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Seasonal Effects on the Bovespa Index

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ABSTRACT: The purpose of this paper is to investigate three anomalies in the São Paulo Stock Exchange (BOVESPA) index: the day-of-the-week effect, the twist on the Monday effect and the holiday effect. The period from Jan/1995 to Dec/2007 is analyzed, with subperiods established according to presidential terms. The paper addresses the theories on market efficiency and on the seasonal effects analyzed. Statistics indicate that the anomalies were not consistently present during the periods studied.

Keywords: anomalies, seasonality, day-of-the-week effect, twist on the Monday effect, holiday effect, efficient market.

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1. INTRODUCTION

Since 1970 there have been a host of studies about anomalies that occur with regards to financial market returns on stocks. These studies were inspired by observations that stocks do not fluctuate arbitrarily, following a random walk. The market efficiency theory, which economic theorists have studied at length, explains this behavior.

The anomalies are called calendar anomalies, or the calendar effect, due to their occurrence at specific times of the month or year. One example is the holiday effect, where stock returns rise significantly before holidays. These studies were at their height during the 1970s and 1980s, when many calendar effects arose. In the 1990s a number of studies asked whether these effects still occurred, many showing that they were no longer significant. Dubois and Louvet (1996) showed that the weekend effect is no longer significant in the United States in the period most recently studied by the authors. Some of these studies led to renewed arguments that the markets tended to return to their efficiency, as many who had begun practicing arbitrage on these anomalies saw their premiums waning.

The objective of this study is to give an overview of the key anomalies studied since the 1970s for IBOVESPA assets. The anomalies are: the day-of-the-week effect, the holiday effect and the twist on the Monday effect.

The study on the holiday effect was based on the article by Lakonishok and Smidt (1988) in which they studied market anomalies of the Dow Jones Industrial Average index in a ninety-year sample, from 1897 to 1986.

The study on the day-of-the-week effect was based on the article by Smidt and Lakonishok (1988) and the article by Costa Jr. (1990), who studied this anomaly on the BOVESPA index in the period from 1969 to 1988.

The study on the twist on the Monday effect was based on the article by Madureira (1998), which studied the anomaly between 1986 and 1998 on the BOVESPA index and for two simulated portfolios. For the sake of comparison, only the BOVESPA sample has been used.

The test for determining the hypothesis of normality was the Jarque Bera test. The tests for identifying the effect's significance were: ANOVA F, Student's t and Kruskal-Wallis.

2. LITERATURE REVIEW

According to Dimson and Mussavian (1998), market efficiency describes a market in which the prices of financial assets reflect material information. In an efficient market there would be no room for arbitrage, meaning no room for abnormal gains on the stock market.

We can divide market efficiency into three types: weak, semi-strong and strong.

In an efficient market, investors cannot base strategies on past price fluctuations, as they do when using quantitative studies and charts to make asset buying decisions. In this case investors would make less profit than those who simply buy and hold assets.

In the 1970s, especially in the United States, studies about market anomalies began. Below we review some of the main studies conducted since the 1970s.

2.1 Market Anomalies

Empirical studies have shown that markets are not efficient, and for this reason asset prices become distorted. These distortions may be called market anomalies. Below is a review of the three anomalies studied in this paper.

2.1.1 Day-Of-The-Week Effect

"The day-of-the-week effect refers to the fact that daily returns on risk assets vary according to the day of the week." (Costa Jr., 1990). Empirical studies have suggested two hypotheses for the day-of-the-week effect. The first is that return rates on Monday tend to be significantly negative; and the second theory is that returns on the last day of the week tend to be high.

Agrawal and Tandom (1994) studied the day-of-the-week effect in eighteen countries. The Monday effect occurred in some of the countries, while Friday's returns were high in the majority of them.

In his study on the predictability of returns on the Brazilian market, Aguiar (2006) identified the Monday effect in the period from July 1, 1994 to June 30, 2005.

