Efficient Market Hypothesis And Stock Market Anomalies: Empirical Evidence In Four European Countries

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ABSTRACT

The stock market efficiency is the idea that equity prices of listed companies reveal all the data regarding the company value (Fama, 1965). In this way, there isn't possible to make additional returns. However, evidence against the Efficient Market Hypothesis is growing. Researchers studied Calendar Anomalies (CAs) that characterised financial markets. These CAs contradict the efficient hypothesis. This research studies some of the most important market anomalies in France, Germany, Italy and Spain stock exchange indexes in the first decade of new millennium (2001-2010). In this study, to verify the distribution of the returns and their auto correlation, we use statistical methods: the GARCH model and the OLS regression. The analysis doesn't show strong proof of comprehensive Calendar Anomalies. Some of these effects are country-specific. Furthermore, these country-anomalies are instable in the first decade of new millennium, and this result demonstrates some doubt on the significance of CAs.

Keywords: EMH; Calendar Anomalies; January Effect; Weekdays Effect; France; Germany; Italy; Spain

1. INTRODUCTION

*I*n the stock market an important principle used to measure the efficiency is the correlation between prices and all the information present in a market. The Efficient Market Hypothesis (EMH), also called Random Walk Theory (Kendall, 1953), is the consideration that the equity value of a listed firm reflects all data regarding the business value. "Efficient market" was presented in 1965 by Eugene Fama. He suggested that stocks always trade at fair value. This make impossible for investors to buy undervalued stocks or to sell stocks at overestimated prices. A market is efficient if prices adjust rapidly and, on average, without bias to new info. Thus, there isn't a reason to believe that prices are excessively high or low. So, in an efficient context it is impossible to beat the market. Investors pay a fair price. Based on this theory, an investor's only concern is selecting a particular risk-returns trade-off.

However, this model has received a significant amount of attention since its presentation. At first glance, it may be easy to identify a number of deficiencies in the efficient market theory. In fact, studies against the EMH are increasing, particularly with regard to return predictability (Rossi, 2016). Scholars who examine Calendar Anomalies (CAs) have indicated that CAs deny the stock market efficiency (Nasir, Khan and Rossi, 2016).

This study wants to examine calendar anomalies in four European markets. The paper has this structure: the second paragraph is a short literature review on calendar anomalies (or seasonal effects). In the third section, we explain the research method and the data collection. The empirical findings for the main CAs follow. The fifth section proposes explanations and conclusions regarding seasonal effects in the European stock markets.

2. A LITERATURE REVIEW OF CAs

In the past forty years, empirical checks have been realized to show the stock market efficiency. However, since the nineties, numerous studies have focused on examining the inefficiency of the markets by detecting various anomalies in the prices of the stock (Rossi, 2015).

In this section, we describe the calendar anomalies in markets characterized by different micro-structures. Calendar anomalies are cyclic earnings irregularities in which the series is founded on the calendar. "The calendar time hypothesis states that the market behaves differently at different hours of the day, on different days of the week, and at various times of the month and year" (Rossi, 2015: 287). In general, the calendar effects studies form scholars are: (i) the month effect (in particular January), and (ii) the effected related to the weekdays.

