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THE WEEKEND EFFECT ON THE INDEX RETURNS OF 15 STOCK EXCHANGES AROUND THE WORLD

Abstract: This study examines the weekend effect on the returns of 15 stock exchange indexes around the world. Empirical tests were performed on the daily returns of stock market indexes from the sample countries over the period from January 2010 to May 2015. The results conclude that the weekend effect no longer exists in the USA. In addition, the weekend effect has disappeared in European Union member countries (France, and Germany) and the UK. The effect has also disappeared in almost every country studied in Latin America except Venezuela and Chile, where it persists. This study contributes to elucidating the effect of weekends and time differences when negotiating on stock markets. The results help comprehend the potential relationship between stock exchange index returns around the world and the location of the market. This work provides useful insights for investors making decisions, scholars, and policy makers.

Keywords: weekend effect, stock market, EU, US, Latin America

WPŁYW WEEKENDU NA ZWROTY Z INDEKSÓW 15 GIEŁD NA CAŁYM ŚWIECIE

Streszczenie (abstrakt): Niniejsze badanie analizuje wpływ weekendu na zwroty z 15 indeksów giełdowych na całym świecie. Testy empiryczne przeprowadzono na dziennych zwrotach indeksów giełdowych z krajów objętych badaniem w okresie od stycznia 2010 r. do maja 2015 r. Wyniki wskazują, że efekt weekendu nie występuje już w USA. Ponadto efekt weekendu zniknął w krajach członkowskich Unii Europejskiej (Francja i Niemcy) oraz w Wielkiej Brytanii. Efekt ten zniknął również w prawie wszystkich badanych krajach Ameryki Łacińskiej, z wyjątkiem Wenezueli i Chile, gdzie nadal występuje. Niniejsze badanie przyczynia się do wyjaśnienia wpływu weekendów i różnic czasowych na wyniki transakcji giełdowych. Wyniki pomagają zrozumieć potencjalny związek między zwrotami z indeksów giełdowych na całym świecie a lokalizacją rynku. Praca ta dostarcza przydatnych informacji inwestorom podejmującym decyzje, naukowcom i decydentom.

Słowa kluczowe: efekt weekendu, rynek akcji, UE, USA, Ameryka Łacińska

1. Introduction

The purpose of this research is to evaluate the weekend effect on the returns of 15 stock exchange indexes around the world. Stock market returns are a widely documented subject in financial literature. Research has focused on how the price of securities influences the stock market. Fama (1970) developed the efficient-market hypothesis according to which asset prices reflect all available information on the market making it impossible to "beat a market" that has abnormal returns at the same risk level.

Thus, drawing from experience in hospitals, it has been shown that patients admitted on the weekend had a significantly higher overall mortality rate relative to risk, at 1.19; and a 95% confidence interval, at 1.14-1.23 (Pauls et al. 2017). The probable explanation is that employees bear a grudge for having to work while their family members are taking a weekend break and consequently put less effort into their work. Weekends have also been shown to have on effect on overdose and drug abuse, excessive drinking, and other kinds of rule infringement that result in people going to hospital. In addition, fewer employees tend to be allocated to work on weekend shifts, resulting in a reduced labour force.

In the finance domain, the weekend effect has been the subject of constant debate. A number of studies have contradicted the validity of the efficient market hypothesis, highlighting the existence of anomalies. Therefore, in this paper we seek to examine one of them: the weekend effect, also called the Monday effect and the Monday seasonal, in other words, a day of the week effect where Fridays show lower returns than Mondays. As a result, the average return is higher for Monday, which has three times more expected returns than the other days of the week (French, 1980).

Complimentarily, this study intends to examine evidence of time anomalies related to the weekend effect in Latin America (Brazil, Mexico, Argentina, Chile, Peru, Colombia and Venezuela) in comparison with Europe (France, Germany and the United Kingdom) and the United States under the trading day hypothesis.

