ? 2 t-i ? 2 t = ? 0 + ? ? 2 t-1 + ? ? 2

D RM : dummy variable corresponding to the period of the rest of the month ? t : the error term.

The null hypothesis and the alternative may be as follows H0: a1 = a2 = 0 H1: a1 and a2 are different from zero.

The rejection of the null hypothesis implies that the average yield for the end of the period of the month and the rest of the month are significantly different which proves that there is end the month's effect on the Tunisian stock market.

Since there is no consensus on the definition of a specific window for the end of period, we will choose a window [-5, 5] and study the average returns of the index of the month on this interval. Therefore, on day -1 is the last trading day of the month, day 1 is the first trading day of the month, day 2 is the second trading day of the month and so on. In this context, we will test the following hypothesis: Hyp 2: There is an anomaly in end of the month on the Tunisian stock market.

iii. January Effect To test for the January effect the GARCH (1, 1) model has the following form: R t : the monthly return in month t a t : the average return in month t D t : dummy variables corresponding to the twelve months of the year ? t : the error term. We considered the following hypothesis: H0: a1 = a2 = ... = a12 = 0. H1: At least two coefficients are different from zero.

The rejection of the null hypothesis implies that the average monthly returns (at) are significantly different from each other. It follows that there is seasonality in monthly returns. In this case, we will apply the following hypothesis: Hyp 3: There is seasonality in monthly returns.

13 ? Ramadan effect

To test the presence of Ramadan effect, we will estimate the following model: With: R t : appropriate return on day t a 1 : the average return period of rest of the year a 2 : the average return for the month of Ramadan D RAM dummy variable corresponding to the period of the month of Ramadan D RA : dummy variable that corresponds to the off Ramadan (rest of the year) ? t : the error term. The null hypothesis and the alternative are as follows: H0: a1 = a2 = 0 H1: a1 and a2 are different from zero

The rejection of the hypothesis means that the average return for the month of Ramadan and the rest of the year are significantly different; It follows that there is a significant Ramadan effect. In this context, we will test the following hypothesis: Hyp 4: There is a Ramadan effect on the Tunisian stock market.

14 iv. Stationarity test

A series is said to be stationary when its mean and variance are constant over time, that is to say, when there is no significant temporal variation. To test the stationarity of our time series, we will resort to increased Dickey Fuller test. The assumptions of the test, are defined as follows: H0: The series is non-stationary. The process admits a unit root. H1: The series is stationary. The process follows an AR (1) does not admit a unit root. This test involves estimating the following three models:

In our case, the results of the first test model are shown in Table **??**. The value of the ADF test is less than the critical value and the p-value is less than 5%, which excludes the hypothesis of the existence of a unit root. We note that the trend was significant (p-value <5%). Therefore, we will differentiate the series and repeat the same test.

The results obtained are shown in Table **??**0. After differentiated the series once, the lack of a unit root is maintained and the trend became non-significant (p value> 5%). This proves that the series of performance is integrated of order 1 and shows no significant trend.

15 v. Heteroscedasticity test errors

This test is used to check if the error variance is constant for each case, which means that the error variances are constant on the first diagonal. The test assumptions are:

If the p-value <5% then the error term is said heteroscedastic.

The results of the Breusch-Pagan test are shown in Table **??**1. The value of the p-value is less thanR t = a 1 D 1 + a 2 D 2 + ?. + a 12 D 12 + a 13 ? 2 + ? t R t = a 1 D RA + a 2 D RAM + a 3 ? 2 + ? t - t = a Y t-1 + b +ct + t - t = a Y t-1 + b + t - t = a Y t-1 + t H0 : V(it) = ? 2 H1 : V(it) ? ? 2

5% then we conclude that the error term is heteroscedastic.

16 vi. Autocorrelation error test

We are in the presence of autocorrelation in errors when errors are bound by a reproduction process. To detect this problem, you have to use a residue analysis. The test for checking the presence of error autocorrelation is the Durbin Watson. The corresponding test assumptions are: H0 :

17 H1 :

The results of the Durbin Watson test are reported in the Table 12. The value of the p-value is less than 5%, which verifies the existence of autocorrelation of errors.

18 III.

19 Results

a) The weekend effect The estimation's results of the first model are reported in Table 13, show that the average yield for the five days of the week for the period before the Revolution (02/01/2006 until 13/01/2011) and the period after the revolution (14/01/2011 to 31/07/2013) and for the entire study period. The results show that there is seasonality in average yields. Thus, it appears that the average yields are significantly different depending on week' days.

For the entire period, average yields are all negative except returns on Friday, which are the only positive and high (0.1328). The lowest yields occur during the first part of the week and they increase during the second. The lowest average yield is the Tuesday (-0.1253). As expected returns on Monday seem to be consistently low over

the three periods, involving evidence of an effect of Monday, in the Tunisian stock market. Otherwise, average yields from Friday through periods seem to be the highest, suggesting the presence of a Friday effect.