2.1 The January Effect

"As goes January, so goes the year" is a popular rule in the equity market famous as the January effect. The earliest evidence of this seasonal effect was noted by Wachtel (1942). Rozeff and Kinney (1976) realize a research to thoroughly examine the anomaly in U.S. stock market. These researchers found anomalies in the monthly rates of NYSE return from 1904–1974: "With the exception of the 1929–1940 period, there are statistically significant differences in mean returns among months due primarily to large January returns" (Rozeff & Kinney, 1976: 379). Gultekin and Gultekin 1983; Barone, 1990; Agrawal and Tandon, 1994 reported similar results. They showed atypical positive returns in other major developed nations. In particular, "Evidence is provided that there are strong seasonalities in the stock market return distributions... The seasonality, when it exists, appears to be caused by the disproportionately large January returns in most countries…" (Gultekin & Gultekin, 1983: 469). Agrawal and Tandon (1994) found a January anomaly in eighteen countries other than the United States. Barone (1990) examined the Italian Stock Exchange (MIB) from 01/02/1975 to 08/31/1989: "The results obtained on the basis of the MIB index for the whole period considered show that the Italian stock market also has a pronounced seasonal pattern" (Barone, 1990:495). Banz, 1981; Roll, 1983; Keim, 1983 have examined the interaction between month-of-the-year and size effects. These studies found an important negative relationship between stock returns and the total market value of outstanding equity: "Evidence is provided that daily abnormal return distributions in January have large means relative to the remaining eleven months, and that the relation between abnormal returns and size is always negative and more pronounced in January than in any other month" (Keim, 1983: 13). Also, Fama (1991) studied the S&P 500 performances during the period 1941-1981. He found that "the average monthly January return on a value-weighted portfolio of the smallest quintile of CRSP stocks is 8.06% (!), versus 1.34% for the S&P 500" (1587). Brown et al., (1983) studied this seasonality in Australia, where the tax year ends on June 30. These researchers establish cyclic anomalies in December-January and July-August.

Wong, Agarwal, and Wonf (2006) investigate the CAs in the Singapore equity market (from 1993 to 2005): "Specifically, changes in stock index returns are examined surrounding January (the January effect), on different days of the week (the day-of-the-week effect), around the turn of the month (the turn-of-the-month effect) and before holidays (the pre-holiday effect)" (Wong et al, 2006: 123). Their results disclose that certain seasonalities have disappeared in Singapore in recent years, which "leads us to conclude that the January effect changes from positive in the pre-crisis to negative in the post-crisis period" (Wong et al., 2006: 128).

Mylonakis and Tserkezos (2008) examine the Athens Stock market (ASE) in the 1985-2001. They find that the mean returns during January are higher than in other months. The Baltic Stock Market seasonalities was studied by Norvaisiene, Stankeviciene and Lakstutiene (2015) They examine the "the daily log return indexes of Nasdaq OMX Tallinn, Nasdaq OMX Riga, and Nasdaq OMX Vilnius in Baltic stock exchange were analyzed for the period of 2003 – 2014" (Norvaisiene et al., 2015: 468). Their findings show that: "The research of the month effect in Baltic stock markets evidenced that January effect and October effect occurred in Estonia... The most successful months for investors in Lithuanian market were January, August and November as the stock return then was higher than in other months. Together with January, August and November effects, the October effect was established in Lithuania as seasonal trends of stock price decreases were observed in October" (Norvaisiene et al., 2015: 472-473).

2.2 The Weekdays Effect

Another important anomaly is the weekday effect. Typically, the U.S. market is characterized by low mean returns on the first day of the week in comparison with the other days of week. Osborne (1962) documented this CAs in the U.S. stock market. Later the weekdays effect was analysed by numerous researchers: Cross, 1973; French, 1980; Gibbons and Hess, 1981; Lakonishok and Levi, 1982; Keim and Stambaugh, 1984; Jaffe and Westerfield, 1985; Jaffe, Westerfield and Ma, 1989; Wang, Li and Erickson, 1997; Bildik, 2004.

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But, French (1980) and Jaffe et al. (1989) realized the most important studies on this topic. "They reported that average returns are significantly negative on Mondays and that these are significantly lower than the average returns for other weekdays in the USA. On the other hand, average returns on Friday are found to be positive and higher than average returns for the rest of the week" (Rossi, 2015: 289). "During most of the period studied, from 1953 through 1977, the daily returns to the Standard and Poor's composite portfolio are inconsistent... Although the average return for the other four days of the week was positive, the average for Monday was significantly negative..." (French, 1980: 55).

