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# Analysis of the January Effect in Time Series of Mexican Stock Market Indexes

*Análisis del Efecto Enero en las Series Temporales de los Índices Bursátiles Mexicanos*

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## ABSTRACT

The current article has the research objective to search for empirical evidence of the January effect within the time series of the IPC and the sector indexes of the Mexican stock market using econometric GARCH analysis. The dataset is formed by the log returns of the daily closing prices corresponding to the IPC as well as the sector indexes covering the period from 01/01/2010 to 12/31/2018. The main results of the article are as follows: Based on the January effect the Efficient Market Hypothesis in its weak form sense cannot be rejected for the Mexican stock market as the results do not provide significant evidence of the existence of the respective calendar anomaly within the analyzed time series of the IPC and the different sector indexes.

Keywords: Efficient Market Hypothesis; calendar anomalies; January effect; Mexican stock market.

Jel Code: G11, G12, G14.

**RESUMEN**

El presente artículo tiene el objetivo de investigación de buscar evidencia empírica del efecto enero en las series temporales del IPC y los índices sectoriales analíticos del mercado bursátil mexicano utilizando modelos econométricos tipo GARCH. La muestra de datos está conformada de los rendimientos logarítmicos de los precios de cierre diarios correspondientes al IPC así como los índices sectoriales analíticos y se abarca el período 01/01/2010 a 31/12/2018. Los principales resultados del artículo son los siguientes: basado en el efecto enero la Teoría de los Mercados Eficientes en su forma débil no se puede rechazar para el mercado bursátil mexicano, ya que los resultados no muestran evidencia significativa de la existencia de dicha anomalía de calendario en las series de tiempo analizadas del IPC y de los diversos índices sectoriales analíticos.

Palabras clave: Teoría de Mercados Eficientes; anomalías de calendario; Efecto Enero; mercado bursátil mexicano.

Código Jel: G11, G12, G14

## INTRODUCTION

The Efficient Markets Hypothesis is still nowadays one of the most influential theories existing in finance as demonstrated by the Nobel Prize in Economics for its founder Eugene F. Fama in 2013. Fama (1970, 1991) himself differentiates between the three different levels of market efficiency – weak form, semi-strong form and strong form efficiency.

Empirical tests of the different market efficiency levels have a long tradition within financial literature. According to Fama (1991) return seasonality studies as for example tests of the January effect can be considered as tests of the EMH in its weak form sense. Numerous studies using a variety of methodological approaches reach differing results of the degree of existing market efficiency depending on variables such as the analyzed market, period or country.

However, there exists just a small amount of studies relating the January effect and the Mexican stock market (e.g. Cabello and Ortiz, 2003; López and Rodríguez, 2010; Rodríguez and Morales, 2009; Rojo, 2013). In fact, a study using current datasets and taking into account not just the IPC but also the 2009 established sector indexes of the Mexican stock market is not existent.



A study of this type would provide an up-to-date and comprehensive picture of the existence or non-existence of the January effect in time series of the Mexican stock market. Therefore, the present article has the research objective to search for empirical evidence of the January effect within the time series of the IPC and the sector indexes of the Mexican stock market using econometric GARCH analysis.

In order to achieve the outlined research objective, the present article is divided into five main sections. After this introductory part, the second chapter (Theoretical Background) introduces the theoretical fundamentals with respect to the Efficient Market Hypothesis and the January effect as one example of calendar anomalies.

The third part (Methodology) presents the underlying dataset and the methodological approach of the study. The fourth section (Presentation and Analysis of Results) presents and interprets the results of the test and subsequently chapter five concludes.

## THEORETICAL BACKGROUND

### Efficient Market Hypothesis

Theory and Assumptions

In 1970, Eugene F. Fama published an article on so-called efficient markets. Since then the Efficient Market Hypothesis (EMH) has had a strong impact on the world of finance. The article defines that a financial market in which prices always fully reflect available information can be called *"efficient"* and refers to a random process of asset pricing that behaves like a *"fair game"* where the results cannot be systematically predicted.

Uribe and Ulloa (2011) interpret the efficient market definition as follows: Even though the information that occurs in the financial markets is extensive, it is absorbed and reflected at any time by the market prices of the assets. The reason that some future information is not yet reflected in the market prices is simply that it is still unknown by the market participants and its occurrence depends on a random process. Hence, if financial markets are efficient, it is impossible to systematically gain excess profits from the prediction of market prices, regardless of the type of information or prediction techniques used.

Following the previously outlined hypothesis, according to Fama (1970), the following assumptions have to be fulfilled in order to classify a market as efficient:



- Rational and homogeneous expectations:

Economic agents can be characterized by rationality what implies that they correctly use the available and relevant information to formulate rational expectations and thus, establish by their buying and selling decisions correct market prices of the financial assets. In addition, market participants are defined homogeneously according to the model of the Economic Man (homo œconomicus) and therefore also homogeneously take the same (correct) investment decisions.