This study contributes to elucidating the effect of weekends and time differences in negotiating on other stock markets in other countries. The results help comprehend the potential relationship between stock exchange index returns around the world and the effect of location of the stock market.

The remainder of the paper is organized as follows. Section two sets out the theoretical framework featuring mainly the efficient market hypothesis and prior studies, section three covers the applied methodology, after which the findings are documented and lastly the conclusion is made.

2. Theorical Framework

The research on market efficiency started with the seminal work of Fama (1970). This author developed a theory called the Efficient Market Hypothesis (EMH) which asserts that the price of financial assets necessarily reflects all the information available on the market. Three kinds of efficiency test are distinguished:

- Weak efficiency test: an asset price incorporates the historical information available on the market implying any technical analysis is ineffective;
- Semi-strong efficiency test: asset prices reflect both any historical information available and all public information relayed by the market;
- Strong information test: asset prices reflect all available information: historical, public and private.

This theory has been the basis for a wide range of papers on financial subjects and generated numerous studies showing evidence of the existence of different kinds of anomalies.

Prior studies have been conducted on American indexes. French (1980) experimented one of the first studies on stock market anomalies. Studying the daily returns for Standard and Poor's Index over a period of 25 years, he examined the process of investment in the stock exchange using two models: the calendar time hypothesis (continuous process with an expected return on Mondays equal to the sum of the three days: Saturday, Sunday and Monday, that is to say three times the return for the other days of the week), and the trading time hypothesis (in which returns on work days lead to identical returns every day of the week). Both hypotheses were rejected, and he concluded that on Mondays the mean returns were strongly negative, and positive during the rest of the week.

The work of Gibbons and Hess (1981) confirmed these anomalies, with mean returns on Mondays being negative or outstandingly low, in their investigation of S&P 500 and US treasuries, corroborated by the work of Lakonishok and Smidt (1988), who found abnormal returns on weekends.

Similarly, studies have been carried out on other developed countries for which the same anomalies were discovered. Jaffe and Westerfield (1985) found a day of the week effect identical to that of the American market for the Australian, British, Canadian and Japanese equities markets. On average, returns were negative on Mondays and positive on Fridays on the Canadian and English markets, while in Japan and Australia, markets had their lowest returns on Tuesdays.

Later studies focused more on European indexes. Dubois and Louvet (1996) documented a negative mean return at the beginning of the week for eleven indexes (on nine countries) including French, British, German and US markets, and observed that this phenomenon had disappeared in the USA at the end of the period. Arsad and Coutts (1997) studied the behaviour of the British 30 FT index over the period 1935-1997 and documented lower returns on Mondays than on the other days of the week.

Gradually, the field of studies extended to emerging or developing markets on which the market efficiency hypothesis was tested to detect any anomalies.

Costa and Ceretta (2000) performed a study of the different anomalies present on the Ibovespa index in Brazil between 1986 and 1989. Regarding the results, a week-day effect was found with lower returns on Mondays and higher returns on Fridays. Bone and Ribeiro (2002) conducted research which included the week-day effect and holiday effect on the Brazilian Ibovespa index over the period 1995-2007. The findings of the statistical tests

revealed that in almost half of the thirty-eight stocks, the weekday effect was confirmed, with the most differential returns on Tuesdays. Ceretta and Costa (2001) identified the Monday effect in three of the five countries studied in Latin America (from 1994 to 1999).

More recently, Boudreaux and Fuller (2010) studied the weekend effect in two kinds of market: bear markets and non-bear markets succeeding each other (data from September 1976 to September 2002). The statistical evidence shows a weekend effect, but only in non-bear market orientations, on three US indexes: S&P 500, DJIA and Nasdaq.

A study by Rodriguez (2012) examined the day of the week effect from 1993 to 2007 for six countries in Latin America (the same as in our study, except for Venezuela). Three analyses conducted on volatility and returns, for each stock and globally, documented significant evidence of the persistence of a Monday effect or weekend effect in many cases in this area and the existence of a day-of-the-week effect on both returns and volatility.

