

# Halloween Effect in Developed Stock Markets: A US Perspective

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## Abstract

In this paper, we conduct a comprehensive investigation of the Halloween effect evolution in the US stock market over its entire history. We employ various statistical techniques (average analysis, Student's t-test, ANOVA, and the Mann-Whitney test) and the trading simulation approach to analyse the evolution of the Halloween effect. The results suggest that in the US stock market the Halloween effect became more persistent since the middle of the 20<sup>th</sup> century. Despite the decline in its prevalence since that time, nowadays it is still present in the US stock market and provides opportunities to build a trading strategy which can beat the market. These results are well in line with other developed stock markets. Therefore, in the main, our results are inconsistent with the Efficient Market Hypothesis.

**Keywords:** Calendar Anomalies, Halloween Effect, Stock Market, Efficient Market Hypothesis

**JEL Codes:** G12, C63

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# 1 Introduction

[Bouman & Jacobsen \(2002\)](#) observed that every year around May the European press would remark that buyers in stock markets seem to have sold in May and gone away. This was referring to a phenomenon where the month of May would signal the beginning of a bear market, and investors would be better off selling and holding cash. That is, until November when the bull market would return. This phenomenon is known as the Halloween effect.

Essentially, the Halloween effect indicates that returns between November and April are higher than in the other months of the year. [Bouman & Jacobsen \(2002\)](#) notes that this difference in returns cannot be explained by factors such as risk volatility or the January effect, amongst others. Furthermore, these profits were economically exploitable. However, some in the literature suggest that the Halloween effect is a statistical aberration due to, for example, data outliers ([Maberly & Pierce \(2003\)](#), [Maberly & Pierce \(2004\)](#), [Dichtl & Drobetz \(2015\)](#), and [Dichtl & Drobetz \(2014\)](#)), whilst others confirm its continued existence ([Jacobsen & Visaltanachoti \(2009\)](#), [Guo et al. \(2014\)](#), and [Lean \(2011\)](#)), and others suggest that it has since disappeared ([Siriopoulos & Giannopoulou \(2006\)](#)).

If stock markets follow the Efficient Market Hypothesis (EMH), then market anomalies (price, firm-size, and calendar) should not exist at all ([Fama \(1965\)](#), [Fama \(1970\)](#), and [Jensen \(1978\)](#)). In instances where abnormal profits are exploitable, their discovery should result in them disappearing ([Schwert \(2003\)](#)). However, as noted by [Bouman & Jacobsen \(2002\)](#) the Halloween effect does not seem to suffer from Murphy's law and has persisted. Several reasons have been advanced for this in the literature, with the most prominent focusing on psychological and environmental factors underpinning investor behaviour ([Kelly & Meschke \(2010\)](#), [Kamstra et al. \(2003\)](#), [Cao & Wei \(2005\)](#), and [Jacobsen & Marquering \(2008\)](#)).

Several studies focused on the United States (US) stock market. [Bouman & Jacobsen \(2002\)](#) were the first to confirm the existence of the Halloween effect in the US stock market, amongst others. Furthermore, [Bouman & Jacobsen \(2002\)](#) showed that the Halloween effect was economically significant. In another study, [Jacobsen & Visaltanachoti \(2009\)](#) studied the Halloween effect in US sectors and found that in more than two-thirds of these sectors the Halloween effect was statistically significant.

However, [Jacobsen & Visaltanachoti \(2009\)](#) also found differences across sectors, with the Halloween effect absent in consumer sectors, but present in production sectors. Finally, [Jacobsen & Visaltanachoti \(2009\)](#) showed that these differences across sectors could be used to profit from the Halloween effect using sector rotation.

In another US study, [Dichtl & Drobetz \(2015\)](#) using a bootstrap simulation to avoid possible data snooping biases. [Dichtl & Drobetz \(2015\)](#) found that the Halloween effect has weakened in the US, and that inline with [Maberly & Pierce \(2004\)](#), the Halloween effect may have been driven by extreme monthly return observations. However, [Haggard & Witte \(2010\)](#) that the Halloween effect in the US was robust to outliers. Furthermore, [Lucey & Zhao \(2008\)](#) found no evidence of the Halloween effect in the US. [Lucey & Zhao \(2008\)](#) instead found that what was seen as the Halloween effect in the US, was a reflection of the January effect. Therefore, [Lucey & Zhao \(2008\)](#) concluded that the existence of the Halloween effect in the US was uncertain.

More recently, [Jacobsen & Zhang \(2018\)](#) conducted a worldwide study, including the US, of the Halloween effect and found that the Halloween effect was robust. On average, across the world, returns between November to April were 4% higher than for the months of May to October. [Lloyd et al. \(2017\)](#) also found that the Halloween effect was robust in 34 out of 35 countries, including the US. [Arendas et al. \(2018\)](#) focused directly on the US and studied the Halloween effect using data on blue-chip stocks from the Dow Jones Industrial Average between 1980 and 2007. [Arendas et al. \(2018\)](#) found that in 18 out of 35 stocks the Halloween effect was statistically significant, however, the strength of the Halloween effect varied significantly from stock to stock.

Other profitable strategies can coincide or at times be indistinguishable from the Halloween effect. [Afik & Lahav \(2015\)](#) showed that although the is significant in the US, it can easily be outperformed by just holding a market index from the months of March to November each year. [Afik & Lahav \(2015\)](#) show that this strategy persistent for 43 years on the S&P 500 Index, however, they concede that it is difficult to distinguish this effect from the Halloween effect. [Schabek & Castro \(2017\)](#) also showed that strategies starting in October, November and December, also generated abnormal returns. [Schabek & Castro \(2017\)](#) also disputed the finding of [Bouman & Jacobsen \(2002\)](#) and showed that the Halloween effect detected in this study could be subject to sample bias.

In this paper we, therefore, revisit the Halloween effect in the US stock market over its entire history. This is in order to avoid concerns about the validity of some results in the literature caused by, for example, noise and selection biases. To achieve this, we conduct average analysis, Student’s t-tests, Analysis of Variance (ANOVA) tests, Mann-Whitney tests, and trading simulations on the data. Section 2 describes the data and the empirical methodology, and Section 3 presents the empirical results. Lastly, Section 4 offers some concluding remarks.

## 2 Data and Methodology

We use monthly data on various stock markets from the Global Financial Database<sup>1</sup>. That is, the US stock market over the period 1791 to 2015, the UK stock market over the period 1693 to 2017, the Canadian stock market over the period 1915 to 2014, the French stock market over the period 1898 to 2018, the German stock market over the period 1870 to 2018, the Italian stock market over the period 1905 to 2018, the Japanese stock market over the period 1914 to 2013, and the Swiss stock market over the period 1916 to 2015. Table 3 in Appendix A summarises the data. To test the robustness of our results, the analysis is repeated using this data for all these countries. In order to explore the evolution of the Halloween effect, we split the overall samples into 25-year sub-periods. This explains the different end years amongst the eight stock markets. However, the 25-year sub-periods allow for sufficient data for analysis of the dynamics of the evolution of the Halloween effect.

To this end the following hypotheses are tested:

- $H_1$ : The Halloween effect is not a market myth or legend.
- $H_2$ : The Halloween effect evolves over time.
- $H_3$ : The Halloween effect can be exploited to get abnormal profits from trading in the stock market.

We employ average analysis, the Student’s t-test, ANOVA analysis, and the Mann-Whitney test. The average analysis provides preliminary evidence of the difference between the months of November to April and the months of May to October. The parametric and non-parametric tests are carried out on returns which were calculated as follows:

$$R_t = \left( \frac{Close_t}{Close_{t-1}} - 1 \right) \times 100 \quad (1)$$

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<sup>1</sup>The data is available for download at <https://www.globalfinancialdata.com>

where  $R_t$  is the return on the  $t^{th}$  day in percentage,  $Close_t$  is the close price on the  $t^{th}$  day, and  $Close_{t-1}$  is the open price on the  $t - 1^{th}$  day.

Essentially, both the parametric and non-parametric tests test whether returns from the months of November to April and returns from the May to October months are from the same population. A rejection of the null hypothesis, therefore, indicates the presence of a statistical anomaly in a stock market. The Student's t-tests were conducted using a 95% level of confidence and  $N - 1$ <sup>2</sup> degrees of freedom.

To test whether profits on a Halloween effect based trading strategy were exploitable, we use the trading simulation approach. The initial step in the trading simulation approach is to compute the percentage result ( $\%Result$ ) from each deal in the following manner:

$$\%Result = \frac{100 \times P_{open}}{P_{close}} \quad (2)$$

where  $P_{open}$  is the opening price, and  $P_{close}$  is the closing price.

