

DAY OF THE WEEK EFFECT AND STOCK RETURNS: EVIDENCE FROM IBOVESPA

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Day of the week effect study is focused as a stock market anomaly on the equity market practices in Brazil. The modus-operandi applicable in this research consists of daily stock prices concerned to Ibovespa Index, for the period January 1994 to December 2011. The working week for trade matters consist of five days. Study concludes that Friday returns are quite significant and positive. Hence it is inferred that there exists day effect in Brazilian stock market. The returns of Friday on an average are greater in comparison to rest of the days. The day-of-the-week effect happens because does not exist perfect markets.

Key words: Stock Returns, Ibovespa, Day of the Week Effect.

Efeito Dia da Semana e Retornos das Ações: Evidência do Ibovespa

O objetivo do presente estudo é encontrar uma possível anomalia no mercado de ações brasileiro conhecido como Efeito Dia da Semana. Para tanto, nesta pesquisa, utiliza-se preços diários das ações do Ibovespa para o período de janeiro de 1994 até dezembro de 2011. De acordo com os resultados encontrados ao longo deste estudo, infere-se que existe o Efeito Dia da Semana no mercado acionário brasileiro, com retornos positivos e significativos nas sextas-feiras que, em média, são maiores quando comparados aos outros dias da semana. Uma hipótese para esta anomalia é a inexistência de mercado perfeito.

Palavras-chave: Retornos de Ações, Ibovespa, Efeito Dia da Semana.

1. INTRODUCTION

Behavioral finance is the paradigm where financial markets are studied using models that are less narrow than those based on Von Neumann-Morgenstern expected utility theory and arbitrage assumptions. There is a huge psychology literature documenting that people make systematic errors in the way that they think: they are overconfident, they put too much weight on recent experience, etc. Their preferences may also create distortions. Behavioral finance uses this body of knowledge, rather than taking the arrogant approach that it should be ignored. Limits to arbitrage refers to predicting in what circumstances arbitrage forces will be effective, and when they won't be. Behavioral finance uses models in which some agents are not fully rational, either because of preferences or because of mistaken beliefs. Mistaken beliefs arise because people are bad Bayesians. Modern finance has as a building block the Efficient Markets Hypothesis (EMH). The EMH does not assume that all investors are rational, but it does assume that markets are rational. The EMH does not assume that markets can foresee the future, but it does assume that markets make unbiased forecasts of the future. In contrast, behavioral finance assumes that, in some circumstances, financial markets are informationally inefficient (RITTER, 2003).

Calendar anomalies weekend effect, day of the week effect, Month effect in stock market has been widely elucidated in finance literature. The day of the week effect is a phenomenon that develops a form of anomaly of the efficient market theory. This phenomenon explains that average daily returns at different days but we consider same under the efficient market theory. A lot of researchers conducted this research on the day of the week effect on time series data. It is very important for an investor to understand the working of capital markets. The relationship between information and share prices is explained by the market efficiency. So by the day of week effect, the investor will consider the mean of return for different days. But when for and investor, it is necessary to consider return only. In a decision making process, a relational financial decision maker must take into account not only returns but also the variance and volatility of returns. It is very important to identify the return and rise relationship (HUSSAIN; HAMID; AKASH; KHAN, 2011).

The purpose of this study is to elucidate daily stock market anomalies in the Brazilian stock market using its stock index, Ibovespa. We examined daily stock market returns from January 1st 1994 to December 31 2011.

2. DAY-OF-THE-WEEK EFFECTS

One of the basic theoretical propositions motivating the Tobin's model is that the market valuation of equities, relative to the replacement cost of the physical assets they represent, is the major determinant of new investment. Investment is stimulated when capital is valued more highly in the market than it costs to produce it, and discouraged when its valuation is less than its replacement cost (TOBIN; BRAINARD, 1968). With the aid of some simplifying assumptions, the capital asset pricing model comes to dramatic conclusions about practical matters, such as how to choose an investment portfolio and how to value financial assets (MARKOWITZ, 2005).

In economics, a perfect market is defined by several conditions. Among these conditions are: Perfect market information, no participant with market power to set prices, no intervention by governments, No barriers to entry or exit, equal access to factors of production, profit maximization, and no externalities. However the markets are not efficient as suggested by Markowitz (1952), Tobin (1952) Sharpe (1964) in their studies.

