“January effect: 200 years of evolution in the us stock market”

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JANUARY EFFECT: 200 YEARS OF EVOLUTION IN THE US STOCK MARKET

Abstract

This paper is a comprehensive investigation of the January Effect evolution in the US stock market over the period 1791–2015. It employs various statistical techniques (average analysis, Student's t-test, ANOVA, Mann-Whitney test) and a trading simulation approach to analyze the evolution of this anomaly. The results suggest that January effect during the XVIII–XXI century passed the way from rise to fall. The rise of the January Effect starts in the end of the XIX century and this anomaly mostly disappeared in middle of the XX century. Nowadays the January Effect is not present in the US stock market, but even today January stays one of the best months for purchases in the US stock market.

Keywords calendar anomaly, January effect, stock market, Dow Jones Index

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INTRODUCTION

According to the Efficient Market Hypothesis (EMH) it is impossible to predict prices in the stock market and to "beat" the market by making abnormal profits (Fama, 1965). Still, stock market data provide a lot of evidences against this. The most influencing examples are presence of market anomalies, persistence in stock prices, fat tails in price distributions, and other of market inefficiency.

According to the EMH prices in the stock markets should be random, but there are many empirical evidences of abnormal behavior of prices (Cross, 1973; De Bondt & Thaler, 1985; Ariel, 1987; Caporale & Plastun, 2018). These evidences are usually called market anomalies. The most commonly recognized market anomalies are momentum effect and size effects, price bubbles, value investing, and calendar anomalies.

Among calendar anomalies one of the most well-known is the January effect – January exhibits higher returns comparing with the other months of the year. Still empirical evidences about the January effect are mixed. This can be explained by the differences in data sets and data periods, data frequency and methodology, as well as differences in choice of markets, financial assets and countries as objects of analysis. One more possible reason is evolution of the markets (Lo, 2004). Based on evolutionary concept in this paper we will try to show that market anomalies (caw of January effect) are not market myths and they evolve in time.

Using monthly data from the US stock market over the period 1791–2015 we will analyze the evolution of the January effect. To do this we employ various statistical techniques (average analysis, Student's t-test, ANOVA, the Mann-Whitney test) and a trading simulation approach.

The layout of the paper is as follows. Section 2 briefly reviews the literature on January effect and the available evidence. Section 3 describes the data and outlines the empirical methodology. Section 4 presents the empirical results. Section 5 offers some concluding remarks.

1. LITERATURE REVIEW

The EMH is the leading theory explaining behavior of the financial markets. It was developed by Fama (1965), who argued that prices in the financial markets should fully reflect the available information and be unpredictable. But since the 1980's a lot of empirical evidences against the EMH were provided (Cross, 1973; Ariel, 1987; Caporale & Plastun, 2017 and many others).

Some of these inconsistencies were called market anomalies. One of the most famous among them is so called January effect. According to this anomaly returns on January are higher than those of the other months of the year and overall January is the best month for purchases in the stock market. The January effect was found in the different markets all over the world. For example, Giovanis (2008) detect it in the Athens Stock Exchange Market. Hansen et al. (2005) show that January effect is significant for returns stock indices from Denmark, France, Germany, Hong Kong, Italy, Japan, Norway, Sweden, United Kingdom, United States. Stoica and Diaconașu (2011) find the existence of January effect in Czech Republic, Croatia, Macedonia, Romania, Slovenia and Hungary.

Still the evidences are mixed. Carchano and Pardo (2011) analyzing S&P 500, DAX and Nikkei stock index show that the January effect is not statistically and economically significant. Georgantopoulos et al. (2011) find no January effect in the emerging stock markets (Romania, Bulgaria, Croatia and Turkey) and Greece. Wong et al. (2006) reveal that this anomaly has largely disappeared from the Singapore stock market. Caporale and Plastun (2017) provide evidences about the absence of the January effect in the Ukrainian stock market.

This can be explained by the differences in data sets and data periods, data frequency and methodology, as well as differences in choice of markets, financial assets and countries as objects of analysis. One more possible reason is evolution of the markets. The last assumption is confirmed by Fortune (1998, 1999), Schwert (2003), and Olson et al. (2010) who find that another well-known calendar anomaly (the weekend effect) has become less important over the years. The aim of this study is to check this hypothesis for the case of the January effect.

2. DATA AND METHODOLOGY

We use New York Stock Exchange monthly data over the period 1791–2015. The data source is New York Stock Exchange.

In order to explore the evolution of the January Effect we split overall period into a number of sub periods. The length of each sub period is 25 years. This allows obtaining sufficient data sets for analysis with statistically significant results and at the same time to see the dynamics of the evolution.