- Information characteristics:

Market participants have free and instant access to all available information. However, only new, unexpected, fundamental information can change the market price of a financial asset. In this sense, the term fundamental information can be defined as information that changes the real economic prospects for example of company (in case of a stock). According to the EMH investors interpret new (fundamental) information rationally and quickly, and use their knowledge to establish *“fair”* market prices which reflect fundamental values. As all market participants possess the same information and take the same correct investment decisions, consequently, no individual investor could systematically gain excess returns above the average market return level.

- Non-existence of taxes or transaction costs:

By not having to consider taxes or transaction costs, market participants are able to respond easily and quickly to new, relevant information and incorporate this information instantly into the market prices of the asset by their buying and selling decisions.
Given the outlined assumptions above, one reaches one of the following main findings of the EMH: In the medium and long-term inefficiencies in the form of differences between the market price of an asset and its fundamental value cannot exist. Possibly existing inefficiencies in the short run would be immediately eliminated by the rational investors using a perfectly functioning arbitrage process (Barberis and Thaler, 2002; Demmler, 2017).

*Types of Information Efficiency*
According to Fama (1970, 1991) it can be differentiated between the three following levels of efficiency according to the type of information:

- Weak form efficiency:

The current market prices of an asset reflect the totality of the existing historical information represented by the historical price movements of the asset. Hence, analysis methods which are based on the analysis of historical prices (technical analysis) are obsolete and cannot result in excess returns.

- Semi-strong form efficiency:

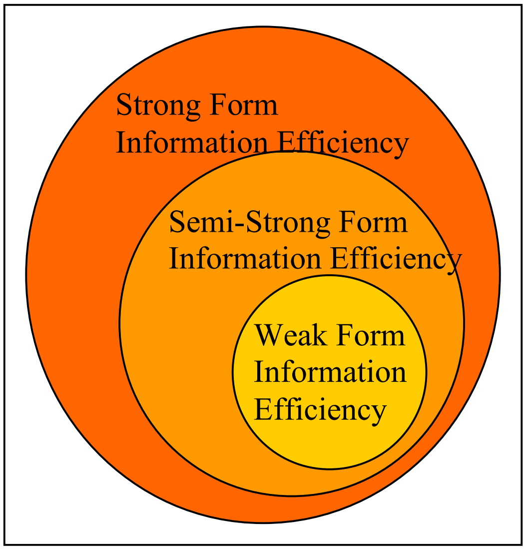


Departing from weak form efficiency, the semi-strong efficiency additionally incorporates all public information available (i. e. corporate publications, any type of news media coverage, analysts' publications, etc.). Thus, forecasting techniques as the fundamental analysis, which depends on the analysis and interpretation of public information, are not necessary as its use cannot result in above average investment returns.

- Strong form efficiency:

The strong form information efficiency is the most complete one as it takes into account the previous two types of information efficiency and, furthermore, considers non-public information (insider information). As within this type of information efficiency market prices reflect all the existing information, it is not possible for any investor to systematically gain excess investment returns. Hence, within this type of market the only adequate investment strategy is a passive portfolio management approach that results in investors constantly obtaining the average market return.

**Figure 1**
**Types of information efficiency**




Source: Own elaboration (Jensen, 1978).



As can be seen in Figure 1 the different levels of information efficiency are related in a way that the weak form efficiency forms part of the semi-strong form, and this one in return is an essential component of the strong form efficiency type. Thus, the rejection of the EMH in its weak form sense for a specific market automatically eliminates the possibility that this market could be semi-strong and strong form efficient. Hence, the negation of the weak form EMH results in the rejection of the other two forms. However, it is possible that a specific market can be characterized as weak form efficient but semi-strong form inefficient. Consequently, there also exists the possibility of a semi-strong form efficient and strong form inefficient market (Demmler, 2017).

*Criticism of the Efficient Market Hypothesis and Implications for Investors*

The EMH has been controversially discussed since its publication. For example, it seems impossible that its assumptions can be fulfilled in reality. In real markets information is costly and the vast majority of investors have a limited access to it. Moreover, investors are heterogeneous and face problems, for example, in the form of limited liquidity, taxes and transaction costs. León (2013) highlights some important implications for the case that the EMH would be a mirror image of real financial markets:

- Out of an academic perspective, analysis techniques as the technical and fundamental analysis would be useless as market prices would already reflect the information being sought.

- Out of a legal perspective, it would be unnecessary to create laws against the use of insider information.
- Out of an investment perspective, market participants would be encouraged to carry out passive buy and hold strategies in diversified investment alternatives such as indices or large portfolios combining multiple assets.
- Out of a political perspective, governments should influence more actively in the economic decisions of different sectors encouraging for instance companies to realize better investment projects. Enterprises would be given public resources according to the potential of their investment projects and consequently the result would be a much healthier economy.

Another argument against the EMH is a paradox, proposed by Grossman (1976), where he argues that if there exists a general awareness that the capital market is efficient, its participants would begin to act passively, and thus, stop to collect information what would result automatically in an inefficient market.