Some evidence unfavorable to the efficient market hypothesis are also classified according to Fama and French (1992): calendar anomalies or seasonal (January effect, effect change month, day of the week effect, Monday effect); anomalies or fundamental value (over-reaction effect, effect size, effect price / earnings), and technical anomalies (identified by the use of technical analysis or graphical).

The capital market plays a vital role in the allocation of economic resources into production activities of the economy, which are possible only if the securities traded in the market are priced appropriately. The efficient market hypothesis is related to random walk theory. The idea that asset prices may follow a random walk pattern was introduced by Bachelier (1900). The random walk hypothesis is used to explain the successive price changes which are independent to each other. Capital market efficiency is that where stock prices fully reflect all available information (HUSSAIN; HAMID; AKASH; KHAN, 2011).

According to Fama (1970), an efficient market is that in which current prices reflect all available information. This implies that, whatever expected return model is used, the information available at that moment is fully utilized in the determination of equilibrium returns. A market in which (a) there are no transactions costs, (b) all agents have costless access to complete information, and (c) all agents agree as to the implications of such information for the prices of all assets, is certainly an efficient market.

Return predictability and excess volatility are market-observed anomalies that challenge the market efficiency hypothesis. A possible explanation for such phenomena involves a learning process by investors. Even though investors are rational, they do not know the true distribution of future dividends and improve their parameter estimates over time (SANVICENTE, DELGADO, 2010).

Amélie (2010) proposes to evaluate whether asymmetry influences the day-of-the-week effects on volatility. We also investigate empirically the impact of the day-of-the-week effect in major international stock markets using GARCH family models from a forecast framework. Indeed the existence of calendar effects might be interesting only if their incorporation in a model results in better volatility forecasts.

Borges (2009) examines day of the week and month of the year effects in seventeen European stock market indexes in the period 1994-2007. We discuss the shortcomings of model specifications and tests used in previous work, and propose a simpler specification, usable for detecting all types of calendar effects. Recognizing that returns are non-normally distributed, autocorrelated and that the residuals of linear regressions are variant over time, we use statically robust estimation methodologies, including bootstrapping and GARCH modeling. Although returns tend to be lower in the months of August and September, we do not find strong evidence of across-the-board calendar effects, as the most favorable evidence is only country-specific. Additionally, using rolling windows regressions, we find that the stronger country specific calendar effects are not stable over the whole sample period, casting

additional doubt on the economic significance of calendar effects. We conclude that our results are not immune to the critique that calendar effects may only be a “chimera” delivered by intensive data mining.

Eleftherios (2009) examines the calendar anomalies/effects in 55 Stock market Exchange indices of 51 countries around the world. The calendar effects which are examined are the turn-of-the-Month effect, the day-of-the-Week effect, the Month-of the-Year effect and the semi-Month effect. The methodology which is followed is the test hypothesis of two unequal data samples with bootstrapping simulated t-statistics. Simultaneously, with the same procedure a seasonality test is applied in order to investigate if more frequent seasonality on expected returns or in volatility is presented. The conclusion is that we reject all calendar effects in a global level, except from the turn-of-the-Month effect, which is present in 36 stock indices and that there is higher seasonality in volatility rather on expected returns, concerning the day of the week and the month of the year effects. The main purpose of the paper is to present a methodology appropriate for data mining which rejects the existence and persistence of main calendar anomalies as the Monday and January effects, while previous methodologies accept them. So this paper presents an alternative approach in the estimation of calendar anomalies and data mining, as well gives some guide notes for financial strategy.

According to Kyrtsov, Leontitsis and Siriopoulos (2006) several recently developed chaotic forecasting methods give better results than the random walk forecasts. However they do not take into account specific regularities of stock returns reported in empirical finance literature, such as the calendar effects. In this paper, we present a method for filtering the day-of-the-week and the Holiday effect in a time series. Our main objective is twofold. On the one hand we study how the underlying dynamics of the Nasdaq Composite, and TSE 300 Composite returns series can be influenced by the presence of calendar effects. On the other hand we adapt our method to chaotic forecasting. Its computational advantages lead to significant improvements of forecasts.

According to Leontitsis and Siriopoulos (2006) a method is presented that takes into account the day-of-the-week and the turn-of-themonth effect and the holiday effect and embodies them to neural network forecasting. It adjusts the time series in order to make its dynamics less distorted. After a predicted value is calculated by the network, the inverse adjustment is made to obtain the final predicted value. If there are no calendar effects on the time series this method has approximately the same performance as its classic counterpart. Empirical results are presented, based on NASDAQ Composite, and TSE 300 Composite indices using daily returns from 1984 to 2003.