The following hypotheses are tested in this research:

H1: January Effect is not market myth and legend.

H2: January Effect evolves in time.

To confirm/reject these hypotheses we use the following techniques:

- average analysis;
- parametrical tests (Student's t-tests, ANOVA analysis);
- non-parametrical tests (Mann-Whitney tests);
- Trading simulation approach.

Average analysis provides preliminary evidence on whether there are differences between returns on January and other months of the year.

Both parametric and non-parametric tests are carried out given the evidence of fat tails and kur-

tosis in returns. The Null Hypothesis (*H0*) in each case is that the data belong to the same population, a rejection of the null suggesting the presence of an anomaly.

Student's t-tests are carried out for the null hypothesis that returns on January and other months of the year belong to the same population; a rejection of the null implies a statistical anomaly in the price behaviour on January.

The test is carried out at the 95% confidence level, and the degrees of freedom are $N - 1$ (N being equal to $N_1 + N_2$). Returns are computed as follows:

$$R_i = \left(\frac{Close_i}{Close_{i-1}} - 1 \right) \cdot 100\%, \qquad (1)$$

where R_i returns on the i-th month in %; $Close_{i-1}$ close price on the (i-1) month; $Close_i$ close price on the i-th month.

When anomaly is detected using the previous methods we examine whether these give rise to exploitable profit opportunities by means of a trading simulation approach. Specifically, we use an algorithm based on the January effect to replicate the behavior of a trader who opens positions on the US stock market and holds them for a whole month.

We use the following procedure to simulate the trading process. First we compute the percentage result of the deal:

$$\% \text{ result} = \frac{100\% \cdot P_{open}}{P_{close}}, \qquad (2)$$

where P_{open} – closing price; P_{close} – closing price.

The sum of results from each deal is the total financial result of trading. A strategy resulting positive total profits is defined as indicating an exploitable market anomaly.

To make sure that the results we obtain are statistically different from the random trading ones we carry out t-tests. We chose this approach instead of carrying out z-tests because the sample size is less than 100. A t-test compares the means from two samples to see whether they come from the same population. In our case the first is the average profit/loss factor of one trade applying the trading strategy, and the second is equal to zero because random trading (without transaction costs) should generate zero profit.

The null hypothesis (*H0*) is that the mean is the same in both samples, and the alternative (*H1*) that it is not. The computed values of the t-test are compared with the critical one at the 5% significance level. Failure to reject *H0* implies that there are no advantages from exploiting the trading strategy being considered, whilst a rejection suggests that the adopted strategy can generate abnormal profits.

An example of the t-test is presented in Table 1.

Table 1. Example of the t-test for the trading strategy effectiveness evaluation: US stock market in 1966–1990

Parameter	Value
Number of the trades	25
Total profit	42.72
Average profit per trade	1.71
Standard deviation	3.49
t-test	2.45
t critical (0.95)	1.78
Null hypothesis	rejected

As can be seen there is statistically significant difference in terms of total net profits relative to the random trading case, and therefore market inefficiency is confirmed.

3. EMPIRICAL RESULTS

Empirical results for the January Effect are presented in Appendices A–D. The results of simple average analysis are displayed in Table A 1 and Figure A 1.

As can be seen since 1866 till nowadays average returns on the January were higher then returns on the other days of the year. For example during 1866–1890 period the difference was 0.75% vs 0.023%, i.e. 25 times. This evidence in favor of the

Table 2. Overall results for the January effect: case of the US stock market during 1791–2015

Period	Visual inspection	ANOVA analysis	Student's t-test	Mann-Whitney Test	Trading simulation	Overall
1791–1815	–	–	–	–	–	0
1816–1840	–	–	–	–	–	0
1841–1865	–	–	–	–	–	0
1866–1890	+	–	–	–	–	1
1891–1915	+	+	+	+	+	5
1916–1940	+	+	+	+	+	5
1941–1965	+	+	+	+	+	5
1966–1990	+	–	–	–	+	2
1991–2015	+	–	–	–	+	2