After adding the financial results from all deals, a positive financial result indicates an exploitable stock market anomaly and a negative financial result represents the opposite. T-tests were carried out to ensure that financial results are statistically different from random trading. Since the sub-sample sizes are less than 100, t-tests were carried out instead of z-tests. A rejection of the null hypothesis, that is, the mean of the population were profit can be exploited is not different from that of the population were exploitable profits are equal to zero, indicates that there are advantages to the simulated trading strategy.

The results for the US stock market are presented in Appendix B. We present a summary of the results for the other developed stock markets in Table 2. However, a supplementary Appendix C is available with full results for these markets.

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<sup>2</sup> $N = N_1 + N_2$  in this case.

## 3 Results

### 3.1 Average analysis

The results of the simple average analysis are displayed in Table 4 and Figure 2. Table 4 reveals that the Halloween effect first appeared in the 1841 to 1865 sub-period and continued until the 1891 to 1915 sub-period. However, the differences between the November to April months and the May to October months became more pronounced in the middle of the 20<sup>th</sup> century. This continued until the last sub-period (1991 to 2015), which had the largest difference of all the sub-periods. This difference is clearly demonstrated in Figure 2 which shows the highest ANOVA multiplier<sup>3</sup> in the last sub-period.

### 3.2 Statistical tests

However, the ANOVA analysis (Table 5), the Mann-Whitney test (Table 6), and the t-tests (Table 7) show that these differences were not statistically significant. This is despite the rejection of the null hypothesis in 1991 to 2015 sub-period using the Mann-Whitney test. This suggests that the Halloween effect is a myth in the US stock market.

### 3.3 Trading strategy

Practically, it is interesting to consider how a trading strategy based on the Halloween effect would perform compared to a simple buy and hold strategy. In Table 8 and Figure 3 we show the results of this trading simulation, and these reveal that between 1941 and 2015 the trading strategy based on the Halloween effect generated stable profits and these profits were statistically different from random trading. This is confirmed in Figure 3 which shows that both the percentage of successful trades and the profit percentage increased significantly after 1941. All other periods failed to generate significant trades based on the Halloween effect.

### 3.4 Persistence over time

Is the Halloween effect a recent phenomenon, or has it persisted in the past? The combined effect of the average analysis, statistical tests, and trading simulation

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<sup>3</sup>The ANOVA-multiplier uses the  $\frac{F}{F_{CV}}$  ratio to test for the statistical significance of anomalies, where  $F_{CV}$  is the critical value of the  $F$ -statistic

shows the persistence of the Halloween effect over time. Table 1 shows this combined effect. A higher overall score indicates that the Halloween effect was more prevalent during that period. Clearly, Table 1 shows that the Halloween effect was not expressly persistence in the US stock market.

Table 1: Halloween effect persistence in the US stock market

Period	Average analysis	Students t-test	ANOVA	Mann- Whitney test	Trading simula- tion	Overall
1791-1815	-	-	-	-	-	0
1816-1840	-	-	-	-	-	0
1841-1865	-	-	-	-	-	0
1866-1890	-	-	-	-	-	0
1891-1915	-	-	-	-	-	0
1916-1940	-	-	-	-	-	0
1941-1965	-	-	-	-	+	1
1966-1990	+	-	-	-	+	2
1991-2015	+	-	-	+	+	3

Note: + means the anomaly is present, and - means that it is not present. The Overall column simply counts the number of + with a higher number indicating stronger evidence of the anomaly.

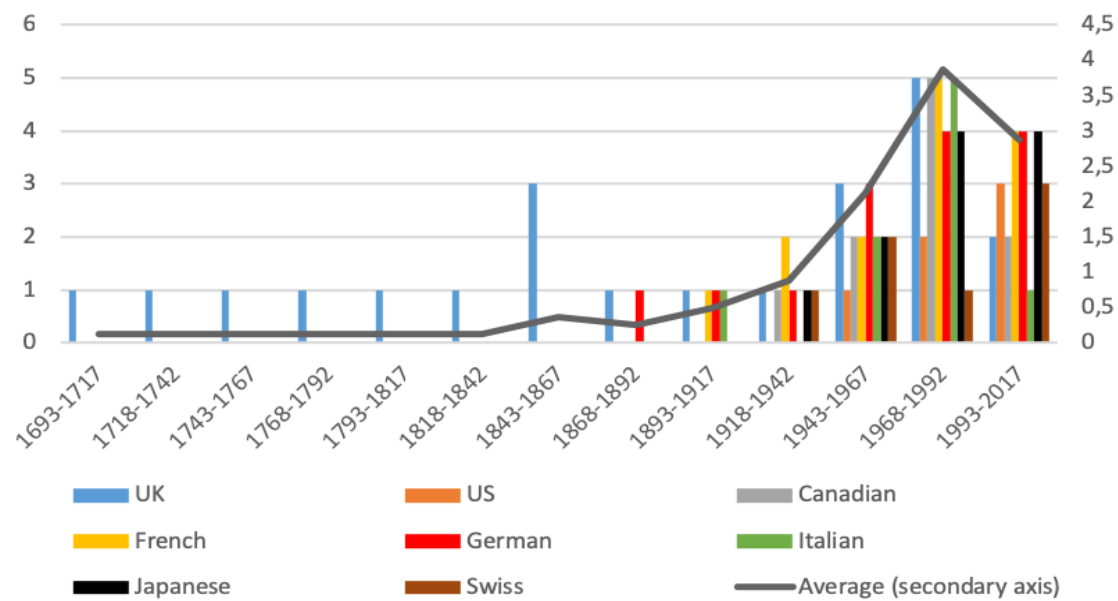
An argument can be made that the Halloween effect is a recent phenomenon in the US stock market. The Halloween effect in the US stock market was present from the 1960s. Interestingly, the Halloween effect only became more and more prevalent after the 1960s. The Halloween effect also allowed for abnormal profit generation since the 1960s and as a result, was detectable.

## 4 Robustness

The persistence of the Halloween effect in the US stock market is well in line with other developed markets. Table 2 shows that the persistence of the Halloween effect in the UK, Canadian, French, German, Italian, Japanese, and Swiss stock markets. In the main, the Halloween effect was absent in most of these markets prior to the middle of the 20<sup>th</sup> century, with the exception of the UK stock market where the Halloween effect briefly appeared between 1843 and 1867, and in the Japanese stock market.

Similar to the US stock market, the persistence of the Halloween effect increased with time. However, in the German and Swiss stock markets, the Halloween effect disappeared in the last sub-period. It is not clear if this suggests that the Halloween effect has disappeared indefinitely from these markets. What is clear is that the Halloween effect is not omnipresent, but has been more persistence since the middle of the middle of the 20<sup>th</sup> century.

Figure 1: Halloween effect in developed stock markets



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

Figure 1 clearly confirms this point. The average overall score for all stock markets, including the US stock market, increases substantially after 1917 and then subsequently begins to slightly decline after 1992. Therefore, our main result is that the US stock market along with other developed markets is not in line with the EMH due to the prevalence of the Halloween effect.

As mentioned earlier, clear explanations for the existence of the Halloween effect remain the subject of debate. However, the fact that the Halloween effect became more persistent during the same period in which significant improvements in the news media available, significant improvements in labour reforms- particularly with vacations, and in data processing ability must be noted.



Table 2: Persistence of the Halloween effect in developed stock market

Period	Average analysis	Students t-test	ANOVA	Mann-Whitney test	Trading simulation	Overall
<b>UK stock market</b>						
1693-1717	+	-	-	-	-	1
1718-1742	+	-	-	-	-	1
1743-1767	+	-	-	-	-	1
1768-1792	+	-	-	-	-	1
1793-1817	+	-	-	-	-	1
1818-1842	+	-	-	-	-	1
1843-1867	+	+	-	-	+	3
1868-1892	+	-	-	-	-	1
1893-1917	+	-	-	-	-	1
1918-1942	-	-	-	-	-	1
1943-1967	+	+	-	-	+	3
1968-1992	+	+	+	+	+	5
1993-2017	+	-	-	-	+	2
<b>Canadian stock market</b>						
1915-1939	+	-	-	-	-	1
1940-1964	+	-	-	+	+	2
1965-1989	+	+	+	+	+	5
1990-2014	+	-	-	-	+	2
<b>French stock market</b>						
1870-1894	+	-	-	-	-	1
1895-1919	+	-	-	-	-	1
1920-1944	+	-	-	-	-	1
1945-1969	+	-	-	+	+	3
1970-1994	+	+	+	-	+	4
1995-2018	+	+	+	-	+	4
<b>German stock market</b>						
1905-1929	+	-	-	-	-	1
1930-1954	-	-	-	-	-	0
1955-1979	+	-	-	-	+	2
1980-2004	+	+	+	+	+	5
2005-2018	+	-	-	-	-	1
<b>Italian stock market</b>						
1870-1894	+	-	-	-	-	1
1895-1919	+	-	-	-	-	1
1920-1944	+	-	-	-	-	1
1945-1969	+	-	-	+	+	3
1970-1994	+	+	+	-	+	4
1995-2018	+	+	+	-	+	4
<b>Japanese stock market</b>						
1905-1929	+	-	-	-	-	1
1930-1954	-	-	-	-	-	0
1955-1979	+	-	-	-	+	2
1980-2004	+	+	+	+	+	5
2005-2018	+	-	-	-	-	1
1916-1940	+	-	-	-	-	1
1941-1965	+	-	-	-	+	2
1966-1990	+	-	-	-	-	1
1991-2015	+	-	-	+	+	3
<b>Swiss stock market</b>						
1905-1929	+	-	-	-	-	1
1930-1954	-	-	-	-	-	0
1955-1979	+	-	-	-	+	2
1980-2004	+	+	+	+	+	5
2005-2018	+	-	-	-	-	1