Lenkkeri, Marquering and Strunkmann-Meister (2006) propose this study extends research on the day-of-the-week effect towards European real estate indices. We examine this anomaly for several European securitized real estate index returns between 1990 and 2003. Although the countries under analysis have unique country-specific patterns, we find that eight out of eleven European countries exhibit abnormally high Friday returns. Moreover, two different Europe indices also exhibit the Friday anomaly. The anomaly is robust with respect to extreme observations, alternative specifications and several well-known calendar effects.

Tonchev and Kim (2004) uses a new data set from three Eastern European countries (Czech Republic, Slovakia and Slovenia) to investigate whether the so-called calendar effects are present in the newly

developing financial markets in those countries. Five calendar effects are examined in both mean by OLS regression and variance by GARCH; the day of the week effect, the January effect, the half-month effect, the turn of the month effect and the holiday effect. In the empirical analysis, very weak evidence has been found for the calendar effects in the three countries, and these effects, where they exist, have different characteristics in the different stock markets.

According to Sullivan, Timmermann and White (1998) economics is primarily a non-experimental science. Typically, we cannot generate new data sets on which to test hypotheses independently of the data that may have led to a particular theory. The common practice of using the same data set to formulate and test hypotheses introduces data-snooping biases that, if not accounted for, invalidate the assumptions underlying classical statistical inference. A striking example of a data-driven discovery is the presence of calendar effects in stock returns. There appears to be very substantial evidence of systematic abnormal stock returns related to the day of the week, the week of the month, the month of the year, the turn of the month, holidays, and so forth. However, this evidence has largely been considered without accounting for the intensive search preceding it. In this paper we use 100 years of daily data and a new bootstrap procedure that allows us to explicitly measure the distortions in statistical inference induced by data-snooping. We find that although nominal P-values of individual calendar rules are extremely significant, once evaluated in the context of the full universe from which such rules were drawn, calendar effects no longer remain significant.

Johnston, Kracaw and McConnell (1991) provide a comprehensive study of weekly seasonal effects in GNMA, Tbond, T-note, and T-bill futures returns. Two distinct patterns are found in returns on GNMA, T-bond, and T-note contracts, while no seasonals are noted for T-bill futures. A negative Monday seasonal is found for GNMA and T-bond contracts. A positive Tuesday seasonal is found on GNMA, T-bond, and T-note contracts. Our evidence indicates that the significance of weekly seasonals depends in an important way on the time period studied. The negative Monday phenomenon occurs only in the data before 1982, while the positive Tuesday effect is present only after 1984. In addition, we find that both seasonal phenomena occur only during months prior to a delivery month. This effect appears to be related to the calendar month. More specifically, the Monday effect is apparently concentrated during February, while the Tuesday effect is concentrated during May.

Investors that are interested in including international markets in their portfolio need to know if these markets are integrated or not. We pursued the answer to this question by studying possible seasonality in international markets. Our analysis focused on an empirical comparison of the day of the week effect in the major European markets from July 1977 to March 2004, and included not only returns but volatility as well. To begin with, we should note that most European markets do not reflect a day of the week effect since the results for each day do not differ significantly from the other days of the week. The returns in these markets are based on representative indexes and reveal independence concerning which day of the week the return is calculated on. Nevertheless a seasonal effect can be observed on Mondays for the French and Swedish markets. The Swedish markets also reflects a significantly higher return on Fridays as opposed to the remaining days of the week. With respect to the existence of abnormal volatility in the equation of conditional variance in the European markets, the following can be observed.

A day of the week effect is present in all of the financial markets except in Portugal and the Czech Republic, where a symmetric model is applied. Exceptions are found in France and the Czech Republic, using an asymmetric T-ARCH model. Nevertheless, this effect does not agree with other analysed financial markets. However if we introduce a parameter which accounts for different behaviour in the volatility of the stock market indexes, then continuity in the day of the week effect becomes evident, differentiating the rise and fall of prices. Its presence is unlike that of the GARCH model because the statistical significance of the day of the week in the symmetric model in some cases could have been affected by asymmetric effects that were considered in the structure of the variance in the model (APOLINARIO; SANTANA; SALES; CARO, 2006).