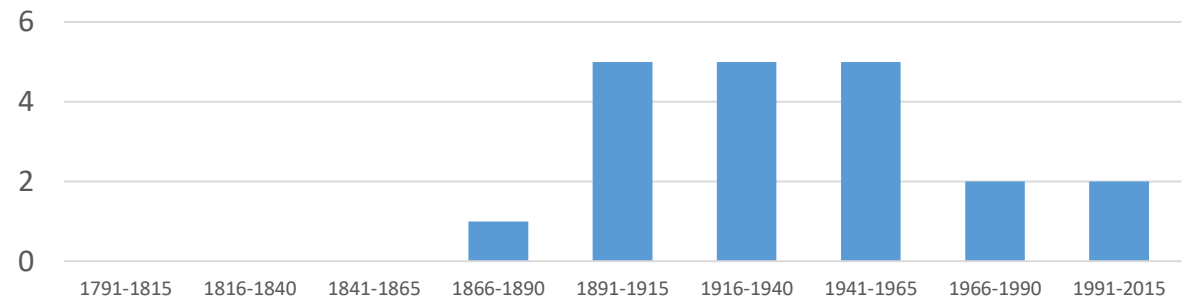
January effect (January exhibits higher returns). At the same time the difference was rather unstable both from the position of the size and statistical significance.

Results of parametrical and non-parametrical statistic tests are presented in Table B 1 (ANOVA analysis), Table B 2 (t-tests) and Table C 1 (Mann-Whitney test). As can be seen the January Effect in the US stock market was observed since 1891 till 1966. But since 70–80-s it is disappeared. These results are confirmed by the trading simulations (Table D 1). Non-random profits were generated from trading based on the Holiday effect (buy at the start of the January and close position at the end of this month) during 1891–1915, 1916–1940, 1941–1965, 1966–1990 and 1991–2015 periods.

Summary of these results are presented in Table 2 and Figure 1.

Overall it can be concluded that the January Effect for a rather long period of time was real statistical anomaly which could be exploited and generated profits from trading. Period 1891–1940 was the time of rise for the January Effect. Looks like the roots of this effect can be found during this period of time. It was undisputed and provided profit opportunities from trading based on this anomaly. Still since 70–80-s this anomaly has disappeared from the US stock market.

As for the possible implications it should be mentioned that results of this study show that the Efficient market hypothesis really fails from time to time. But anyway markets tend to be more efficient during their evolution, moving from less efficient with a number of anomalies to more efficient. From the practical view results indicate that January is still the best month in the US stock market for buying stocks. Trading strategy based on the January effect can generate profits even nowadays and these profits are statistically different from the random trading results.



Note: * scale from 0 to 5, where 0 is total absence of anomaly and 5 is the most convincing presence of anomaly

Figure 1. Evolution of the January effect: case of the US stock market during 1791–2015*

CONCLUSION

In this paper we have examined the January effect (January exhibits higher returns) in the US stock market case over the period 1791–2015 using different methods (average analysis, parametric tests including Student's t-test and ANOVA, non-parametric tests such as the Mann-Whitney tests and trading simulation approach).

The results suggest that the January Effect for a rather long period of time was real statistical anomaly which could be exploited and generated profits from trading. Period 1891–1940 was the time of the rise for the January Effect. It provided profit opportunities from trading based on this anomaly. But since 70–80-s this anomaly has disappeared from the US stock market.

We find evidences against the Efficient market hypothesis. Still anomalies are not eternal. Markets tend to be more efficient during their evolution, moving from less efficient with a number of anomalies to more efficient.

As for the practical implications, trading strategy based on the January effect can generate profits in the US stock market even nowadays and these profits are statistically different from the random trading results.

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APPENDIX A. AVERAGE ANALYSIS

Table A 1. Average returns by months in the US stock market during 1791–2015

Period	All other months	January
1791–1815	–0.03	–0.44
1816–1840	–0.01	–0.06
1841–1865	0.30	–1.47
1866–1890	0.03	0.75
1891–1915	0.12	1.59
1916–1940	–0.12	1.70
1941–1965	0.62	1.81
1966–1990	0.31	1.71
1991–2015	0.57	1.03