In addition, Grossman and Stiglitz (1980) added that expected investment returns need to be higher than information cost because otherwise the interest in investing would disappear. Subsequently, Shiller (1981) questioned the EMH with the concept of excess volatility. The author concludes that the volatility of stocks is too high to be explained by models of market efficiency.



A critique of the research area of behavioral finance is that the EMH assumes market domination by perfectly rational investors. However in reality, the formation of expectations and the behavior of market participants can be characterized by limited rationality (Simon, 1955) or even irrationality. In real financial markets, irrational market participants could gain significant importance in the short, medium and long-term asset pricing process (Demmler, 2017).

An additional point of criticism on the EMH is the existence of so-called capital market anomalies. According to Lo (2007) an anomaly can be defined as "a regular pattern in an asset´s returns which is reliable, widely known, and inexplicable." Calendar anomalies are an example of these capital market anomalies and will be presented in the subsequent section.

## Return Seasonality in Stock Markets

*Calendar Anomalies*

The presence of calendar anomalies, also known as stock market seasonality, has been the subject of multiple research studies. According to Fama (1991) seasonality studies can be classified as tests of the EMH in its weak form sense. Calendar anomalies reflect abnormal return patterns within the stock market in certain periods as for example days, weeks, months or even years. Nageswari and Selvam (2011) define calendar anomalies as regular and repetitive patterns in time series of stock returns which lead to systematically higher or lower returns in certain periods compared to other periods.

The Monday effect, for example, exists when on this day the average return is consistently lower, and the volatility is systematically higher than on the other days of the week. Also, the change of month effect indicates that stock prices tend to increase over the last four days of the present month and the first three days of the subsequent one (Kristjanpoller and Muñoz, 2012; Quantpedia, 2015).

In general, existing calendar anomalies have been attributed to various factors as for example government and investor decisions, business conditions, economic indicators and international events. Nevertheless, regardless of their origin or cause, the existence of calendar anomalies calls into question the EMH as they permit to forecast future market prices based on past returns – a reality that should not exist according to the EMH. In particular, one of the most analyzed stock market calendar anomalies is the so-called January effect which will be presented in detail in the following section.

*The January Effect*

The January effect refers to the observation of abnormally high returns in the first month of the year compared to all the other months. Ritter (1988) defines the January effect as the return phenomenon where stock companies have abnormally high returns during the period that starts on the last day of December and continues during the following month of January. Multiple scientific studies in financial literature have reach mixed results with respect to its existence or non-existence.



In general, the results of these studies vary depending on the specific asset, portfolio, country or market, applied model and analyzed period. For examples, different results are often obtained by evaluating the same index or asset in one original study and in a subsequent one years later.

Asteriou and Kavetsos (2006) search empirical evidence of calendar effects in the stock markets of the Czech Republic, Slovakia, Slovenia, Hungary, Lithuania, Poland, Romania and Russia during the period 1991-2003, using regression models proposed by Gultekin and Gultekin (1983) and Jaffe and Westerfield (1989). Their results show statistically significant evidence of the January effect in Hungary, Poland, Romania and Slovakia.

At the global level, Giovanis (2009) uses GARCH models to analyze 55 stock markets around the world and does not find strong statistical evidence of the existence of the January effect. In fact, the author just finds a very weak January effect appearing in only 7 stock markets. In contrast, Giovanis (2009) also finds that the month of December shows a stronger calendar effect, as 12 stock markets of the sample present relatively higher returns in this month compared to the rest of the year. Based on the results of his study the author finally rejects the EMH as every stock market of the sample presents, in some way or another, systematic monthly return patterns.

Marrett and Worthington (2011) search for potential differences in the average monthly returns of various industrial sectors of the Australian stock market. At the market level, they find that average returns are significantly higher (almost three times) in April, July and December. Furthermore, they also provide special evidence for small businesses which show significantly higher returns in January, August and December in comparison to other months. In addition, Marrett and Worthington (2011) identify a January effect for the financial and energy sectors as well as telecommunications and transport. On the other hand, they do not find any evidence for a January effect in the industries of health and insurance, materials and communication.

The study concludes that the high level of seasonality implies a non-efficiency of the Australian stock market in the weak form sense – a result that can be explained according to Marrett and Worthington (2011) by tax payments and liquidity restrictions for especially small enterprises.



One can also find some studies concerning calendar anomalies and the January effect in particular for the Mexican stock market. For example, Cabello and Ortiz (2003) analyze the returns of the Mexican stock market in Mexican Pesos and U.S. Dollars and detect a January effect for the period 1986-2001. Later Rodríguez and Morales (2009) search for the day of the week effect and the January effect using ARCH models. In a total of 23 companies listed on the Mexican stock market the study identified the day of the week effect in 7 and the January effect in 10 companies.

As well for the Mexican stock market, López and Rodríguez (2010) at first propose two econometric approaches with "dummy" variables. Secondly, they evaluate the presence of ARCH effects in the results obtained and, finally, adjust their tests by using a GARCH model in order to take into account the volatility of the returns. López and Rodríguez (2010), using market prices expressed in Mexican Pesos, find evidence of the January effect and other calendar anomalies for the period 1987-2009. However, the same test does not find such evidence using a dataset on a US Dollar basis. Moreover, Rojo (2013) cannot confirm in her study, using ARCH models, the presence of abnormal returns in January with respect to the other months of the year.