During the period 1997 to 2004, ten of the indexes recorded positive growth while five lost value. Although positive annual index closing price changes were the norm between 1997 and 2004, many of the European indexes experienced negative changes especially in 1998 and 2002. It is important to note that between 1999 and 2000, the Russian MTM and the Turkish XU, 100 achieved astronomical growth. There was presence of the day of the week effect during the period 1997-2004. Seven of the European Financial markets experienced negative returns on Monday and seven others also experience negative returns on Wednesday. The occurrence of the highest daily return is almost evenly spread across Monday, Thursday and Friday. The lowest return was generally experienced on Monday and Wednesday. There was generally high volatility of returns in the European markets. The returns were generally skewed to the left. The daily returns exhibited greatest volatility on Monday for eleven of the markets. Even though the markets of Russia, Turkey and Spain markets showed the highest standard deviations the markets that displayed the highest coefficients of variation are those of Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Switzerland and Turkey. The generally low returns for these countries except in the case of Turkey may be partially responsible for this observation. The results of the Levene's (1960) test of the equality of standard deviations of the returns at the 5 percent confidence level could not reject the Null Hypothesis that mean returns are equal across the days of the week for all the markets except for MBTEL, Italy (CHUKWUOGOR-NDU, 2006).

3. DATA AND METHODOLOGY

The data used the software Economática in this paper consist of daily using values for the major Brazilian stock market index, Ibovespa, from January 1994 to December 2011. During this period trading is conducting Monday to Friday. The daily returns R_t computed from Ibovespa Index as follows.

$$R_t = \ln \left(\frac{I}{I_{t-1}} \right) \times 100$$

Where R_t is the daily percentage return on Ibovespa Index on day t . I and I_{t-1} are closing values of the day respectively. To investigate the day of the week investigate the day of the week effect we estimate the following regression equation.

4. EMPIRICAL RESULTS

We conducted study to investigate the day of week effect in Bovespa stock exchange. We calculate daily market returns for each day of week, by using Ibovespa index daily data.

Table1 - Summery Statistics

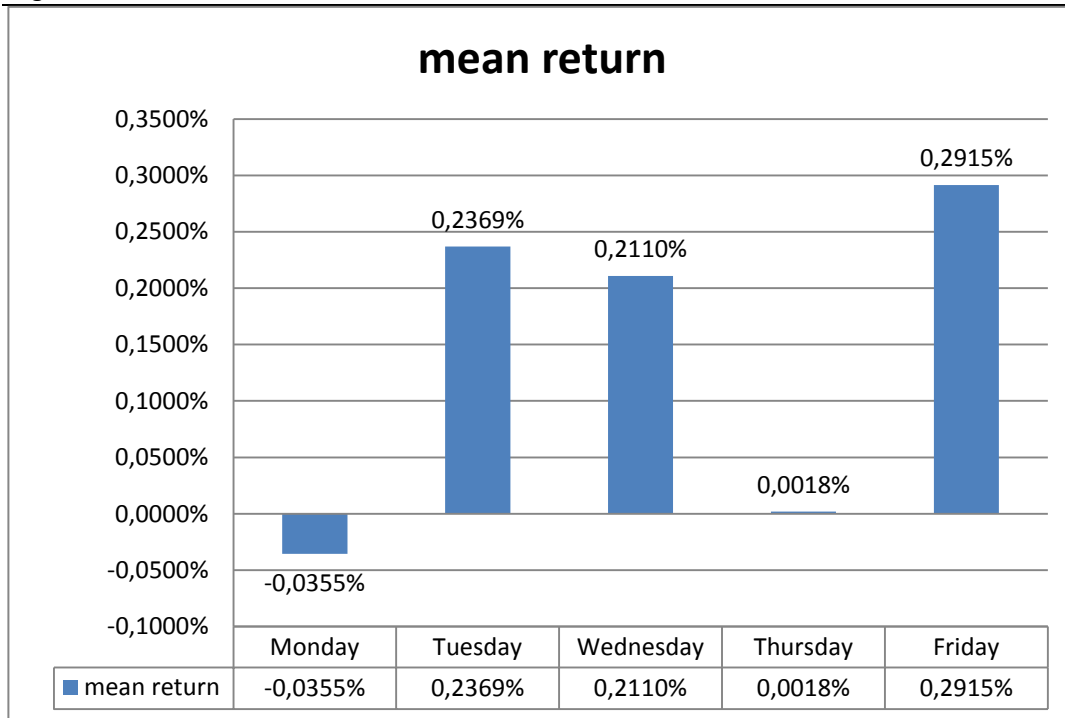
	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	-0,0355%	0,2369%	0,2110%	0,0018%	0,2915%
Median	0,0276%	0,2314%	0,1578%	0,1140%	0,2494%
Minimum	-14,9762%	-9,8627%	-11,3931%	-15,8267%	-9,2324%
Maximum	14,6592%	18,6834%	10,9925%	12,1447%	33,3992%
Standard deviation	0,0251	0,0244	0,0227	0,0256	0,0254

By descriptive statistics we note that mean return of the Friday is higher than the rest of the week. The mean return on Tuesday is 0,2915%, which is higher than the other days of week. The return on Tuesday and Wednesday is highest than Monday and Thursday. The higher mean return shows that there is Friday effect in Bovespa Stock exchange. The lowest return was experienced on Monday.