Jain and Joh (1988) showed that the exchanges volume of the NYSE in the first day of the week is about 90% of its usual volume from Tuesday to Friday. Wang et al. (1997), using data from 1962 to 1993 observe "that the well-known Monday effect occurs primarily in the last two weeks (fourth and fifth weeks) of the month. In addition, the mean Monday return of the first three weeks of the month is not significantly different from zero" (2171).

The weekdays anomalies were also analysed by Kiymaz and Berument (2003). They use the S&P 500 index from 1972 to 1997: "The highest volatility occurs on Mondays for Germany and Japan, on Fridays for Canada and the United States, and on Thursdays for the United Kingdom," the researchers note (Kiymaz & Berument, 2003: 363). Several researches shown that the anomaly may be linked to the fact that firms and governments tend to receive negative news over the weekend or that trading volumes increase on Fridays due to information symmetry and decrease on Mondays due to information asymmetry. Bildik (2004) affirmed that Monday anomaly vanish when "the returns of the final trading day of the previous week are positive" (Rossi, 2015: 290). Not all markets confirm the same deviations in the weekday effect. Jaffe and Westerfield (1985) study the daily returns of four equity markets. They discover that "lowest mean returns for the Japanese and Australian stock markets occur on Tuesday" (Jaffe and Westerfield, 1985: 433). Balaban (1995) detected a Tuesday effect in Turkey: "Empirical results verify that although day of the week effects are present in Istanbul Securities Exchange Composite Index (ISECI) return data for the period January 1988-August 1994, these effects change in direction and magnitude through time" (Balaban, 1995: 139).

2.3 Other Calendar Effects

Other types of calendar anomalies also have been examined by scholars. The effect linked to the turn-of-the-month (TOM), recognised by Ariel (1987) in the U.S. stock market, was followed by other studies: Pettengill and Jordan (1988), Lakonishok and Smidt (1988), Barone (1990), Agrawal and Tandon (1994), Hensel and Ziemba (1996), van der Sar (2003) and McConnell and Xu (2008). As noted by Rossi (2015: 291), other studies have examined the following CAs:

- The holiday effect (Lakonishok & Smidt, 1988), also analysed by; Pettengill (1989), Ariel (1990), Barone (1990), Cadsby and Ratner (1992) and Dodd and Gakhovich (2011);
- The religious calendar effect, studied by Almudhaf (2012), Barmak (2012) and Nasir et al. (2016).

This brief analysis indicates a significant amount of fragmentation in the literature. "There is no single, unified point of view on the relationship of the EMH to calendar effects." (Rossi, 2015: 292).

3. DATA AND METHODS

This study aims to verify the January and the weekdays effects in the following four European countries: France, Germany, Italy and Spain. Using the Yahoo finance webpage, we collected daily data on these countries' equity market indexes from 01/02/2001 to 12/31/2010. In this study, we use the model previous tested from Borges (2009). So, day-to-day returns are calculated as follows:

$$kn = \ln\left(\frac{Pn}{Pn} - 1\right)$$

In this formula *kn* is the day-to-day return of the equity exchange index and *Pn* is the equity index at time *n*.

So, all daily returns are calculated with an interval of one calendar day, except for the first day of the week: in this case we have a break of three calendar days. So, we have 2450 observations per country. In Table 1 there are descriptive statistics of the daily returns of the four stock markets.

Table 1. Descriptive Statistics for Daily Returns (2001-2010)

Country	Observations	Mean	Standard Deviation	Standard Error of Mean	MAX	MIN
France	2461	0.0001716	0.0132970	0.0002263	0.07007	-0.07683
Germany	2463	0.0002947	0.0144467	0.0002450	0.07264	-0.09432
Italy	2441	0.0001894	0.0123344	0.0002089	0.06834	-0.10639
Spain	2435	0.0003311	0.0128988	0.0002211	0.06324	-0.07343

Source: Author's calculations

We discover that the mean daily returns range from 0.017% for the French market to 0.033% for the Spanish market. In this period, Germany has the maximum daily returns (+7.26%), whereas the minimum daily returns occurred in Italy (-10.63%). The Italian context is characterised for the lower standard error of the mean (0.0002089), suggesting lower return volatility, and higher in Germany (0.0002450), a signal of relatively higher volatility.