Other research including the weekend effect corroborates these last findings on a larger scale (including eleven countries in our study). Indeed, studying the link between the volatility of the stock market, speculative short sellers, and the weekend effect using indexes from sixty countries, Kazemi (2013) tested Chen and Singal's (2003) explanation of the weekend effect. According to this author, the weekend effect may be linked to short sales. He conducted his work by dividing data into two sub-periods, one before 1995 (1980-1994) and the other one after 1995 (1995-2007), and evidenced that in the first period, short sales can explain the weekend effect for all countries, and in the second period, short sales can explain the phenomena in emerging markets, but no longer in developed ones. These results corroborate with Benetti and Favero (2008) where they compare the weekend effect across seven Latin American countries and the USA, highlighting any variations or similarities in the phenomenon across different markets.

On the other hand, Carlucci et al. (2014) studied the weekday effect anomaly on the returns of three main indexes in Brazil (Ibovespa), Mexico (Inmex), and the USA (Dow Jones). He tested three methods (the regression analysis, the hypothesis test for different means, and the Krustkal-Wallis non-parametric test) on the set of data from 2004 to 2012. The analysis performed showed that statistically, there is no discrepancy between the mean return of each day of the week in the three indexes. This means that the anomaly of the weekend effect is no longer present on these three major indexes.

3. Research Method

This section presents the data used, the way they were collected, and the statistical model adopted.

1. Sample

First, we collected the daily closing prices of each index from Bloomberg software and the Google financial browser for the last five years in three areas (Latin America, USA and Europe). The countries and associated stock exchange indexes, the number of observations, and the beginning/closing date of the period studied are detailed in the table below. The numbers of observations are not equal due to the specificities of each market (non-trading days). A description of each index is provided in Appendix 1.

Description of initial dataset

Country	**Index**	**N° observation used**	**Beginning date**	**Closing date**
Brazil	Ibovespa	1351	04/01/2010	22/05/2015
Argentina	Merval	1315	04/01/2010	22/05/2015
Chile	IGPA	1248	19/05/2010	22/05/2015
Colombia	IGBC	1319	04/01/2010	22/05/2015
Peru	IGBVL	1340	04/01/2010	30/04/2015
Venezuela	IBVC	1083	05/01/2010	22/05/2015
Mexico	IRT	1354	04/01/2010	22/05/2015
Mexico	Inmex	1355	04/01/2010	22/05/2015
Mexico	Mexbol	1359	04/01/2010	22/05/2015
USA	Nasdaq	1356	04/01/2010	22/05/2015
USA	S&P 500	1356	04/01/2010	22/05/2015
USA	Dow Jones	1356	04/01/2010	22/05/2015
Germany	DAX	1376	04/01/2010	22/05/2015
France	CAC 40	1378	04/01/2010	22/05/2015
UK	FTSE	1394	04/01/2010	22/05/2015

2. Econometric Model

The first step in analysing the weekend effect consists in calculating the daily returns for each index, using the logarithmic form:

$$R_t = 100 \; x \; ln \; (P_t / P_{t-1}) = E(R_t) + \varepsilon_t$$

- R_t is the return rate of the stock indexes on day t;
- P_t is the nominal closing price of the index on day t;
- $E(R_t)$ is the expected return value on day t;
- ε_t is an independent random variable whose expected value is equal to zero.

To compute the market return, the use of a stock market index from each sample country was established. For the United States and Mexico, three indexes were chosen: the Dow Jones, Nasdaq and Standard & Poor's in the USA, and Inmex, Mexbol and IPC in Mexico.