The return more common on Monday is 0,0276%, on Tuesday is 0,2314%, on Wednesday is 0,1578%, on Thursday is 0,1140% and Friday is 0,2494%.

The standard deviation is similar on the days of the week.

Figure 1 – Mean Return



Empirical results of this study indicate that there is a significant Friday, Tuesday and Wednesday effect in Brazilian Stock market during a week. On Friday there is high return. Returns on Thursday are more volatile over other days.

The independent samples t-test compares the difference in the mean

A t-test is any statistical hypothesis test in which the test statistic follows a Student's t distribution if the null hypothesis is supported. It can be used to determine if two sets of data are significantly different from each other, and is most commonly applied when the test statistic would follow a normal distribution if the value of a scaling term in the test statistic were known.

H_0 = Difference in average between Tuesday, Wednesday and Friday to another days.

Defining the acceptance region of H_0 , according to the type of test and variable.

$$T_{n-1;critic} = t_{6-1;0,01} = t_{5;0,01} = 2,132$$

For the set under consideration we have

Table 2 - Mean values

	Monday	Monday	Monday	Thursday	Thursday	Thursday
	-0,0003550	-0,0003550	-0,0003550	0,0000180	0,0000180	0,0000180
	Tuesday	Wednesday	Friday	Tuesday	Wednesday	Friday
	0,0023690	0,0021100	0,0029150	0,0023690	0,0021100	0,0029150

di	0,0027240	0,0024650	0,0032700	0,0023510	0,0020920	0,0028970
di2	0,0000074	0,0000061	0,0000107	0,0000055	0,0000044	0,0000084

Calculate the value of the test variable:

$$d = \sum d_j / n = 0,002633$$

$$s_d = \sqrt{\frac{\sum d_i^2 - [(\sum d_i)^2 / n]}{n-1}} = 0,000420517$$

$$t_{n-1} = \frac{\bar{d}}{(s_d / \sqrt{n})} = 37,57037472$$

Decide for acceptance or rejection of H0

$$T5 > t5;0,99$$

$$37,57 > 2,132$$

Thus, we conclude with 99% confidence (or a chance of 1% error) that there are differences between the means, ie, exist the day of week effect.

5. CONCLUSION

We examined daily returns for Ibovespa index from the period 1994-2011. The study launched to investigate the day of week effect in Brazilian Stock market. In Brazilian Stock Market trading occurs five days a week.

The Efficient Market Hypothesis explains that there are constant market returns for whole week. Empirical results of this study indicate that there is a significant Friday, Tuesday and Wednesday effect in Brazilian Stock market during a week. On Friday there is high return. Returns on Thursday are more volatile over other days.

According to Chukwuogor-Ndu (2006) the occurrence of the highest daily return is almost evenly spread across Thursday and Friday. The lowest return was generally experienced on Monday and Wednesday. The occurrence, in Brazilian Stock Market, of the highest daily return is on Friday and Tuesday. The lowest return was experienced on Monday. The results are similar, but different.

According to Hussain et al (2011) empirical results of this study indicate that there is a significant Tuesday effect in Pakistani Stock market during a week. On Tuesday there is high return but on the

other days of the week explains constant returns. Returns on Tuesday are more volatile over other days. The occurrence, in Brazilian Stock Market, of the highest daily return is on Friday. Despite the existence of the day-of-the-week effect, the day of the highest return are different in the two markets.

The day-of-the-week effect happen because do not exist perfect market. In economics, a perfect market is defined by several condition. Among these conditions are: Perfect market information, no participant with market power to set prices, no intervention by governments, No barriers to entry or exit, equal access to factors of production, profit maximization, and no externalities. True perfect competition can exist only under a set of conditions that are not possible in the real world, and so no real perfect markets exist. The concept is used in economics, not to describe any state of affairs in the real world, but as a construct to simplify thought experiments about how economies work and provide a benchmark to which real world markets can be compared.

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