Note: + means the anomaly is present, and - means that it is not present. The Overall column simply counts the number of + with a higher number indicating stronger evidence of the anomaly.

## 5 Conclusion

In this paper, we examined one of the most recognised calendar anomalies, the Halloween effect, in the US stock market. According to the Halloween effect returns between November and April must have significantly stronger average growth than in other months. This is impossible according to the EMH. To achieve this we utilised average analysis, the Students t-test and ANOVA, the Mann-Whitney test, and the trading simulation approach. The results revealed that in the US stock market the Halloween effect first appeared in the middle of the 20<sup>th</sup> century. However, nowadays the Halloween effect is less prevalent but continues to provide opportunities to build a trading strategy which can beat the market. These results are well in line with other developed markets. Therefore, our results are inconsistent with the EMH. An interesting observation from this study is that the persistence of the Halloween effect in the various stock markets is consistent with the Adaptive Market Hypothesis. What is somewhat controversial is that the period in the middle of the 20<sup>th</sup> in which the Halloween effect was most persistent is, in the literature, thought of as the period when stock markets became more efficient. However, this can be explained by the fact that unlike other the other calendar anomalies, the Halloween effect does not suffer from Murphy's law.

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# Appendices

## A Data

Table 3: Data

Country	Stock Market	Sample Period
US	S&P 500 Index	1791-2015
UK	FTSE All Share Index	1693-2017
Canada	S&P/TSX 300 Composite Index	1898-2018
France	CAC All Tradable Index	1870-2018
Germany	CDAX Composite Index	1870-2018
Italy	Banca Commerciale Italiana Index	1905-2018
Japan	Nikkei 225	1914-2013
Switzerland	Switzerland Composite Stock Price Index	1916-2015

## B Halloween Effect in the US Stock Market

Table 4: Average returns in the US stock market

Period	November to April	May to October
1791-1815	-0.41	-0.04
1816-1840	-0.49	0.32
1841-1865	2.14	-0.49
1866-1890	0.56	0.43
1891-1915	2.71	-0.03
1916-1940	-1.75	2.22
1941-1965	4.92	3.22
1966-1990	4.40	0.34
1991-2015	6.07	0.74

Figure 2: Average returns in the US stock market

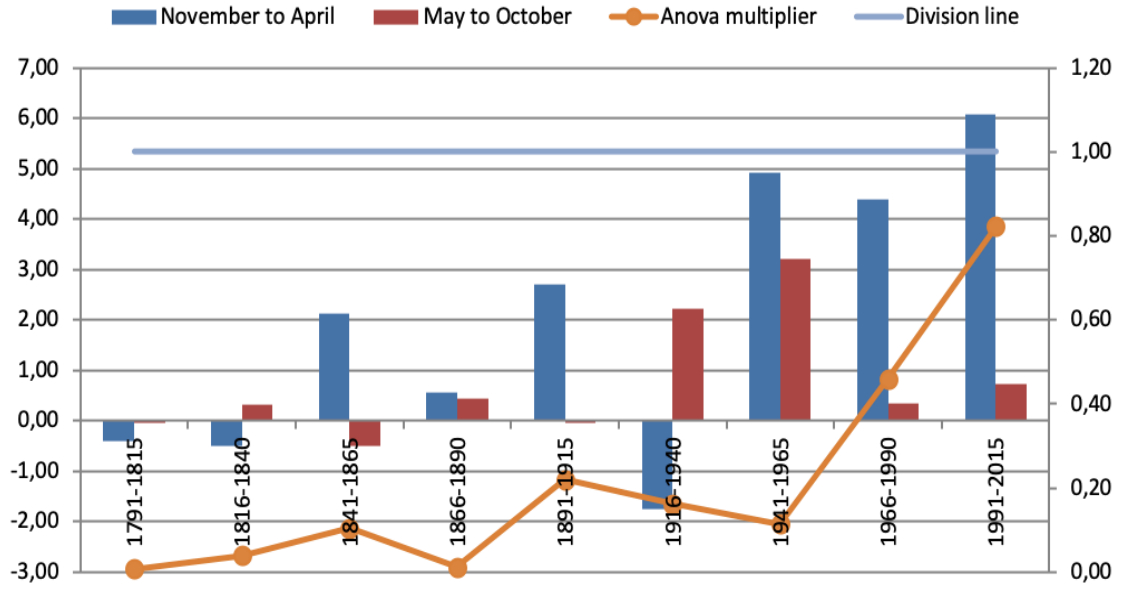


Table 5: ANOVA test of the Halloween effect in the US stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1791-1815	0.03	0.87	4.05	not rejected	not confirmed	0.01
1816-1840	0.16	0.69	4.04	not rejected	not confirmed	0.04
1841-1865	0.42	0.52	4.04	not rejected	not confirmed	0.10
1866-1890	0.05	0.83	4.04	not rejected	not confirmed	0.01
1891-1915	0.89	0.35	4.04	not rejected	not confirmed	0.22
1916-1940	0.66	0.42	4.04	not rejected	not confirmed	0.16
1941-1965	0.46	0.50	4.04	not rejected	not confirmed	0.11
1966-1990	1.86	0.18	4.04	not rejected	not confirmed	0.46
1991-2015	3.33	0.07	4.04	not rejected	not confirmed	0.82

Table 6: Mann-Whitney test of the Halloween effect in the US stock market

Period	Adj. H	d.f.	p- value	Crit. value	Null hypothesis	Anomaly	Kruskall mul- ti- plier
1791-1815	0.65	1	0.42	3.84	not rejected	not confirmed	0.17
1816-1840	1.04	1	0.31	3.84	not rejected	not confirmed	0.27
1841-1865	0.20	1	0.66	3.84	not rejected	not confirmed	0.05
1866-1890	0.00	1	0.95	3.84	not rejected	not confirmed	0.00
1891-1915	0.49	1	0.49	3.84	not rejected	not confirmed	0.13
1916-1940	1.32	1	0.25	3.84	not rejected	not confirmed	0.34
1941-1965	0.14	1	0.71	3.84	not rejected	not confirmed	0.04
1966-1990	1.11	1	0.29	3.84	not rejected	not confirmed	0.29
1991-2015	4.70	1	0.03	3.84	rejected	confirmed	1.22

Table 7: T-test of the Halloween effect in the US stock market

Period	Parameter	November to April	May to October
1791-1815	Mean,%	-0.41	-0.04
	t-criterion	-0.29	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1816-1840	Mean,%	-0.49	0.32
	t-criterion	-0.46	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1841-1865	Mean,%	2.14	-0.49
	t-criterion	0.61	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1866-1890	Mean,%	0.56	0.43
	t-criterion	0.05	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1891-1915	Mean,%	2.71	-0.03
	t-criterion	0.94	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1916-1940	Mean,%	-1.75	2.22
	t-criterion	-0.79	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1941-1965	Mean,%	4.92	3.22
	t-criterion	0.60	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1966-1990	Mean,%	4.40	0.34
	t-criterion	1.37	
	Null hypothesis	not rejected	
	Anomaly	not detected	