Costa Jr. (1990) conducted a study from 1986 to 1989 and registered the weekend effect on the IBOVESPA. The weekend effect says that Monday's returns are significantly negative and Friday's returns are significantly positive. Thaler (1987) suggests a behavioral explanation for this anomaly: investors are in a good mood on Friday and a bad mood on Monday.

In the total period of the Lakonishok and Smidt (1988) study, from 1897 to 1986, the weekend effect was present, with a 5% level of significance both for Monday's returns and Friday's returns. An analysis of the subperiods shows the Monday effect in seven of the nine subperiods studied and the Friday effect in six of the nine subperiods.

2.1.2 Twist On The Monday Effect

This anomaly has been the subject of fewer studies than other anomalies. It holds that Monday's negative returns only occur when the market's stocks fell the previous week. Studies conducted by Jaffe et al. (1989), Leal and Sandoval (1994) and Aggarwal and Leal (1996) say that when there is a week of higher than average returns, the following Monday will have higher than average returns as well.

Madureira (1998), in his study of the twist on the Monday effect, analyzed the period from 1986 to 1998. For the IBOVESPA, he found that Mondays following weeks with negative returns have significantly negative returns at a level of significance of 1%. This analysis also considered the 1986-1989, 1990-1993 and 1994-1998 subperiods. The anomaly occurred in the first subperiod with a level of significance of 1%; it also occurred in the second subperiod, but with a level of significance well below 9.7%; in the third subperiod the anomaly disappeared altogether with a level of significance of 32.8%.

2.1.3 Holiday Effect

The holiday effect holds that significantly positive returns will precede holidays. Holiday is defined as a day when trading would normally take place, but does not.

Lakonishok and Smidt (1988) identified the holiday effect in their study of the DJI from 1897 to 1986 with a significance of 1%. The effect occurred in all but two periods: 1911-1924 and 1976-1986. In the period 1964-1975, the level of significance was 5%. For the other six subperiods the level of significance was 1%.

Ariel (1990) studied the period from 1963 to 1982, with 160 days preceding holidays. The period did present positive returns on the days preceding holidays. The study's author also divided the period in half; the anomaly was still statistically significant in the two subperiods. He also analyzed the intraday effect on the days preceding holidays, showing returns rise significantly during the final hours of trading as compared to the rest of the day.

Meneu and Pardo (2004) conducted a study with the key stocks on the Spanish market in the period from 1990 to 2000, identifying the presence of the holiday effect for these main stocks.

3 METHODOLOGY

3.1 Statistical Tests And Hypotheses

The Jarque Bera test is used to analyze the hypothesis of normality of the sample's returns. For the hypothesis of normality, the skewness and kurtosis coefficients should be 0 and 3, respectively. Jarque Bera statistic is calculated as follows:

$$JB = T\left[\frac{S^2}{6} + \frac{(k-3)^2}{24}\right]_{\alpha} \approx \chi^2$$

We reject the hypothesis of normality of the returns if $JB > \chi^2_{\alpha,2}$, where $\chi^2_{\alpha,2}$ is the quantile of level 1-α of the distribution χ^2 with two degrees of freedom.

Independent of the normality test, we used parametric and non-parametric tests, the same criterion adopted by Costa Jr. (1990).

The first parametric test used was the ANOVA F, which compares the sample's averages. A high F means that one of the averages is different from the others. To identify which average is different, if it is different, the Student's t-test is used; this test shows which average is significantly different from zero.

The non-parametric test used is the Kruskal Wallis test, which is based on the ranking of each observation to test whether two or more of the samples belong to the same group. "The Kruskal Wallis test rejects the null hypothesis that all the groups have the same distribution when H is large." (MOORE, 2005, p.252).

3.2 Regressions Used

For each anomaly, one or more hypothesis tests were created to test the significance of the variables to be studied. Levels of significance of 1%, 5% and 10% were used to validate the study.