Considering the presented studies, one cannot find a clear result with respect to the existence or non-existence of the January effect in Mexico. Hence, the present study is dedicated to the analysis of this phenomenon for the current Mexican stock market.

## METHODOLOGY

### Research Problem

The presence of calendar anomalies, in particular of the January effect, has been analyzed for different stock markets all around the world. The results of these studies are often contradictory and differ depending on factors such as country, specific market and analyzed period.

It needs to be mentioned that the majority of the studies realized for Mexico focus their analysis on the IPC (Índice de Precios y Cotizaciones) which represents the leading stock index of the Mexican market. However, since March 2009 the Mexican Stock Exchange offers a new classification of the Mexican market using additionally to the IPC a total of 7 sector indexes. This new classification is based on international standards also used by other stock exchanges and presents a starting point for a better segmentation in order to facilitate market studies and comparative analyses (Bolsa Mexicana de Valores, 2019).



In particular, the present study focuses on the possible identification of the January effect on the Mexican stock market including the IPC and the sector indexes, since its existence – like the existence of any other calendar anomaly – would reject the EMH in its weak form sense. For this reason, the present article formulates the following research objective: Search for empirical evidence of the January effect within the time series of the IPC and the sector indexes of the Mexican stock market using econometric GARCH analysis.

### Dataset and Statistical Method

The dataset is formed by the daily closing prices corresponding to the IPC as well as the sector indexes. The prices were obtained from the database Investing (2019). As was already mentioned, the Mexican Stock Exchange started its sector classification in March 2009. However, in order to cover a unified period of 12 months a year the data of the present study includes the time series of 01/01/2010 to 12/31/2018. Hence, the logarithmic daily returns of the IPC and the 7 sector indexes covering the period mentioned above are used for the analysis.

The present study replicates the methodology proposed by López and Rodríguez (2010). The model for testing the existence of seasonal effects is as follows:

$$R_t = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \cdots + \alpha_{12} D_{12t} + u_t \quad (1)$$

Where:
$R_t$= logarithmic return of the stock index en t
$\alpha_i$= average logarithmic daily return of month i
$u_t$= identically and independently distributed error term
$D_{it}$= stationary "dummy" variables

And:

$$D_{it} = \begin{cases} 1 & \text{if the return in t corresponds to month i} \\ 0 & \text{otherwise} \end{cases}$$

However, this model is adapted to test the presence of the January effect, in such a way that this month becomes the month of reference, leaving the model as follows:

$$R_t = c + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \cdots + \alpha_{12} D_{12t} + u_t \quad (2)$$



where c represents the average return in the month of January and the coefficients α represent the difference between the returns of the month of January and month i.

The null hypothesis seeks to prove that the coefficients $\alpha_i$ are equal to 0. Thus, negative values of the coefficients of the "dummy" variables would be the statistical evidence of the existence of the January effect.

However, as de Arce (1998) points out, in classical time-series theory statistical approaches are based on a stationary stochastic process. This implies the assumption of a constant variance of the time series – a fact that normally does not apply for financial time series. In addition, according to Rojo (2013), in financial time series it is common to find the following problems: lack of a regular dynamic structure in the mean, leptokurtic distributions, volatility clustering and volatility persistence, among others.

Therefore, the present study tests for ARCH effects in the residuals of Equation 2. Afterwards, if necessary, the model is estimated again by a GARCH (1,1) model in order to consider a time-dependent variance and evaluate the existence of the January effect under this new specification.

Autoregressive conditional heteroscedasticity (ARCH) models, introduced by Engle (1982), aim to determine a pattern of statistical behavior for the variance and their importance lies in considering past information of the variable and its volatility as an explanatory factor of the present behavior of the variable, suggesting like this a predictable future.

## PRESENTATION AND ANALYSIS OF RESULTS

### Descriptive Statistics

Table 1 shows the descriptive statistics obtained from the daily logarithmic returns of each index. Results are expressed in percentage.

**Table 1**
**Descriptive statistics**

| | *IPC* | *SE2* | *SE3* | *SE4* | *SE5* | *SE6* | *SE7* | *SE9* |
|---|---|---|---|---|---|---|---|---|
| *Mean* | 0.0115 | 0.0132 | 0.0317 | 0.0474 | 0.0352 | 0.0102 | 0.0163 | 0.0035 |
| *Median* | 0.0323 | 0.0334 | 0.0535 | 0.0169 | 0.0506 | -0.0070 | 0.0510 | 0.0033 |
| *Maximum* | 4.1672 | 4.5396 | 3.9455 | 5.6354 | 3.7476 | 5.3856 | 4.9096 | 6.3343 |
| *Minimum* | -6.0620 | -7.3391 | -5.8997 | -11.6760 | -5.2488 | -10.6358 | -8.9974 | -7.8634 |
| *SD* | 0.9113 | 1.0053 | 0.7998 | 0.9585 | 0.7869 | 1.0372 | 1.1303 | 0.9465 |
| *Kurtosis* | 6.6828 | 5.6493 | 7.1004 | 15.9374 | 7.4714 | 10.6874 | 9.0154 | 9.0347 |
| *Skewness* | -0.4734 | -0.2699 | -0.5667 | -0.6504 | -0.5765 | -0.5427 | -0.8461 | -0.2343 |
| *Jarque-Bera* | 1363.421 | 689.32 | 1706.45 | 15941.78 | 2010.56 | 5683.45 | 3681.99 | 3454.61 |

Source: own elaboration.