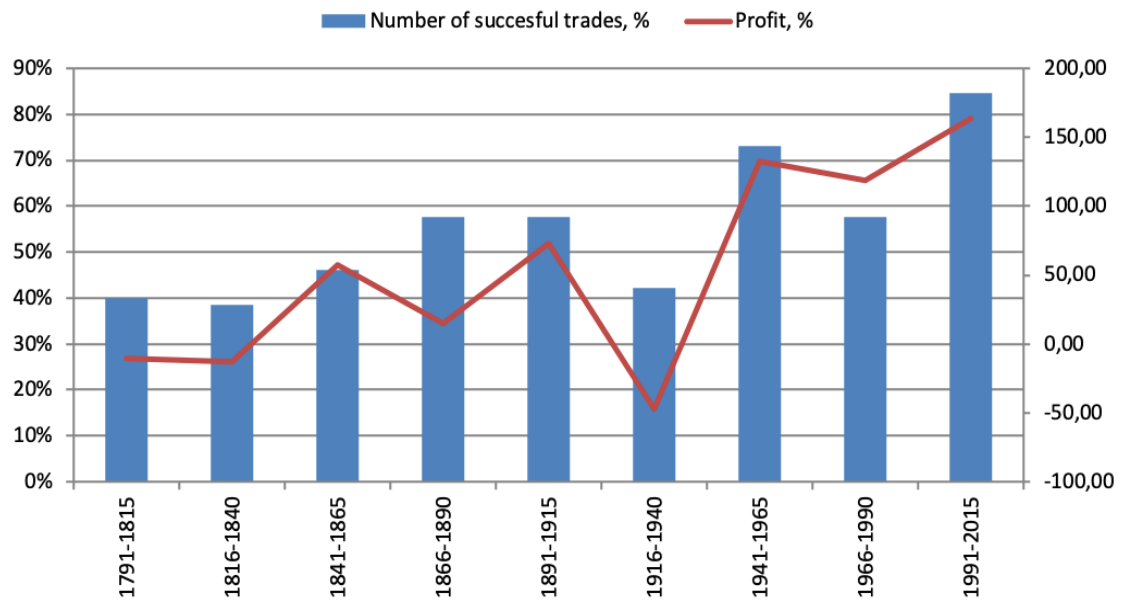


1991-2015	Mean,%	6.07	0.74
	t-criterion	1.72	
	Null hypothesis	not rejected	
	Anomaly	not detected	

Table 8: Trading simulation results of the Halloween effect in the US stock market

Period	Number of trades, units	Number of suc- cessful trades, unit	Number of suc- cessful trades, %	Profit, %	Profit % per year	t-test	Result
1791-1815	25	10	0.4	-10.70	-0.43	- 0.48	failed
1816-1840	26	10	0.38	-13.29	-0.53	-0.44	failed
1841-1865	26	12	0.46	57.75	2.31	0.89	failed
1866-1890	26	15	0.58	15.01	0.60	0.37	failed
1891-1915	26	15	0.58	73.09	2.92	1.44	failed
1916-1940	26	11	0.42	-47.16	-1.89	-0.63	failed
1941-1965	26	19	0.73	132.84	5.31	2.61	passed
1966-1990	26	15	0.58	118.90	4.76	2.22	passed
1991-2015	26	22	0.85	163.99	6.56	3.61	passed

Figure 3: Trading simulation results of the Halloween effect in the US stock market



## C Supplementary Appendices

### C.1 Halloween Effect in the UK Stock Market

Table 9: Average returns in the UK stock market

Period	November to April	May to October
1693-1717	0.65	-1.45
1718-1742	2.18	-3.06
1743-1767	0.50	0.33
1768-1792	0.77	-1.34
1793-1817	0.53	-1.11
1818-1842	2.04	-2.66
1843-1867	2.27	-1.28
1868-1892	0.70	0.06
1893-1917	1.07	-1.01
1918-1942	-0.14	1.21
1943-1967	3.53	-6.04
1968-1992	11.16	-2.27
1993-2017	4.52	-0.47

Figure 4: Average returns in the UK stock market

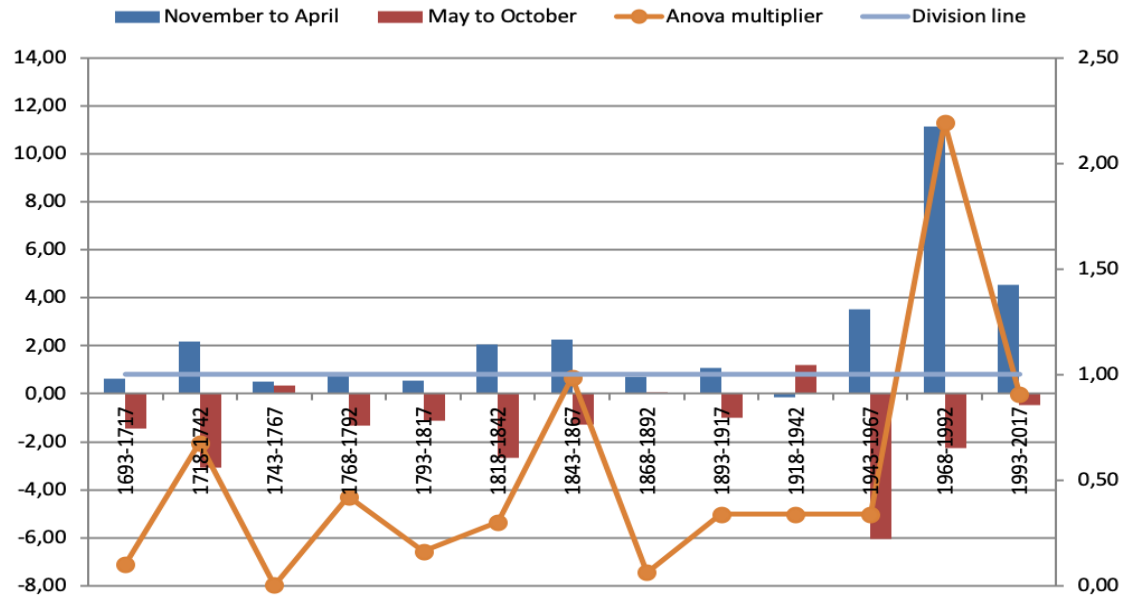


Table 10: ANOVA test of the Halloween effect in the UK stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1693-1717	0.41	0.53	4.04	not rejected	not confirmed	0.10
1718-1742	2.73	0.10	4.04	not rejected	not confirmed	0.68
1743-1767	0.01	0.92	4.04	not rejected	not confirmed	0.00
1768-1792	1.71	0.20	4.04	not rejected	not confirmed	0.42
1793-1817	0.66	0.42	4.04	not rejected	not confirmed	0.16
1818-1842	1.22	0.27	4.05	not rejected	not confirmed	0.30
1843-1867	3.99	0.05	4.05	not rejected	not confirmed	0.99
1868-1892	0.25	0.62	4.04	not rejected	not confirmed	0.06
1893-1917	1.37	0.25	4.05	not rejected	not confirmed	0.34
1918-1942	1.37	0.25	4.05	not rejected	not confirmed	0.34
1943-1967	1.37	0.25	4.05	not rejected	not confirmed	0.34
1968-1992	8.86	0.00	4.04	rejected	confirmed	2.19
1993-2017	3.67	0.06	4.04	not rejected	not confirmed	0.91

Table 11: Mann-Whitney test of the Halloween effect in the UK stock market

Period	Adj. H	d.f.	p- value	Crit. value	Null hypothesis	Anomaly	Kruskall mul- ti- plier
1693-1717	0.19	1	0.66	3.84	not rejected	not confirmed	0.05
1718-1742	3.36	1	0.07	3.84	not rejected	not confirmed	0.88
1743-1767	0.00	1	0.99	3.84	not rejected	not confirmed	0.00
1768-1792	3.22	1	0.07	3.84	not rejected	not confirmed	0.84
1793-1817	1.04	1	0.31	3.84	not rejected	not confirmed	0.27
1818-1842	2.56	1	0.11	3.84	not rejected	not confirmed	0.67
1843-1867	3.39	1	0.07	3.84	not rejected	not confirmed	0.88
1868-1892	0.01	1	0.93	3.84	not rejected	not confirmed	0.00
1893-1917	2.93	1	0.09	3.84	not rejected	not confirmed	0.76
1918-1942	0.13	1	0.72	3.84	not rejected	not confirmed	0.03
1943-1967	0.63	1	0.43	3.84	not rejected	not confirmed	0.16
1968-1992	9.20	1	0.00	3.84	rejected	confirmed	2.40
1993-2017	2.00	1	0.16	3.84	not rejected	not confirmed	0.52