This paper analyses the returns of stock exchanges, comparing the daily returns in specific periods. CAs could be analysed also by observing the returns of separate stocks of a specific country (French, 1980; Keim & Stambaugh, 1984; Rogalski, 1984; Basher & Sadorsky, 2006). Officer (1975) affirms: "Although the results indicate some evidence of a seasonal, it is shown that this is not prima facie evidence of market inefficiency. It is suggested that a more likely explanation is related to the structure of the economy, e.g., changing opportunity cost of money through the year" (Officer, 1975: 29).

For the stock exchange indexes, we accept the method usually adopted in the literature: we estimate five equations, each for a specific day. So, we've five different dummies, D_i (i= 1 to 5).

$$kn = a + \beta i D i n + \varepsilon n \quad (1)$$

In literature, the principal method for the stock exchange index is to estimate twelve different equations – from January to December – to detect the presence of a month effect. The approach is to consider twelve distinct dummies, M_i (i=1 to 12):

$$kn = a + \beta i M i n + \varepsilon n \quad (2)$$

This general model, can be used to analyse any CAs.

Several studies on this topic (French, 1980; Gibbons & Hess, 1981; Jaffe & Westerfield, 1985) use the OLS regression. Connolly (1989) notes, however, that problems may rise with this method. First, the stock exchange index returns are expected to be auto correlated; in addition, the residuals are possibly non-normal, and the variance of the residuals may be variable (Borges, 2009).

For this reason, Engle (1982) propose the use of AutoRegressive Conditional Heteroscedasticity (ARCH) models: This is a way to correct variability in the residuals variance. These models assume that the variance of the residuals (σ_t^2) is not constant over time and that the error term cannot be shown $\varepsilon t \approx iid(0, \sigma_t^2)$. The common form of the GARCH model is realised by Bollerslev (1986). "The variance of the residuals is expressed as the sum of a moving-average polynomial of order q on past residuals (the ARCH term) plus an autoregressive polynomial of order p, on past variances" (Borges, 2009: 13):

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} a_i \varepsilon_{t-i}^2 + \sum_{l=1}^{p} \lambda_i \sigma_{t-1}^2$$

Research aim is to detect calendar effects in two cases as follows:

  a. effects related to different month, and
  b. weekday effects.

4. DATA ANALYSIS

Using the previous discussed procedures, the analysis shows some important anomalies for all four stock exchange from 2001 to 2010 using Stata 14 software.

4.1 OLS Regression

The first step of my analysis was to compute specific OLS regressions for single country. To verify the presence of weekday effects we use model (1), and for the analysis of the month effects, we use model (2). The result was 20 regressions for the first effect analysed, and 48 regressions for the second effect. Assumed the non-normal distribution of the data, we use the OLS regressions calculated with robust standard errors (Table 2).

Table 2. Month Effects and Weekday effects (2001-2010): Differences in Mean Returns

	France	**Germany**	**Italy**	**Spain**
Month Effects				
1	0.0004749	0.0008359	0.0012871*	0.0018090***
2	-0.0003231	0.0012121*	-0.0001053	0.0008851*
3	0.0005054	-0.0001550	0.0005649	-0.0000444
4	0.0013473	0.0011499*	0.0009911	-0.0006599
5	-0.0009063	-0.0002721	-0.0013156*	-0.0011102*
6	-0.0002222	-0.0002557	-0.0008788	-0.0008025
7	-0.0005472	-0.0002311	-0.0001822	-0.0002298
8	-0.0012451	-0.0009988	-0.0009034	-0.0009151
9	-0.0019366**	-0.0014471**	-0.0012295*	-0.0012039**
10	0.0012451	-0.0009802*	-0.0001622	0.0008933
11	0.0011559	0.0004971	0.00142591*	0.0007722
12	0.0005599	0.0010654*	0.0007922	0.0006792
Weekday Effects				
1	-0.0001959	0.0003257	-0.0005972	-0.0003911
2	0.0001915	-0.0000226	0.0000211	-0.0000048
3	-0.0003856	-0.0005174	-0.0003291	0.0001423
4	0.0000643	0.0007959*	0.0002922	-0.0001875
5	0.0003369	-0.0005767	0.0006033	0.0004351