Note: The meanings of the variables are as follows: Price and Quotation Index (IPC), Materials Sector Index (SE2), Industrial Sector Index (SE3), Consumer Discretionary Sector Index (SE4), Consumer Staples Sector Index (SE5), Health Care Sector Index (SE6), Financial Sector Index (SE7), Telecommunication Services Sector Index (SE9).

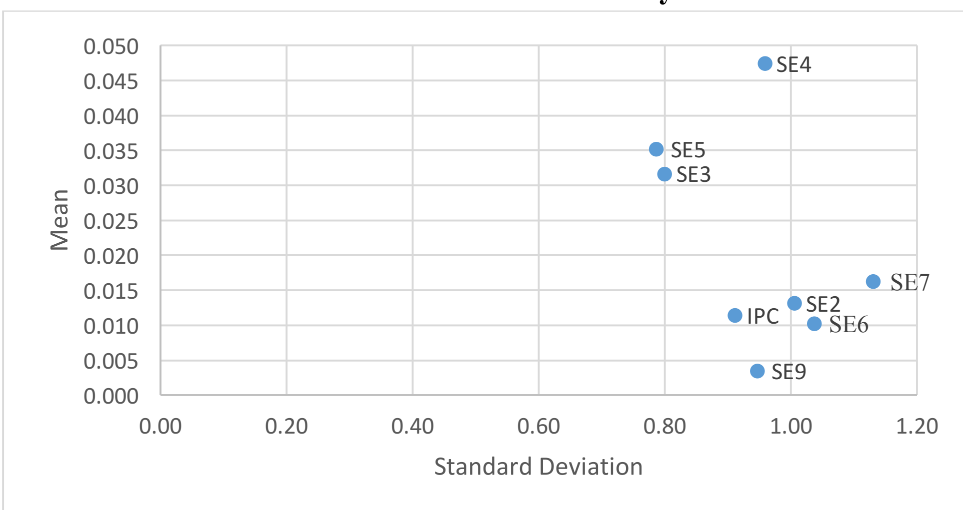
One can find similarities between the 8 indexes with respect to the results for the mean, median and standard deviation (SD). It appears natural that the sector indexes show similar results in comparison to the IPC as this main index of the Mexican stock market reflects the overall behavior of the entire market. The average returns of the indexes for the analyzed period are only just above 0. For instance, the IPC shows a mean return of 0.0115 %. This return level appears to be marginal. However, one has to consider that the database is formed by daily index prices and, thus, returns are expressed on a daily basis as well.

As shown in Table 1 and Figure 2 the highest mean return corresponds to the Consumer Discretionary Sector Index (SE4) and the lowest to Telecommunication Services Sector Index (SE9). The Financial Sector Index (SE7) represents the highest risk expressed by the standard deviation and the Consumer Staples Sector Index (SE5) the lowest one.

Moreover, it can be observed that the analyzed indexes show leptokurtic distributions what implies a higher concentration of the return data around their mean. The values for kurtosis of the analyzed indexes are all above 3 what is according to DeCarlo (1997) the reference value for a normal distribution.

In fact, the assumption of a normal distribution is rejected because the Jarque-Bera statistics reach very high values. Furthermore, the skewness coefficients are slightly below 0, suggesting that the data is skewed to the left, which means that the probability of having negative returns is slightly higher.

**Figure 2**
**Media and standard deviation of analyzed indexes**




Source: own elaboration.



**ARCH Effects and GARCH (1,1) Model**

After running the regression of Equation 2, the Lagrange Multiplier (LM) test proposed by Engle (1982) is performed in order to detect heteroscedasticity. The results of this test are shown in Table 2.

**Table 2**
**ARCH LM test**

| | *IPC* | *SE2* | *SE3* | *SE4* | *SE5* | *SE6* | *SE7* | *SE9* |
|---|---|---|---|---|---|---|---|---|
| *F-statistic* | 16.1209 | 93.7785 | 61.3713 | 9.3352 | 15.1765 | 113.0663 | 22.0196 | 71.1867 |
| *Prob. F* | 0.0001 | 0.0000 | 0.0000 | 0.0023 | 0.0001 | 0.0000 | 0.0000 | 0.0000 |
| *Obs*R-squared* | 16.0209 | 90.1219 | 59.8017 | 9.3051 | 15.0886 | 107.7745 | 21.8264 | 69.0739 |
| *Prob. Chi-Square(1)* | 0.0001 | 0.0000 | 0.0000 | 0.0023 | 0.0001 | 0.0000 | 0.0000 | 0.0000 |

Source: own elaboration.
Note: All values are significant at the 1 % level.