3.2.1 Day-Of-The-Week Effect

To test the day-of-the-week effect anomaly, a multiple regression was made, using the following formula:

$$R_t = a_1 D_{1t} + a_2 D_{2t} + a_3 D_{3t} + a_4 D_{4t} + a_5 D_{5t} + e_t$$

Where, R_t is the daily return of the index on day t, D_{it} is the dummy variable that indicates the day of the week, a_i is the average projected return for the day of the week and e_t is the random error.

3.2.2 Twist Of The Monday Effect

The multiple regression to be studied in this anomaly is demonstrated below:

$$R_{Seg} = \alpha_t + \beta_t D_t + e_t$$

Where, R_{Seg} is the daily return of the index on Monday, α_t is the model constant, referring to the Monday return when the preceding week's return is negative, D_t is the dummy variable that indicates when the Monday return is positive after a week of positive returns, β_t is the regression coefficient that measures when the Monday return is positive after a positive week and e_t is the random error.

3.2.3 Holiday Effect

For the holiday effect the returns are divided into three types: before the holiday, after the holiday and normal days (other days). The regression of this anomaly is very similar to that of the day-of-the-week effect, as seen below:

$$R_t = a_1 D_{1t} + a_2 D_{2t} + a_3 D_{3t} + e_t$$

Where, R_t is the daily return of the index on day t, a_I is the regression coefficient of the returns on date i, D_{it} is the dummy variable for the returns on date i and e_t is the random error.

3.3 Profile Of The Sample

The database was taken from the Economática database, whose BOVESPA code is IBOV. The sample contains the daily returns at closing of the BOVESPA index, deflated by the General Price Index, in the period from 01/1995 to 12/2007. The sample is also divided into three subperiods: 01/1995 – 12/1998, 01/1999 – 12/2002, 01/2003 – 12/2007. These subperiods were divided according to presidential terms, the latter having all the years of the Lula administration.

Calculation of daily returns assumed that stock prices followed the multiplicative random walk model. Daily returns were therefore calculated as follows:

$$R_t = Ln(IBOV_t / IBOV_{t-1})$$

Where, R_t is the IBOVESPA returns on date t, $IBOV_t$ is the IBOVESPA closing price on date t and $IBOV_{t-1}$ is the IBOVESPA closing price on date t-1

4. RESULT

Consistent with the results of Aguiar's study (2006), the daily returns of the sample studied do not exhibit the normal profile identified by the Jarque Bera test.

4.1 Day-Of-The-Week Effect

Table 2 shows that in the complete period there were abnormal returns on Monday, Wednesday and Friday with levels of significance of 10%, 5% and 5%, respectively. In the subperiods, we were unable to identify the anomaly, as in one of the tests, ANOVA F or Kruskal-Wallis, there was no significance.

Table 1 – Result of the Day-of-the-week Effect

		Mon.	Tue.	Wed.	Thu.	Fri.
1995-2007	n	642	644	654	635	641
	Average	-0.1474%	0.1284%	0.1684%	-0.1439%	0.2514%
	Statistic T	-1.66*	1.40	2.04**	-1.41	2.55**
	Statistic F			**3.98*** **		
	Kruskal-Wallis			**10.60** **		
1995-1998	n	198	202	199	190	199
	Average	-0.2575%	0.4507%	-0.0106%	-0.4279%	0.2509%
	Statistic T	-1.33	2.07**	-0.05	-1.68*	1.12
	Statistic F			**2.76** **		
	Kruskal-Wallis			**6.84**		
1999-2002	n	197	195	204	198	195
	Average	-0.2017%	-0.2277%	0.2609%	0.0186%	0.2278%
	Statistic T	-1.19	-1.53	1.84*	0.11	1.13
	Statistic F			**1.92**		
	Kruskal-Wallis			**9.58** **		
2003-2007	n	247	247	251	247	247
	Average	-0.0158%	0.1461%	0.2352%	-0.0556%	0.2706%
	Statistic T	-0.15	1.37	2.26**	-0.50	2.94***
	Statistic F			**2.00***		
	Kruskal-Wallis			**6.29**		

*Level of significance: *=10%, **=5%, ***=1%*

4.2 Twist On The Monday Effect

The Table below shows abnormal negative returns in the complete period for Mondays following negative weeks with a level of significance of 5%. For the subperiod from 1995 to 1998 the same anomaly occurred, but with a level of significance of 10%. For the other subperiods there were no abnormal returns.