Thus, for the period before the revolution, average yields are all negative except Friday, the lowest significant returns occur on Monday and Tuesday (-0.1303 -0.1871 and) from wednesday the average yield increases to 0.1789 on Friday, which is the highest level of the week. Therefore, we can confirm the presence of a weekend effect on the Tunisian market during this period.

However the results in the context of the second sub-period (after Revolution) show that there is no significant associations between changes in stock returns and day of the week in the case of our sample. Indeed, we can notice that the daily average yields of the week are not significant, they are negative on Monday, Tuesday, Wednesday and Thursday and Friday positive. We can suggest that the disappearance of daily anomalies after the revolution can be caused by pessimism and skepticism of investors during the severe recession of the market (after the revolution).

We can therefore conclude that there is a Monday and Friday effect on the Tunisian stock market for the entire period, which affirms the hypothesis of the presence of a weekend effect on the Tunisian stock market during these times. For the post revolution period, there is disappearance of daily anomalies.

These results are similar to results found in most previous studies especially those found by Mehdianb and Stoica (2012) on the Romanian market.

b) The month's end effect Table **??**4 presents the average yields of the month's end period and the period of rest of the month. Let us recall that we chose the window **??**-5, 5] to the end of the month.

Table **??**4 presents the average returns of the month's end period and the rest of the month and that for the entire study period and the two sub-periods. First, we can notice that the return for the end of the month is statistically significant, positive and higher, whereas the return of the rest of the month is significantly negative for the period of **??**2006) **??**2007) **??**2008) **??**2009) **??**2010) **??**2011) **??**2012) **??**2013).

Same conclusion for the period before the revolution, average yields are significant, the return of the end of the month is much higher, it is positive 0.1056 while the yield of the rest of the month is negative (-0.0641). In the case of the second sub-period, average yields are no longer significant; they became weak and even negative for the end of period.

For this, we can say for the whole sample period and for the first sub-period the existence of an end of month effect is statistically significant. Whereas on the second sub-period, we have not detected an effect of month's end, average yields are no longer significant, this can be explained by the lack of investor confidence and the recession that the Tunisian stock market known after the revolution.

20 c) The January's effect

Table **??**5 shows the average monthly returns. For the entire period, significant returns are those January, February, April, August, and September. The highest yield is in January (0.1235). The end of year returns (November, December) are the only negative but they arenot significant. This proves the existence of a January effect on the Tunisian stock market for the total period of the sample.

The same conclusion can be deduced from the second column of the table. Significant average yields are those of January, April, August, September and October. The highest yields are from January and September. So we can conclude that there is an effect January on the Tunisian stock market during this period. Regarding the second sub-period, we can notice that all means returns are statistically insignificant except for the return of the month of March, which invalidates the hypothesis of the existence of a January effect on the Tunisian stock market after the revolution.

In conclusion, the results in Table **??**5 prove the existence of a January effect on the Tunisian market during the entire period of the sample and the first subperiod. We can also note that, apart from the month of January, the months of August and September have high significant returns. Therefore, we suggest the existence of a Holiday effect on the Tunisian stock market.

On the other hand, and as in the case of daily returns, after the revolution all returns have become weaker and not significant. We can explain this by the lack of investors and prudence.

21 d) The Ramadan effect

Table **??**6 shows the average yields of the month of Ramadan and the rest of the year. The study of the entire period allowed us to record a significantly higher average performance during the month of Ramadan (0.0892) against a negative return for the rest of the year (-0.0432). We therefore confirm the existence of Ramadan effect on the Tunisian market.

In line with the results already interpreted the pre-revolution period registered an average yield of 0.1085 during the month of Ramadan, which is statistically significant Whereas a significant average yield of 0.0562 for the rest of the year. The return of the month of Ramadan is 2 times higher than those of the off-Ramadan. In contrast, the second sub-period was marked by low and insignificant average return for the month of Ramadan and the rest of the year. Which excludes, the existence of Ramadan effect during this period (post-Revolution).

From Table **??**6, we confirm the hypothesis of the existence of Ramadan effect on the Tunisian stock market

during the entire period and the first sub-period. By Wherease, during the second sub-period, returns are not significant which invalidates our hypothesis for this period.

IV.

22 Discussion

The results found allowed us to confirm the four assumptions. This means that there are on the Tunisian stock market the four expected effects.

The results found for the weekend effect is similar to the majority of the results of previous studies. Thus, many studies have shown the negative and low yields during the first half of the week (Monday and Tuesday) and high yields in the second. Lower yields and high volatility on Monday means that investors are prudent to take positions during the first day of the week when investor expectations are still not clear after the weekend.