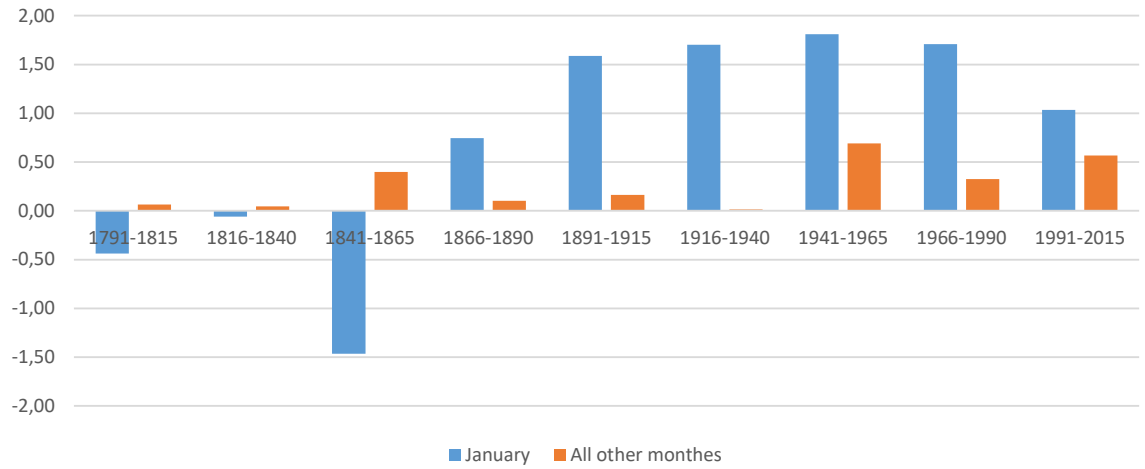

Figure A 1. Average returns by months in the US stock market during 1791–2015

APPENDIX B. PARAMETRIC TESTS

Table B 1. ANOVA test of the January Effect for the US stock market during 1791–2015

Period	F	p-value	F critical	Null hypothesis	Anomaly
1791–1815	0.46	0.50	4.04	not rejected	not confirmed
1816–1840	0.01	0.93	4.04	not rejected	not confirmed
1841–1865	3.06	0.09	4.04	not rejected	not confirmed
1866–1890	1.51	0.23	4.04	not rejected	not confirmed
1891–1915	6.46	0.01	4.04	rejected	confirmed
1916–1940	6.40	0.01	4.04	rejected	confirmed
1941–1965	4.10	0.05	4.04	rejected	confirmed
1966–1990	3.40	0.07	4.04	not rejected	not confirmed
1991–2015	0.53	0.47	4.04	not rejected	not confirmed

Table B 2. T-test of the January Effect for the US stock market during 1791–2015

Period	All other months		January		t-test	Null hypothesis	Anomaly
	aver	sigma	aver	sigma			
1791–1815	–0.03	0.52	–0.44	2.94	–0.69	not rejected	not confirmed
1816–1840	–0.01	0.63	–0.06	2.59	–0.09	not rejected	not confirmed
1841–1865	0.30	1.67	–1.47	4.75	–1.84	not rejected	not confirmed
1866–1890	0.03	1.08	0.75	2.72	1.31	not rejected	not confirmed
1891–1915	0.12	1.43	1.59	2.51	2.88	rejected	confirmed
1916–1940	–0.12	2.33	1.70	2.74	3.21	rejected	confirmed
1941–1965	0.62	1.19	1.81	2.68	2.19	rejected	confirmed
1966–1990	0.31	1.32	1.71	3.56	1.95	not rejected	not confirmed
1991–2015	0.57	1.49	1.03	2.81	0.81	not rejected	not confirmed

APPENDIX C. NON-PARAMETRIC TESTS

Table C 1. Kruskal-Wallis test of the January Effect for the US stock market during 1791–2015

Parameter	Adjusted H	d.f.	P value	Null hypothesis	Anomaly
1791–1815	3.73	1.00	0.05	not rejected	not confirmed
1816–1840	0.00	1.00	0.99	not rejected	not confirmed
1841–1865	4.62	1.00	0.03	rejected	not confirmed
1866–1890	1.77	1.00	0.18	not rejected	not confirmed
1891–1915	6.46	1.00	0.01	rejected	confirmed
1916–1940	3.96	1.00	0.05	rejected	confirmed
1941–1965	4.85	1.00	0.03	rejected	confirmed
1966–1990	3.65	1.00	0.06	not rejected	not confirmed
1991–2015	0.03	1.00	0.87	not rejected	not confirmed

APPENDIX D. TRADING SIMULATION RESULTS

Table D 1. Trading simulation results of the January Effect for the US stock market during 1791–2015

Parameter	Number of succesful trades, %	Profit, %	Profit % per year	t-test	Null Hypothesis	Anomaly
1791–1815	29%	–10.92%	–0.44%	–0.76	not rejected	not confirmed
1816–1840	40%	–1.51%	–0.06%	–0.12	not rejected	not confirmed
1841–1865	16%	–36.66%	–1.47%	–1.57	not rejected	not confirmed
1866–1890	56%	18.65%	0.75%	1.40	not rejected	not confirmed
1891–1915	72%	39.74%	1.59%	3.23	rejected	confirmed
1916–1940	60%	42.56%	1.70%	3.17	rejected	confirmed
1941–1965	80%	45.25%	1.81%	3.45	rejected	confirmed
1966–1990	68%	42.72%	1.71%	2.45	rejected	confirmed
1991–2015	60%	25.85%	1.03%	1.88	rejected	confirmed