The null hypothesis states that no ARCH effects exist. Analyzing the probabilities obtained for each index, the null hypothesis is rejected. Thus, further results of the outlined Equation 2 will not be shown. Instead, Equation 2 will be adjusted to a GARCH (1,1) model in order to take into account heteroscedasticity.

The GARCH models are composed of two equations that are solved simultaneously – one for the conditional mean and the other for the conditional variance. Table 3 presents the results of Equation 2 adjusted to a GARCH (1,1) model. Results were obtained using Eviews 10.

**Table 3**
**GARCH (1,1) model results for Equation 2**

| Month | IPC | SE2 | SE3 | SE4 | SE5 | SE6 | SE7 | SE9 |
|---|---|---|---|---|---|---|---|---|
| Jan | -0.00007 | -0.00036 | 0.00063 | 0.00004 | -0.00060 | -0.00071 | -0.00070 | -0.00014 |
| | [0.9025] | [0.6087] | [0.5555] | [0.9773] | [0.1594] | [0.3604] | [0.1912] | [0.7962] |
| Feb | -0.00021 | 0.00060 | -0.00075 | 0.00007 | 0.00133 | -0.00299 | 0.00053 | -0.00039 |
| | [0.8047] | [0.5434] | [0.6564] | [0.9737] | **[0.0659]*** | **[0.0005]***** | [0.5811] | [0.6217] |
| Mar | 0.00141 | 0.00078 | 0.00062 | 0.00192 | 0.00221 | 0.00191 | 0.00157 | 0.00086 |
| | **[0.0737]*** | [0.4266] | [0.7125] | [0.3849] | **[0.001]***** | **[0.0925]*** | **[0.0597]*** | [0.2598] |
| Apr | 0.00009 | 0.00058 | -0.00044 | 0.00053 | 0.00072 | 0.00114 | 0.00133 | -0.00048 |
| | [0.9025] | [0.5531] | [0.7883] | [0.7954] | [0.2254] | [0.2912] | [0.1312] | [0.5326] |
| May | -0.00083 | -0.00066 | -0.00179 | -0.00064 | 0.00071 | 0.00109 | -0.00016 | -0.00061 |
| | [0.2588] | [0.4814] | [0.2588] | [0.7597] | [0.3075] | [0.2998] | [0.8559] | [0.4373] |
| Jun | 0.00089 | 0.00097 | 0.00019 | -0.00010 | 0.00144 | 0.00076 | 0.00091 | 0.00107 |
| | [0.219] | [0.2927] | [0.9076] | [0.9605] | **[0.0281]**** | [0.457] | [0.2525] | [0.1657] |
| Jul | 0.00065 | 0.00176 | 0.00012 | 0.00124 | 0.00075 | 0.00086 | 0.00211 | 0.00029 |
| | [0.4177] | **[0.0742]*** | [0.9452] | [0.5579] | [0.2151] | [0.4206] | **[0.0194]**** | [0.7224] |
| Aug | 0.00006 | 0.00035 | -0.00091 | -0.00012 | 0.00062 | 0.00089 | 0.00124 | 0.00026 |
| | [0.935] | [0.7092] | [0.5741] | [0.9552] | [0.3689] | [0.4252] | [0.139] | [0.7487] |
| Sep | 0.00007 | 0.00040 | -0.00037 | -0.00012 | 0.00109 | 0.00008 | 0.00143 | 0.00017 |
| | [0.9284] | [0.6818] | [0.8245] | [0.955] | [0.1235] | [0.9388] | [0.1005] | [0.8363] |
| Oct | 0.00074 | 0.00075 | -0.00038 | 0.00075 | 0.00123 | 0.00141 | 0.00191 | 0.00122 |
| | [0.3344] | [0.4416] | [0.8142] | [0.7117] | **[0.0703]*** | [0.1567] | **[0.0243]**** | **[0.0882]*** |
| Nov | -0.00008 | 0.00010 | -0.00062 | 0.00073 | 0.00112 | 0.00058 | 0.00042 | -0.00039 |
| | [0.9173] | [0.9158] | [0.669] | [0.7117] | **[0.0932]*** | [0.5724] | [0.6611] | [0.6544] |
| Dec | 0.00131 | 0.00166 | 0.00063 | 0.00097 | 0.00184 | 0.00114 | 0.00243 | 0.00108 |
| | [0.1446] | **[0.0977]*** | [0.696] | [0.6618] | **[0.0078]***** | [0.2869] | **[0.0125]**** | [0.2308] |
| ✔ | 0.09754 | 0.06598 | 0.15000 | 0.15000 | 0.06772 | 0.13929 | 0.10051 | 0.07855 |
| | [0] | [0] | [0.0013] | [0.0003] | [0] | [0] | [0] | [0] |
| 🚲 | 0.87253 | 0.90591 | 0.60000 | 0.60000 | 0.90311 | 0.63785 | 0.86807 | 0.91234 |
| | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| ✔ 💥 🚲 | 0.97007 | 0.97188 | 0.75000 | 0.75000 | 0.97083 | 0.77714 | 0.96858 | 0.99089 |

Source: own elaboration.
Note: The values in brackets are p-values.
*** Significant at the 1 % level.
** Significant at the 5 % level.
* Significant at the 10 % level.