It seems that this is consistent with the hypothesis of the closing of the market, French **??**1980). Also, low yields on Monday may be explained by the lack of liquidity and market information after the weekend. This lack of information leads investors to avoid taking decisions on Mondays. The upward trend of the return on the Tunisian stock market confirms that the yield increases when more public information reaches the market during the week. This explains the low yield of Monday, and high performance on Friday.

The second proven effect on the Tunisian market is the end of the month effect seems to be similar to existing literature. In addition to important and positive returns during the month's end, we found a concentration of returns around the first ten days of the month. It was found that the first ten days of the month have higher average returns than the rest of the month.

The covering of balance sheets and the rebalancing of portfolios at the end of each month seem to explain the effect of the end of the month. Thus, the reason behind this trend may be cognitive beliefs of investors related to news of the coming months. With the start of the new month, investors are starting to buy in hoping to achieve more profit on the basis of new information which explains the high yields from the beginning of the month.

The third anomaly detected on the Tunisian stock market is January's effect. Thus we find significant returns higher during the month of January compared to other months. This result is in line with previous studies although a number of them confirm the absence of this anomaly in some markets. In the case of the Tunisian stock market, it seems that the assumption of covering balance sheets, portfolio rebalancing and the lack of information with the beginning of the year could explain as this anomaly. Thus, investors tend to buy at the beginning of the year and hope to earn more profit during the months when the information about the new year increase more and more. The hypothesis of investor sentiment could also explain the January effect. In fact, investors tend to be optimistic and in good spirits with the beginning of the year, which affects their investment decisions by purchasing securities during the period of January.

The last effect studied is that of Ramadan. By studying the average yields of the holy month and the rest of the year, we noticed that the average return for the month of Ramadan is much higher. This result is similar to the results of Redhead and Rodgers (2011) who studied the existence of this anomaly in Middle Eastern markets (Bahrain, Egypt, Jordan, Kuwait, Saudi Arabia, Turkey). They find a significant and positive effect on Ramadan most of the markets.

This anomaly can be explained by the positive mood that exists throughout the month of Ramadan. The result that we found through these calendar anomalies, stipulate important implications for investors. The existence of these anomalies on the Tunisian stock market is against the principle of efficiency of financial markets because it can generate abnormal economic profits to investors by taking account of these anomalies.

All these anomalies and their effects on stock returns and volatility could allow investors to take advantage of price changes that are relatively regular, designing investment strategies representing predictable patterns. Also the presence of these anomalies can provide fund managers the ability for timing optimal decisions based on changes in daily and monthly price.

Through this paper, we examined the stock returns of Tunindex to verify the existence of calendar anomalies on the Tunisian market. The results show, for the sample period, the weak and negative returns during the first part of the week (Monday and Tuesday), and positive and high yields during the second half of the week (Wednesday, Thursday and Friday). The highest and the positive performance only occurs on Friday. This proves the existence of a weekend effect on the Tunisian market.

Regarding the first sub-period (before revolution), the effect Monday has disappeared because Monday and Tuesday returns are not significant. The yields of the second part of the week are always significant and high, and the highest yield was recorded on Friday. For post-revolution period, the yields are not significant. Next, we examined the effect of the end of the month and have found, for the entire period and for the pre-revolution period of end of the month is much higher than the rest of the month. It is almost 2.5 times greater. So, we can say that there is in fact end the month effect on the Tunisian market. As the case of daily returns, we are seeing non-significant returns during the period after the revolution.

Another effect has been studied is the effect of January. By examining the average yields of each month, we did not detect a significant effect on of January in the Tunisian market. In fact and in the three periods, the majority of returns are not significant, significant yields and the higher occur in the months of April, August and September. We have suggested the existence of a significant in fact Holiday.

Finally, we studied the existence of the Ramadan effect. From the results, we found a significant effect

Ramadan; In fact the average yield of the holy month is twice as high as the rest of the year. This is valid for the entire period and the period before revolution. For the second sub-period, yields still not significant.

These results show, in general, the existence calendar anomalies on the Tunisian stock market. Most of the anomalies can be explained by the combination of various factors such as the suspension of trading during the weekend, portfolio rebalancing, the time of the publication of information and investor sentiment. On the other hand, we can also deduce results found high volatility and lower stock returns after the revolution, which led to the disappearance of anomalies on the Tunisian market. This phenomenon can be explained by the uncertainty and lack of confidence among investors under the new country's situation.

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25 Conclusion

Figure 1: ?

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Figure 2: Table 2 :

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Figure 3: Table 3 :

345 [1] [2]

Table ??3 : Average yield depending on the day of the week.

.1 Monday

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