*Significance level: 0.1 **Significance level: 0.05 ***Significance level 0.01
Source: Author's calculations

Numerous previous studies on calendar effects can be considered totally the consequence of data mining (Sullivan et al., 2001). For this reason, Cooper, McConnell and Octchinnikov (2006) "perform a randomized-bootstrap procedure to test the statistical significance of the indicator variable in the monthly time-series regressions" (322).

Also in this analysis, the results could be susceptible to the criticism: "Many researchers go to great lengths in attempts to avoid this pitfall. Ultimately, however, it has been extremely difficult for a researcher to account for the effects the cumulated "collective knowledge" of the investment community may have had on a particular study. The methods used here provide a principled way to conduct research as a sequential process in which new studies build on evidence from earlier papers" (Sullivan et al, 2001: 283). So, in the weekdays effects, the overall results do not differ significantly from those we might expect to find in a casually sample. With regard to the effect related to a specific month, we've six important coefficients (at 1%), 9 (5%) and 14 (10%). These data are comparable to the number of significant coefficients we might suppose to discover with random data at 5% (8) and 10% (13). These results show a specific focus of the coefficients in specific part of the year and of a week. For these reasons, it will be possible further investigation.

As first consideration, January has higher returns; however, this finding is only significant at 5% in two countries (Italy and Spain). A second reflection, for the four countries, daily returns are higher in four months for different reasons and with different significant level: April, October, November and December. In this last case, daily returns are higher only in one country. Third, all markets have poorer returns than average in August and September. The stronger month effect is clearly shown in September. If there weren't effects related to the months, the probability that in any month excess returns are negative is 0.5. If we accept independence among the equity markets, the probability that all markets have negative excess returns in the same period is $0.5^{12} = 0.024\%$. In twelve months, the probability of obtaining this effect is: $0.024\% \times 12 = 0.288\%$. However, because these stock markets are connected with each other, simultaneous activities in all markets are expected to occur. So, there isn't a proof of a month effect. The possible explanation is linked to the behaviour of investors (postponing investment decisions) related to summer holidays.

Although the specific coefficients for daily excess returns are not significant, there is a decrease in Monday, Tuesday and Wednesday in three countries, whereas we have positive returns on Thursdays and Fridays.

4.2 GARCH Model

To check the strength of the previous results, bootstrapping can be realized to the OLS regressions, as Sullivan et al. (2001) propose. After performing a test of ARCH effects on the data, we confirm that this is present in the data for all four markets. So, we re-estimate all models using the GARCH (1,1) method. A lot of researches inferred that stock returns haven't a normal distribution and for that reason, we use - in this research - the Kruskal-Wallis test to verify whether the null hypothesis that all "clusters" come from the same population is valid. We choose to consider exclusively which weekday effects continue to be significant (at 5%) for every of the statistical methods applied (Table 3).