Table 3 shows that neither the IPC nor the sector indexes show any statistically significant abnormal returns in the month of January with respect to the rest of the year.

The months with most seasonal effects are March, October and December. In March there are calendar effects for the IPC, SE5 (Consumer Staples Sector), SE6 (Health Care Sector) and SE7 (Financial Sector), in October for SE5 (Consumer Staples Sector), SE7 (Financial Sector) and SE9 (Telecommunication Services Sector), and December for SE2 (Materials Sector), SE5 (Consumer Staples Sector) and SE7 (Financial Sector). On the other hand, months like January, April, May, August and September do not present significant abnormal returns.

The most relevant calendar effects – with a level of significance of 1 % – can be found for SE5 (Consumer Staples Sector) in March and December and for SE6 (Health Care Sector) in February. Unlike the rest of the indexes, the Industrial Sector (SE3) and the Consumer Discretionary Sector (SE4) do not present seasonal effect.

In addition, the Consumer Staples Sector (SE5) appears to be most relevant, not only because it shows the most calendar effects (6), but also because half of the coefficients are significant at the 5 % level and even at the 1 % level for the months of March and December. The second most important sector index is the Financial Sector (SE7) with a total of 4 calendar effects, including three significant ones at the 5 % level (July, October and December).



With reference to the question if the identified calendar effects are either positive (positive abnormal return) or negative (negative abnormal return) one can see in Table 3 that the vast majority of the total of 16 effects with statistical significance on the 10 %, 5 % and 1 % level are positive. Hence, 15 identified calendar anomalies imply an abnormal positive return for a specific index in a specific month in comparison to other months. Just one calendar anomaly shows negative abnormal returns – Health Care Sector (SE6) in February. In addition, the sum of the coefficients ($\alpha + \beta$) is close to one in all cases what implies that volatile shocks are persistent.

## CONCLUDING REMARKS

The present article had the research objective to search for empirical evidence of the January effect within the time series of the IPC and the sector indexes of the Mexican stock market using econometric GARCH analysis.

The IPC as the main index does not present a January effect. However, abnormal returns can be detected for the month of March. These results coincide with the study of Rojo (2013) who also does not find a January effect for the time series (1992-2013) of the Mexican IPC, but abnormal returns in March.

Within the analysis of the different sector indexes none of them show statistical evidence of a January effect. However, evidence of other calendar effects can be found for several sector indexes. Especially the months of March, October and December seem to be important as a total of 9 statistically significant calendar effects distributed between the following sector indexes can be identified: Materials Sector Index (SE2), Consumer Staples Sector Index (SE5), Health Care Sector Index (SE6) and Financial Sector Index (SE7) and SE9 (Telecommunication Services Sector).

In general, the hypothesis that the January effect is present in the IPC and the sector indexes of the Mexican stock market is rejected since no statistical evidence for a January effect is found.

This, however, is by far not enough to reject the EMH in its weak form sense for the Mexican stock market in general which in fact, on the one side, appears to be an efficient market with respect to the general non-existence of the January effect. Nevertheless, the identification of other calendar anomalies for the IPC and several sector indexes questions again this assumed weak form efficiency of the Mexican stock market.



From the perspective of an investor the results of the present study could be used in order to better time short and medium-term investments in certain indexes and like this realize abnormal financial profits. For example, one can recommend investments in general throughout the whole year in the Consumer Staples Sector Index (SE5) as this index shows a total of 6 statistical significant calendar effects (February, March, June, October, November, December) and all of them imply positive abnormal returns. Furthermore, the Consumer Staples Sector Index (SE5) is the less risky one according to the calculated standard deviation.

## REFERENCES

Asteriou, D. and Kavetsos, G. (2006). Testing for the existence of the 'January Effect'. *Applied Financial Economics Letters, 2*, 375–381. https://doi.org/10.1080/17446540600706817

Barberis, N. and aler, R. (2003). A survey of behavioral finance, in: G.M. Constantinides & M. Harris & R. M. Stulz (ed.), *Handbook of the Economics of Finance*, edition 1, volume 1, chapter 18, pages 1053-1128, Elsevier.

Bolsa Mexicana de Valores (2019). Sectoriales Analíticos. México: BMV. https://www.bmv.com.mx/es/indices/ana liticos/

Cabello, A. and Ortiz, E. (2003). Day of the week and month of the year anomalies in the mexican stock market. *Revista Mexicana de Economía y Finanzas, 2*(3), 217-241.

de Arce, R. (1998). *Introducción a los modelos Autorregresivos con Heterocedasticidad Condicional (ARCH)*. Programa de Doctorado en Modelación Económica del Instituto LR Klein. Consulted from: https://www.uam.es/otros centros/klein/doctras/doctra9806.pdf

De Carlo, L. T. (1997). On the Meaning and Use of Kurtosis. *Psychological Methods*, 2, 292-307. http://dx.doi.org/ 10.1037/1082-989X.2.3.292

Demmler, M. (2017). *Irrationality of Asset Price Bubbles Human Decision-Making in the Course of Financial Bubbles*. México-City, Pearson.