In this paper, the following regression was used to test the return generation model hypothesis:

$$R_t = \beta_2 d_2 + \beta_3 d_3 + \beta_4 d_4 + \beta_5 d_5 + \beta_6 d_6$$

For the generation of returns by work day, where R_t corresponds to the return of the country's index on day t, and the dummy variables (indicative variables equal to 1 on the respective weekdays and to 0 on other days) indicate the weekday when the return of R_t is observed (d=2: Monday, d=3: Tuesday, d=4: Wednesday, d=5: Thursday, d=6: Friday), the mean returns on Mondays, Tuesdays, Wednesdays, Thursdays and Fridays are represented, respectively, by β2, β3, β4, β5 and β6.

4. Analysis of Results

To conduct this research, historical series of daily closing prices were used for indexes from three main zones: Latin America, Europe, and the United States of America. These zones are very significant when analyzing information from capital markets worldwide.

Among these, indexes from seven Latin American countries were selected: Brazil (Ibovespa), Mexico (IRT, Mexbol, Inmex), Argentina (Merval), Peru (IGBVL), Colombia (IGBVC), Chile (IGPA), Venezuela (IBVC), three countries from Europe: France (CAC 40), Germany (DAX), and the United Kingdom (FTSE 100), and finally the United States. This set of data was obtained from Bloomberg software and the Google Finance browser for the period from January 2010 to May 2015.

Table 1 shows the descriptive statistics of the return rates. Note that the mean returns are positive for twelve indexes and that only three indexes have negative returns in Latin America: Colombia, Peru, and Brazil. The highest mean returns are for the IBVC index in Venezuela with 0.46% (explained by a high inflation rate in the country of around 50% during the last five years), followed by the Nasdaq index in the USA and the DAX Index in Europe. The Brazilian index, Ibovespa, had the lowest returns at -0.02 %, which is likely linked to the slowdown that Brazil has been undergoing since 2011. Merval (Argentina) and IBVC (Venezuela) have the highest standard deviation, probably in parallel with the economic situation of these two countries.

When analyzing Table 2, with a confidence interval of 95%, we find that among the panel of countries, only two display significant anomalies: Venezuela and Chile (highlighted).

Indeed, for Chile, we note that Monday and Friday have abnormal returns, which indicates that a weekend effect still exists in this country. The results for Venezuela indicate that there are abnormal returns on every day of the week except for Monday. These findings are in correlation with the analyses carried out by Rodriguez (2012) and Benetti and Favero (2008).

Table 1. Descriptive statistics of daily return rates from January 2010 to May 2015 in seven Latin American countries, three countries in Europe, and the United States.

	Latin America								
Country	Brazil	Argentina	Venezuela	Peru	Colombia	Chile	Mexico		
Index	Ibovespa	Mervin	IBVC	IGBVL	IGBC	IGPA	IRT	INMEX	MEXBOL
Arithmetic Means	-0.01720	0.12153	**0.46098**	-0.00434	-0.00720	0.00741	0.03096	0.02414	0.02469
Standard deviation	1.41088	1.98608	1.87796	1.29073	0.996	0.75483	0.94329	1.00345	0.94344
Kurtosis	1.53359	3.22909	17.06469	12.43863	2.00485	6.98560	2.98787	3.10320	2.97913
Minimum	-8.43075	1.98608	-13.47216	-13.29076	-5.01464	-5.97879	-6.06206	-6.73339	-6.06203
Maximum	4.97603	8.31994	19.81068	6.91630	4.21372	4.47179	4.16716	4.26971	4.16716
No Observa-tion	1350	1314	1303	1340	1318	1248	1354	1354	1354

				Europe		
Country	**United States**			France	Germany	United Kingdom
Index	Nasdaq	Dow Jones	S&P500	CAC 40	DAX	FTSE 100
Arithmetic Means	**0.05957**	0.04145	0.04774	0.01939	**0.04973**	0.01876
Standard deviation	1.10985	0.91358	0.95290	1.33894	1.26251	0.96518
Kurtosis	3.57907	3.91776	4.86365	3.49801	2.43377	2.53324
Minimum	-7.14891	-5.70611	-47.26405	-5.63464	-5.99466	-4.77923
Maximum	5.15918	4.15333	4.49814	9.22080	5.21038	5.03227
No Observation	1356	1356	1356	1379	1377	1395

Table 2. Results of regression and tests for daily return rates from January 2010 to May 2015 in seven Latin American countries, three countries in Europe, and the USA.