Table 12: T-test of the Halloween effect in the UK stock market

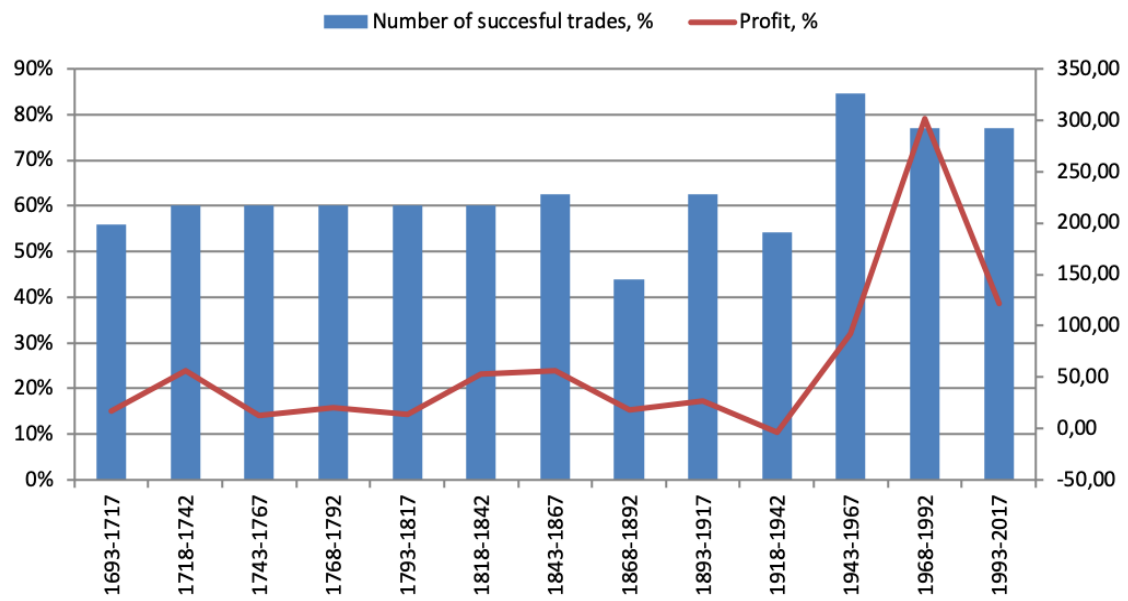
Period	Parameter	November to April	May to October
1693-1717	Mean,%	0.65	-1.45
	t-criterion	0.62	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1718-1742	Mean,%	2.18	-3.06
	t-criterion	1.59	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1743-1767	Mean,%	0.50	0.33
	t-criterion	0.10	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1768-1792	Mean,%	0.77	-1.34
	t-criterion	1.26	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1793-1817	Mean,%	0.53	-1.11
	t-criterion	0.78	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1818-1842	Mean,%	2.04	-2.66
	t-criterion	1.08	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1843-1867	Mean,%	2.27	-1.28
	t-criterion	1.92	
	Null hypothesis	rejected	
	Anomaly	detected	
1868-1892	Mean,%	0.70	0.06
	t-criterion	0.48	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1893-1917	Mean,%	1.07	-1.01
	t-criterion	1.63	
	Null hypothesis	not rejected	
	Anomaly	not detected	

1918-1942	Mean, %	-0.14	1.21
	t-criterion	-0.47	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1943-1967	Mean, %	3.53	-6.04
	t-criterion	2.08	
	Null hypothesis	rejected	
	Anomaly	detected	
1968-1992	Mean, %	11.16	-2.27
	t-criterion	2.90	
	Null hypothesis	rejected	
	Anomaly	detected	
1993-2017	Mean, %	4.52	-0.47
	t-criterion	1.79	
	Null hypothesis	not rejected	
	Anomaly	not detected	

Table 13: Trading simulation results of the Halloween effect in the UK stock market

Period	Number of trades, units	Number of suc- cessful trades, unit	Number of suc- cessful trades, %	Profit, %	Profit % per year	t-test	Result
1693-1717	25	14	0.56	16.84	0.67	0.35	failed
1718-1742	25	15	0.6	56.77	2.27	0.85	failed
1743-1767	25	15	0.6	12.95	0.52	0.48	failed
1768-1792	25	15	0.6	19.97	0.80	0.65	failed
1793-1817	25	15	0.6	13.85	0.55	0.54	failed
1818-1842	25	15	0.6	53.06	2.12	0.53	failed
1843-1867	24	15	0.63	56.65	2.27	1.88	passed
1868-1892	25	11	0.44	18.10	0.72	0.67	failed
1893-1917	24	15	0.63	26.64	1.07	1.48	failed
1918-1942	24	13	0.54	-3.41	-0.14	-0.08	failed
1943-1967	26	22	0.85	92.58	3.70	2.64	passed
1968-1992	26	20	0.77	301.19	12.05	3.44	passed
1993-2017	26	20	0.77	122.15	4.89	3.50	passed

Figure 5: Trading simulation results of the Halloween effect in the UK stock market





## C.2 Halloween Effect in the Canadian Stock Market

Table 14: Average returns in the Canadian stock market

Period	November to April	May to October
1915-1939	2.42	-0.28
1940-1964	4.72	0.77
1965-1989	7.21	-1.57
1990-2014	4.68	0.16

Figure 6: Average returns in the Canadian stock market

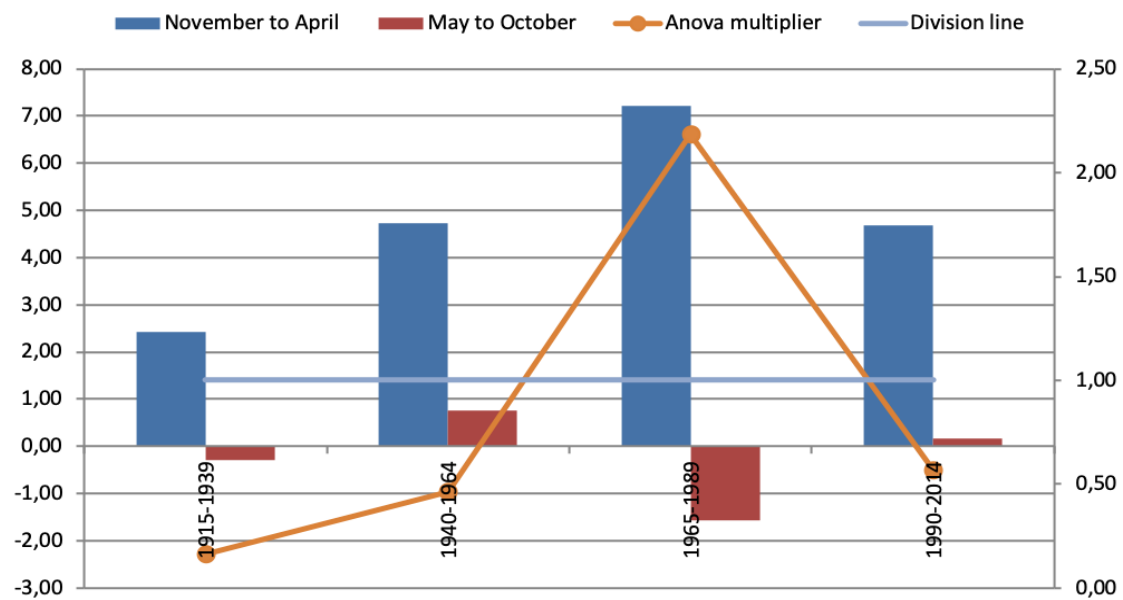


Table 15: ANOVA test of the Halloween effect in the Canadian stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1915-1939	0.66	0.42	4.04	not rejected	not confirmed	0.16
1940-1964	1.88	0.18	4.04	not rejected	not confirmed	0.46
1965-1989	8.84	0.00	4.04	rejected	confirmed	2.19
1990-2014	2.29	0.14	4.04	not rejected	not confirmed	0.57

Table 16: Mann-Whitney test of the Halloween effect in the Canadian stock market

Period	Adj. H	d.f.	p-value	Crit. value	Null hypothesis	Anomaly	Kruskall multiplier
1915-1939	0.05	1	0.82	3.84	not rejected	not confirmed	0.01
1940-1964	1.04	1	0.31	3.84	not rejected	not confirmed	0.27
1965-1989	8.42	1	0.00	3.84	rejected	confirmed	2.19
1990-2014	1.32	1	0.25	3.84	not rejected	not confirmed	0.34

Table 17: T-test of the Halloween effect in the Canadian stock market

Period	Parameter	November to April	May to October
1915-1939	Mean,%	2.42	-0.28
	t-criterion	0.72	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1940-1964	Mean,%	4.72	0.77
	t-criterion	1.29	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1965-1989	Mean,%	7.21	-1.57
	t-criterion	2.83	
	Null hypothesis	rejected	
	Anomaly	detected	
1990-2014	Mean,%	4.68	0.16
	t-criterion	1.42	
	Null hypothesis	not rejected	
	Anomaly	not detected	

Table 18: Trading simulation results of the Halloween effect in the Canadian stock market