Engle, R. (1982). Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica,* 987-1007. DOI: 10.2307/1912773



Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), 383-417. DOI: 10.2307/2325486

Fama, E. F. (1991). Efficient Capital Markets: II. *The Journal of Finance*, *46(*5), 1575-1617. https://doi.org/10.1111 /j.1540-6261.1991.tb04636.x

Giovanis, E. (2009). *The Month-of-the-year Effect: Evidence from GARCH models in Fifty Five Stock Markets.* MPRA Paper 22328, 21 pages.

Grossman, S. (1976). On the Efficiency of Competitive Stock Markets Where Trades Have Diverse Information. *The Journal of Finance*, 31(2), 573-585. DOI: 10.2307/2326627

Grossman, S. J. and Stiglitz, J. E. (1980). On the Imposibility of Informationally Efficient Markets. *The American Economic Review, 70*(3), 393-408. https://doi.org/10.7916/D8765R99

Gultekin, M. and Gultekin, B. (1983). Stock market seasonality: international evidence. *Journal of Financial Economics,* 12(4), 469-481. https://doi.org/10.1016/0304-405X(83)90044-2

Investing (2019). *Índices de México*. México: Investing. Consulted from: https://mx.investing.com/indices/m%C3%A9xicoindices?&majorIndices=on&additionalIndices=on

Jaffe, J. and Westerfield, R. (1985). The week-end effect in stock returns: the international evidence. *The Journal of Finance, 40(2)*, 433-454. https://doi.org/10.1111/j.1540-6261.1985.tb04966.x

Jensen, M. C. (1978). Some Anomalous Evidence Regarding Market Efficiency. *Journal of Financial Economics*, *6*(2/3), 95-101. https://doi.org/10.1016/0304-405X(78)90025-9

Kristjanpoller, W. and Muñoz, R. E. (2012). Análisis del Efecto Día de Semana en los principales mercados accionarios latinoamericanos: una aproximación mediante el criterio de Dominancia Estocástica. *Estudios de Economía, 39*(1), 5-26. https://doi.org/10.17533/udea.le.n81a4

León, E. A. (2013). *La eficiencia del Mercado Accionario Mexicano: Periodo 1993-2010*. Mexico: UNAM.

Lo, A. W. (2007). "Efficient Markets Hypothesis". In L. Blume and S. Durlauf (eds.). The New Palgrave: A Dictionary of Economics. http://web.mit.edu/Alo/www/Papers/EMH_Final.pdf



López, F. and Rodríguez, D. (2010). El efecto enero en las principales bolsas latinoamericanas de valores. *Contaduría y Administración,* (230), 25-46.

Marrett, G. and Worthington, A. (2011). The Month-of-the-year Effect in the Australian Stock Market: A Short Technical Note on the Market, Industry and Firm Size Impacts. *Australasian Accounting Business and Finance, 5*(1), 117-123.

Nageswari, P. and Selvam, M. (2011). An Empirical Study on Seasonal Analysis in the Indian Stock Market. *International Journal of Management & Business Studies, 1*(4), 90-95.

Quantpedia (2015). *Turn of the Month in Equity Indexes*. Consulted from: https://quantpedia.com/screener/Detai ls/41

Ritter, J. R. (1988). The Buying and Selling Behavior of Individual Investors at the Turn of The Year. *The Journal of Finance, 43*(3), 701-717. https://doi.org/10.1111/j.1540-6261.1988.tb04601.x

Rodríguez, D. and Morales, A. (2009). Los efectos "día de la semana" y "mes del año" para los rendimientos de una muestra de acciones que cotizan en la bolsa mexicana de valores. *XV Congreso Internacional de Contaduría, Administración e Informática.* Consulted from: http://congreso.investiga.fca.unam.mx/docs/xv/docs/178.pdf

Rojo, G. (2013). *Anomalías en el Mercado Accionario Mexicano: La presencia del llamado efecto enero.* Master Thesis, UNAM.

Shiller, R. J. (1981). The Use Of Volatility Measures In Assessing Market Efficiency. *The Journal of Finance, 36*(2), 291-304. https://doi.org/10.1111/j.1540-6261.1981.tb00441.x

Simon, H. (1955). A Behavioral Model of Rational Choice. *Quarterly Journal of Economics, 69*(1), 99-118. https:// doi.org/10.2307/1884852

Uribe, J. M. and Ulloa, I. M. (2011). Revisando la Hipótesis de los Mercados Eficientes: Nuevos datos, nuevas crisis y nuevas estimaciones. *Cuadernos de Economía,* 30(55), 127-154. DOI: 127-153. 10.15446/cuad.econ