Table 2 – Result of the Twist on the Monday Effect

		Mon. After a Negative Week	Mon. After a Positive Week
1995-2007	n	281	361
	Average	-0.4043%	0.0526%
	Statistic T	-2.55**	0.54
	Statistic F	**6.59****	
	Kruskal-Wallis	**5.07****	
1995-1998	n	92	106
	Average	-0.6045%	0.0436%
	Statistic T	-1.69*	0.23
	Statistic F	**2.83***	
	Kruskal-Wallis	**2.84***	
1999-2002	n	96	101
	Average	-0.4519%	0.0362%
	Statistic T	-1.75*	0.16
	Statistic F	**2.08**	
	Kruskal-Wallis	**1.88**	
2003-2007	n	93	154
	Average	-0.1571%	0.0696%
	Statistic T	-0.84	0.55
	Statistic F	**1.10**	
	Kruskal-Wallis	**0.29**	

*Level of significance: *=10%, **=5%, ***=1%*

3.4 Holiday Effect

As seen below, the holiday effect did not occur in any of the samples studied in this article.

Table 3 – Result of the Holiday Effect

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		Before the Holiday	After the Holiday	Normal Days
1995-2007	n	116	109	576
	Average	0.2026%	0.1818%	0.1052%
	Statistic T	1.15		0.52
	Statistic F		**0.03**	
	Kruskal-Wallis		**1.32**	
1995-1998	n	29	31	184
	Average	0.2216%	0.2758%	-0.1186%
	Statistic T	0.43	0.66	-0.26
	Statistic F		**0.10**	
	Kruskal-Wallis		**0.05**	
1999-2002	n	39	36	174
	Average	0.2583%	0.0888%	-0.1068%
	Statistic T	1.07	0.20	-0.29
	Statistic F		**0.14**	
	Kruskal-Wallis			
2003-2007	n	48	43	218
	Average	0.1458%	0.0959%	0.4634%
	Statistic T	0.64	0.37	1.93*
	Statistic F		**0.39**	
	Kruskal-Wallis		**4.06**	

*Level of significance: *=10%, **=5%, ***=1%*

4 CONCLUSION

As the results show, the IBOVESPA returns do not exhibit normality, which is already a well known fact. The day-of-the-week effect was not identified consistently, but rather only in the complete period.

As did the Madureira article (1998), we can affirm that the twist on the Monday effect has not occurred recently: It only occurred in the complete sample and in the first subperiod of the sample.

The holiday effect was not identified in any period of the sample, in contrast to the results of some of the studies on the American market. Therefore we can say that this anomaly does not occur on the Brazilian market. In the most recent period, from 2002 to 2006, none of the anomalies studied in the article occurred.

Analyzing the anomalies as a whole, we could say that the Brazilian market does not consistently present the anomalies studied. In the most recent period, from 2002 to 2006, none of the anomalies studied in the article occurred.

As the results indicate, especially for the day-of-the-week effect, the Kruskal Wallis statistical test does not allow us to say that any anomaly occurred in any subperiod. This non-parametric test is extremely important, since it does not consider whether the sample is normal or not.

More detailed studies could help us to understand why these anomalies do not occur on our market, assuming, for example, that Brazil has been stable for less time than the American market.

The day-of-the-week effect is the most commonly studied in the academic world. I think that the next studies should consider back testing with the BOVESPA futures index using stop gains and stop losses.

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