Country	Brazil	Argentina	Venezuela	Peru	Colombia	Chile	Mexico		
Index	Ibovespa	Mervin	IBVC	IGBVL	IGBC	IGPA	IRT	INMEX	MEXBOL
Monday	0.660891	0.663290	0.167857	0.092638	0.084760	0.048258	0.691316	0.919846	0.795318
Tuesday	0.474747	0.383041	0.004582	0.485903	0.656650	0.864972	0.952576	0.949612	0.908096
Wednesday	0.946415	0.208134	0.000000	0.479781	0.134334	0.630006	0.202402	0.172551	0.234525
Thursday	0.703548	0.601618	0.000086	0.364511	0.641383	0.645399	0.682188	0.757251	0.746610
Friday	0.867495	0.064575	0.000478	0.054086	0.642152	0.048362	0.581907	0.798103	0.624255
R Square	0.0007	0.0047	0.0673	0.0062	0.0044	0.0066	0.0017	0.0015	0.0014
Adjusted R Square	-0.0031	0.0009	0.0629	0.0025	0.0006	0.0026	-0.0020	-0.0022	-0.0023
F	0.1762	1.2463	15.5507	1.6714	1.1702	1.6573	0.4518	0.4076	0.3679
Sig F	0.9715	0.2851	0.0000	0.1385	0.3216	0.1420	0.8122	0.8438	0.8708

Country	United States			France	Germany	United Kingdom
Index	Nasdaq	Dow Jones	S&P500	CAC 40	DAX	FTSE 100
Monday	0.586781	0.637332	0.41262642	0.562191	0.867939	0.717501
Tuesday	0.065693	0.183790	0.83193583	0.498377	0.163894	0.059153
Wednesday	0.721817	0.987572	0.08531416	0.913379	0.430732	0.336935
Thursday	0.263463	0.216924	0.71458151	0.347219	0.261524	0.387880
Friday	0.589661	0.515409	0.1530789	0.959769	0.961327	0.851399
R Square	0.0040	0.0029	0.0043	0.0012	0.0028	0.0039
Adjusted R Square	0.0003	-0.0008	0.0006	-0.0024	-0.0008	0.0003
F	1.0716	0.7881	1.1718	0.3387	0.7706	1.0803
Sig F	0.3743	0.5582	0.3208	0.8896	0.5710	0.3694

5. Conclusion

In this paper, we investigated whether the weekend effect exists in seven Latin American countries compared to developed markets such as the USA and Europe (France, Germany and the UK). In the eighty studies we performed, we did not identify any anomalies on weekends on developed markets. We then explored these findings further in other dimensions, such as short sellers, market orientation, volatility, etc. This was followed by research on irregularities of returns in emerging markets, first in Brazil and Mexico, and then opening out to more Latin American countries and mixed areas of research and dimensions, to finally conclude on an eradication of the weekend effect for the Dow Jones, Inmex and Ibovespa indexes.

From the analysis performed, it can be concluded than the weekend effect no longer exists in the USA and European countries (France, Germany and the UK), and that it has disappeared in almost every country studied in Latin America, except Venezuela and Chile, where the effect persists. These findings confirm evidence found in Carlucci's research on recent data and projections made in study reviews over the last five years.