Table 3. Weekday Effects by market

Country	Higher Returns			Lower Returns			Kruskal – Wallis Test
	Regression	Bootstrap/ Regression	GARCH Model	Regression	Bootstrap/ Regression	GARCH Model	
France	-	Monday	-	-	-	-	0.9453
Germany	Tuesday[*]	Tuesday[*]	Tuesday[*]	-	-	-	0.1190
Italy	-	Tuesday	-	-	-	-	0.3033
Spain	-	-	-	-	-	-	0.2679

*Significance at the 0.05 level. **Significance at the 0.01 level.
Source: Author's calculations

Overall, the only country that indicates a stronger weekday effect is Germany, which shows high returns on Tuesdays. This result is consistent with the weekend effect widely previously recognised. But, the general results are: there isn't a weekend anomaly in the European stock markets.

As in the previous effect, we find no general month effects for all countries. Furthermore, the effects initially detected in certain countries (France and Italy) do not remain valid under more robust statistical methodologies (Table 4). Conversely, the stronger month effects include the following:

a. Germany has positive extra returns in February and negative returns in September;
b. Spain presents a positive excess returns in the January, and negative returns in May.

Table 4. Month Effects by Country

Country	Higher Returns			Lower Returns			Kruskal – Wallis Test
	Regression	Bootstrap/ Regression	GARCH Model	Regression	Bootstrap/ Regression	GARCH Model	
France	-	-	-	-	-	-	0.4079
Germany	-	Feb*/Apr*	Feb*	Sep*	Sep*	Sep**	0.0385*
Italy	-	Apr/Jul*	-	-	-	-	0.0844
Spain	Jan**	Jan**	Jan**	Sep*	May*	May*	0,0178*

*Significance level 0.05 **Significance level 0.01
Source: Author's calculations

The sample covers a period of ten years from 2001 to 2010. In addition, we examine whether the perceived CAs are constant during this period. This passage is important because the global results may be present in only a few of the years of the decade.

Furthermore, we compute regular window OLS regressions on the most significant coefficients detected in weekdays and monthly effects. We select four cases: (i) for positive day: Germany/Tuesday; (ii) for negative day: France/Monday; (iii) for positive month: Spain/January, and Italy/April; (iv) for negative month: Germany/September.

More specifically, in the German case, we verify that the coefficient comes positive in the 9th and 10th regression. In more than half the regressions, the upper bound on the 95% confidence interval is a positive return. In the Spanish case, the effect related to the first month appears to be linked primarily to the observations in the first years in the sample. Finally:

    a. In France, the Monday anomaly appears to be a recent phenomenon, and
    b. The April anomaly in Italy looks as a new effect.

These results confirm the high volatility of the CAs. For these reasons, in this stage there are strong doubts on the significance of the month and weekdays effects in the countries studied.

5. CONCLUSIONS

Numerous studies have documented on calendar anomalies principally in US stock markets. While international evidence of these effects continues to increase, studies have found mixed results. "The fragmentation of the literature on calendar anomalies has prevented the formulation of a general theory on this topic… there is no single, unified point of view on the relationship of the EMH to calendar effects" (Rossi, 2015: 293). Though progress has been made in understanding this theme, opportunities remain to improve the knowledge regarding the main motivations behind CAs. Furthermore, the heterogeneity of studies in CAs is linked to the topic investigated.

In this study, we apply a statistic method and we consider only those effects that are important under all different methods. The primary results include the following:

    a. There isn't a strong evidence of an extensive calendar effect in the four nations examined. In particular, these countries appear to be generally protected to the effects related to a specific day. The only effect that requires further studies is the propensity for minor returns in September. In general, all the effects are specific for each country;
    b. There is a similarity between number of significant coefficients that we detect and the number we would expect to discover randomly.

Although my analysis shows a concentration in a specific period, the results could be linked to a strong data mining. The confirmation is that we haven't calendar anomalies constant over time: sub-samples of the data show lower results. Thus, some calendar effects may haven't an economic basis, or they aren't linked to the market microstructure, but rather may be only a result of unpredictable movements in the four stock market considered.
For this reason, the study in the future could be addressed:

- to consider a significant number of countries (not only four);
- to consider different calendar effects (not only January and weekday effects) for each country; and
- to consider recent years (2005-2015).

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