Period	Number of trades, units	Number of successful trades, unit	Number of successful trades, %	Profit, %	Profit % per year	t-test	Result
1915-1939	26	15	0.58	65.35	6.54	1.34	failed
1940-1964	26	18	0.69	127.51	12.8	2.42	passed
1965-1989	26	21	0.81	194.63	19.46	3.50	passed
1990-2014	26	20	0.77	126.24	12.62	2.56	passed

Figure 7: Trading simulation results of the Halloween effect in the Canadian stock market



### C.3 Halloween Effect in the French Stock Market

Table 19: Average returns in the French stock market

Period	November to April	May to October
1898-1922	2.45	0.14
1923-1947	6.42	2.85
1948-1972	4.93	1.70
1973-1997	10.63	-2.51
1998-2018	6.19	-2.60

Figure 8: Average returns in the French stock market

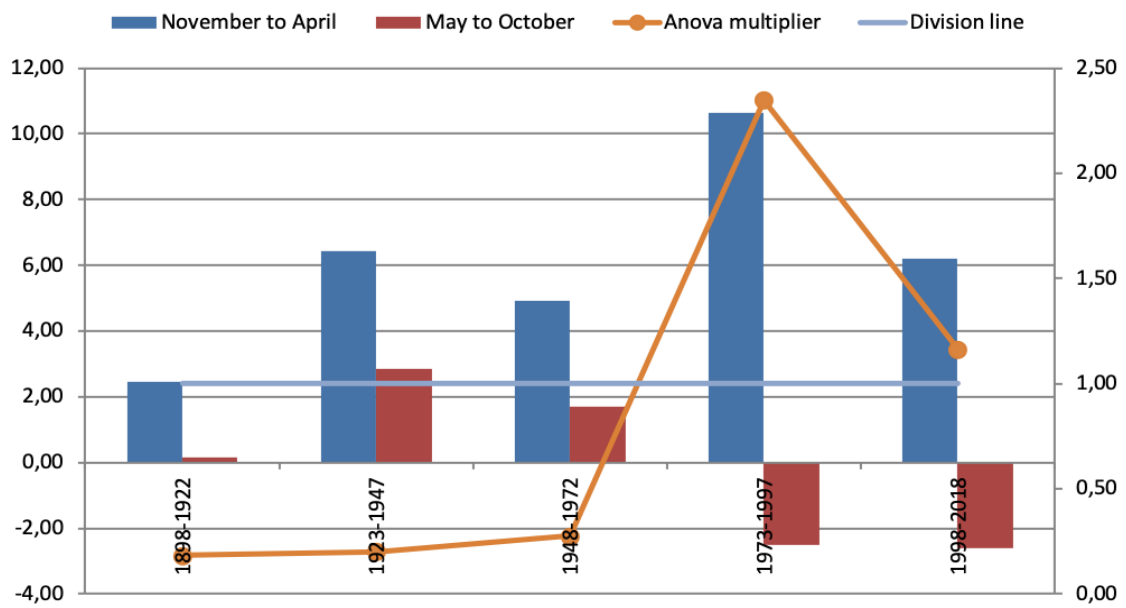


Table 20: ANOVA test of the Halloween effect in the French stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1898-1922	0.74	0.39	4.04	not rejected	not confirmed	0.18
1923-1947	0.81	0.37	4.04	not rejected	not confirmed	0.20
1948-1972	1.11	0.30	4.04	not rejected	not confirmed	0.28
1973-1997	9.49	0.00	4.04	rejected	confirmed	2.35
1998-2018	4.75	0.04	4.08	rejected	confirmed	1.16

Table 21: Mann-Whitney test of the Halloween effect in the French stock market

Period	Adj. H	d.f.	p-value	Crit. value	Null hypothesis	Anomaly	Kruskall multiplier
1898-1922	1.04	1	0.31	3.84	not rejected	not confirmed	0.27
1923-1947	0.49	1	0.49	3.84	not rejected	not confirmed	0.13
1948-1972	0.82	1	0.37	3.84	not rejected	not confirmed	0.21
1973-1997	8.20	1	0.00	3.84	rejected	confirmed	2.14
1998-2018	3.61	1	0.06	3.84	not rejected	not confirmed	0.94

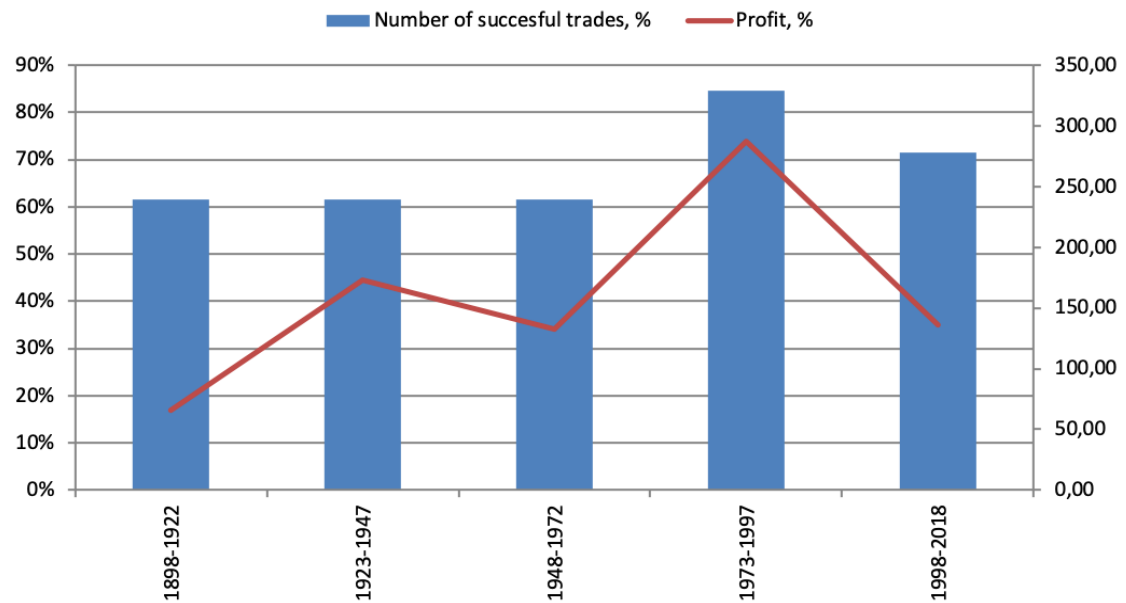
Table 22: T-test of the Halloween effect in the French stock market

Period	Parameter	November to April	May to October
1898-1922	Mean, %	2.45	0.14
	t-criterion	0.89	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1923-1947	Mean, %	6.42	2.85
	t-criterion	0.80	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1948-1972	Mean, %	4.93	1.70
	t-criterion	0.89	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1973-1997	Mean, %	10.63	-2.51
	t-criterion	3.00	
	Null hypothesis	rejected	
	Anomaly	detected	
1998-2018	Mean, %	6.19	-2.60
	t-criterion	2.08	
	Null hypothesis	rejected	
	Anomaly	detected	

Table 23: Trading simulation results of the Halloween effect in the French stock market

Period	Number of trades, units	Number of suc- cessful trades, unit	Number of suc- cessful trades, %	Profit, %	Profit % per year	t-test	Result
1898-1922	26	16	0.62	66.20	6.6	1.70	failed
1923-1947	26	16	0.62	173.32	17.33	2.22	passed
1948-1972	26	16	0.62	133.00	13.30	1.89	passed
1973-1997	26	22	0.85	286.91	28.69	3.85	passed
1998-2018	21	15	0.71	136.15	13.62	2.54	passed

Figure 9: Trading simulation results of the Halloween effect in the French stock market





## C.4 Halloween Effect in the German Stock Market

Table 24: Average returns in the German stock market

Period	November to April	May to October
1870-1894	-0.38	1.98
1895-1919	-2.79	-2.81
1920-1944	8.52	-4.39
1945-1969	5.39	0.80
1970-1994	5.60	-1.58
1995-2018	7.27	-2.10