Possible explanations of this evolution are the integration and interdependence of financial markets. Indeed, the international capital market is an integrated market where any change to the balance of one of the segments leads to an instant change in the equilibrium of the other segments. The financial globalization illustrated by the processes of disintermediation, deregulation and decompartmentalization can explain this phenomenon. Any changes in the economic environment have direct repercussions on other financial locations, since communication is instantaneous and triggers mimetic behaviour. Natural evolution and development in economics, especially in emerging markets, tends to smooth anomalies as shown by the literature review.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The authors received source funding from the ICN Business School for this research.

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Appendix 1: Index Description

EUROPE

- **CAC 40** is the main stock index in Paris. It is a capitalization-weighted measure of the 40 French companies with the most significant stocks. These companies are selected from 100 French companies with the highest securities trade volumes. Each company has a weight determined with respect to its capitalization on NYSE Euronext.
- **DAX** is a German stock index. It represents 30 of the largest, most liquid German companies listed on the Frankfurt Stock Exchange. The DAX was established in 1988 with a base of 1000. Its members account for about 75 % of total equity trading on the Frankfurt Stock Exchange.

UK

- **FTSE 100** is an index composed of the shares of the 100 UK companies with the highest capitalization listed on the London Stock Exchange. The index is managed by an independent company resulting from a joint venture between the Financial Times

and the London Stock Exchange (forming FTSE). The index component companies represent about 81% of the market capitalization of the London Stock Exchange.

LATIN AMERICA

- **MERVAL** is the primary stock index of the stock exchange in Buenos Aires, Argentina. It consists of fifteen stocks. Merval was launched by the Buenos Aires Stock Exchange in the late 1980s to accompany a general movement of stock market performance research featuring the geographical diversification of stock portfolios, which in Argentina went hand in hand with the privatization of large utility companies.
- **IGBVL**: The General índice de la Bolsa de Valores de Lima is a stock index of the Lima stock market. It consists of 34 major market capitalizations in Peru.
- The Mexican IPC index (Indice de Precios y Cotizaciones) is a capitalization weighted index of the leading stocks traded on the Mexican Stock Exchange. The index was developed with a base level of 0.78 on 30 October 1978.
- **INMEX** is a market capitalization weighted index of 20 to 25 of the BMV's most highly marketable issuers, using their most representative series. The sample is limited to issuers with a minimum market value of $100 million and is revised every six months. The weighting cannot be greater than 10% at the start of each calculation period.
- **IPC**: The index of Precios Cotizaciones or IPC is the main stock index in Mexico. It consists of the 35 most liquid shares in the Mexican Stock Exchange. It is a capitalization weighted index.
- **IVBC** is an equity index of the Caracas Stock Exchange, composed of 16 major market capitalizations in Venezuela.
- **IBOVESPA** is the main index of the São Paulo Stock Exchange in Brazil. It is a composite index of 50 major market capitalizations on B3. It is revised quarterly to maintain its representativeness of market trends in Brazil.

UNITED STATES OF AMERICA

- **NASDAQ** is a global electronic marketplace for buying and selling securities, as well as the benchmark index for US technology stocks. The term “Nasdaq” is also used to refer to the Nasdaq Composite, an index of more than 3,000 stocks listed on the Nasdaq exchange that includes the world’s foremost technology and biotech giants such as Apple, Google, Microsoft, Oracle, Amazon, Intel and Amgen.
- **S&P 500** is an index of 500 stocks chosen for market size, liquidity and industry grouping, among other factors. The S&P 500 is designed to be a leading indicator of US equities and is meant to reflect the risk/return characteristics of the large cap universe. The S&P 500 is a market value weighted index - each stock's weight is proportionate to its market value.
- **DOW JONES**: The Dow Jones Industrial Average and Dow Jones is an American stock index located at the New York Stock Exchange, Wall Street, and is the oldest

stock market index in the world. It represents 30 of the largest US companies and is weighted on the share value of companies it comprises. The quotation by share value, without taking into account the market capitalization of listed companies, is unique in the Dow Jones and the Nikkei 225.

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