Figure 10: Average returns in the German stock market

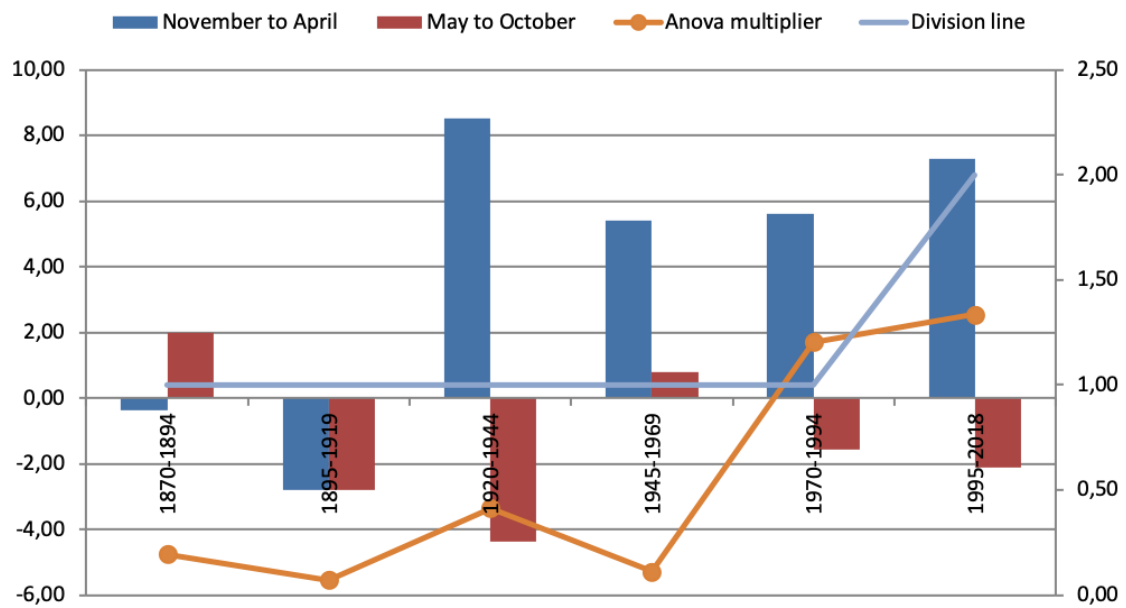


Table 25: ANOVA test of the Halloween effect in the German stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1870-1894	0.79	0.38	4.05	not rejected	not confirmed	0.20
1895-1919	0.29	0.59	4.04	not rejected	not confirmed	0.07
1920-1944	1.67	0.20	4.04	not rejected	not confirmed	0.41
1945-1969	0.45	0.50	4.04	not rejected	not confirmed	0.11
1970-1994	4.87	0.03	4.04	rejected	confirmed	1.21
1995-2018	5.41	0.02	4.05	rejected	confirmed	1.34

Table 26: Mann-Whitney test of the Halloween effect in the German stock market

Period	Adj. H	d.f.	p-value	Crit. value	Null hypothesis	Anomaly	Kruskall multiplier
1870-1894	0.74	1	0.39	3.84	not rejected	not confirmed	0.19
1895-1919	0.28	1	0.60	3.84	not rejected	not confirmed	0.07
1920-1944	3.20	1	0.07	3.84	not rejected	not confirmed	0.83
1945-1969	0.00	1	0.95	3.84	rejected	confirmed	0.00
1970-1994	5.46	1	0.02	3.84	not rejected	not confirmed	1.42
1995-2018	4.78	1	0.03	3.84	not rejected	not confirmed	1.24

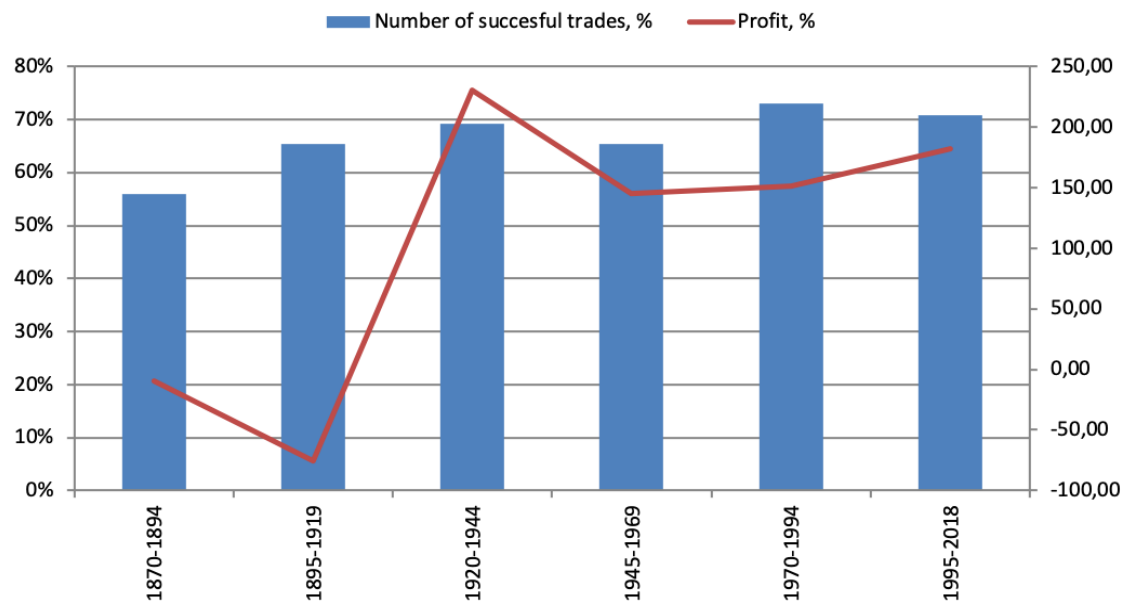
Table 27: T-test of the Halloween effect in the German stock market

Period	Parameter	November to April	May to October
1870-1894	Mean,%	-0.38	1.98
	t-criterion	-0.85	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1895-1919	Mean,%	-2.79	-2.81
	t-criterion	0.00	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1920-1944	Mean,%	8.52	-4.39
	t-criterion	1.22	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1945-1969	Mean,%	5.39	0.80
	t-criterion	0.63	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1970-1994	Mean,%	5.60	-1.58
	t-criterion	2.10	
	Null hypothesis	rejected	
	Anomaly	detected	
1995-2018	Mean,%	7.27	-2.10
	t-criterion	2.23	
	Null hypothesis	rejected	
	Anomaly	detected	

Table 28: Trading simulation results of the Halloween effect in the German stock market

Period	Number of trades, units	Number of successful trades, unit	Number of successful trades, %	Profit, %	Profit % per year	t-test	Result
1870-1894	25	14	0.56	-9.93	-0.40	- 0.22	failed
1895-1919	26	17	0.65	-75.23	-3.01	-0.93	failed
1920-1944	26	18	0.69	230.08	9.20	1.70	failed
1945-1969	26	17	0.65	145.51	5.82	2.77	passed
1970-1994	26	19	0.73	151.21	6.05	2.72	passed
1995-2018	24	17	0.71	181.78	7.27	3.01	passed

Figure 11: Trading simulation results of the Halloween effect in the German stock market



## C.5 Halloween Effect in the Italian Stock Market

Table 29: Average returns in the Italian stock market

Period	November to April	May to October
1905-1929	1.43	-3.37
1930-1954	6.35	6.32
1955-1979	1.97	-1.11
1980-2004	14.09	-3.54
2005-2018	2.92	-3.90

Figure 12: Average returns in the Italian stock market

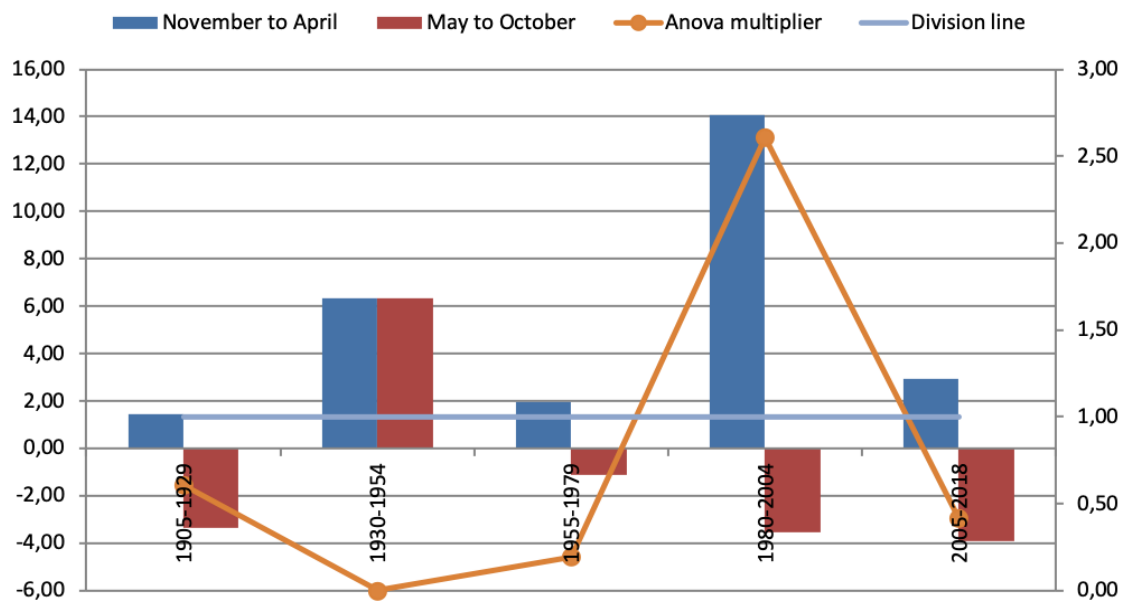


Table 30: ANOVA test of the Halloween effect in the Italian stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1905-1929	2.46	0.12	4.04	not rejected	not confirmed	0.61
1930-1954	0.00	0.99	4.04	not rejected	not confirmed	0.00
1955-1979	0.78	0.38	4.04	not rejected	not confirmed	0.19
1980-2004	10.55	0.00	4.04	rejected	confirmed	2.61
2005-2018	1.75	0.20	4.23	not rejected	not confirmed	0.42

Table 31: Mann-Whitney test of the Halloween effect in the Italian stock market

Period	Adj. H	d.f.	p-value	Crit. value	Null hypothesis	Anomaly	Kruskall multiplier
1905-1929	2.11	1	0.15	3.84	not rejected	not confirmed	0.55
1930-1954	1.41	1	0.24	3.84	not rejected	not confirmed	0.37
1955-1979	0.24	1	0.62	3.84	not rejected	not confirmed	0.06
1980-2004	11.38	1	0.00	3.84	rejected	confirmed	2.96
2005-2018	1.66	1	0.20	3.84	not rejected	not confirmed	0.43

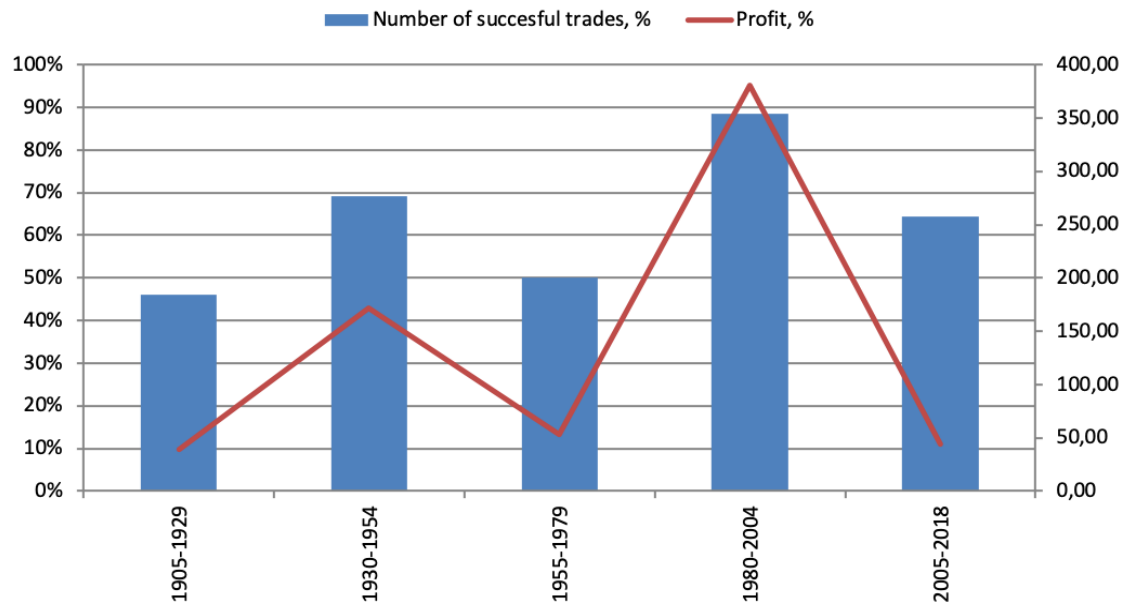
Table 32: T-test of the Halloween effect in the Italian stock market

Period	Parameter	November to April	May to October
1905-1929	Mean,%	1.43	-3.37
	t-criterion	1.46	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1930-1954	Mean,%	6.35	6.32
	t-criterion	0.00	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1955-1979	Mean,%	1.97	-1.11
	t-criterion	0.79	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1980-2004	Mean,%	14.09	-3.54
	t-criterion	3.12	
	Null hypothesis	rejected	
	Anomaly	detected	
2005-2018	Mean,%	2.92	-3.90
	t-criterion	1.24	
	Null hypothesis	not rejected	
	Anomaly	not detected	

Table 33: Trading simulation results of the Halloween effect in the Italian stock market

Period	Number of trades, units	Number of successful trades, unit	Number of successful trades, %	Profit, %	Profit % per year	t-test	Result
1905-1929	26	12	0.46	38.57	3.86	0.76	failed
1930-1954	26	18	0.69	171.49	17.15	1.19	failed
1955-1979	26	13	0.5	53.19	5.32	2.04	passed
1980-2004	26	23	0.88	380.40	38.04	4.54	passed
2005-2018	14	9	0.64	43.76	4.38	0.78	failed

Figure 13: Trading simulation results of the Halloween effect in the Italian stock market





## C.6 Halloween Effect in the Japanese Stock Market

Table 34: Average returns in the Japanese stock market

Period	November to April	May to October
1914-1938	3.09	-1.62
1939-1963	11.20	2.19
1964-1988	9.62	1.95
1989-2013	3.53	-6.04

Figure 14: Average returns in the Japanese stock market

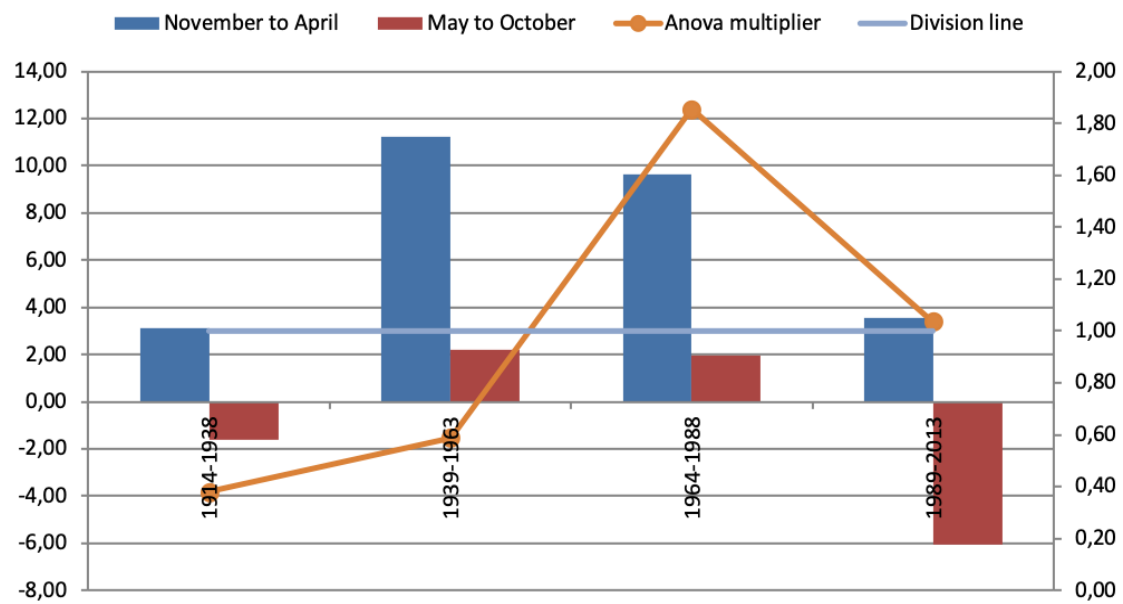


Table 35: ANOVA test of the Halloween effect in the Japanese stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1914-1938	1.53	0.22	4.05	not rejected	not confirmed	0.38
1939-1963	2.37	0.13	4.04	not rejected	not confirmed	0.59
1964-1988	7.50	0.01	4.04	rejected	confirmed	1.86
1989-2013	4.19	0.05	4.04	rejected	confirmed	1.04

Table 36: Mann-Whitney test of the Halloween effect in the Japanese stock market

Period	Adj. H	d.f.	p-value	Crit. value	Null hypothesis	Anomaly	Kruskall multiplier
1914-1938	2.50	1	0.11	3.84	not rejected	not confirmed	0.65
1939-1963	1.41	1	0.24	3.84	not rejected	not confirmed	0.37
1964-1988	6.86	1	0.01	3.84	not rejected	not confirmed	1.79
1989-2013	4.86	1	0.03	3.84	rejected	confirmed	1.27

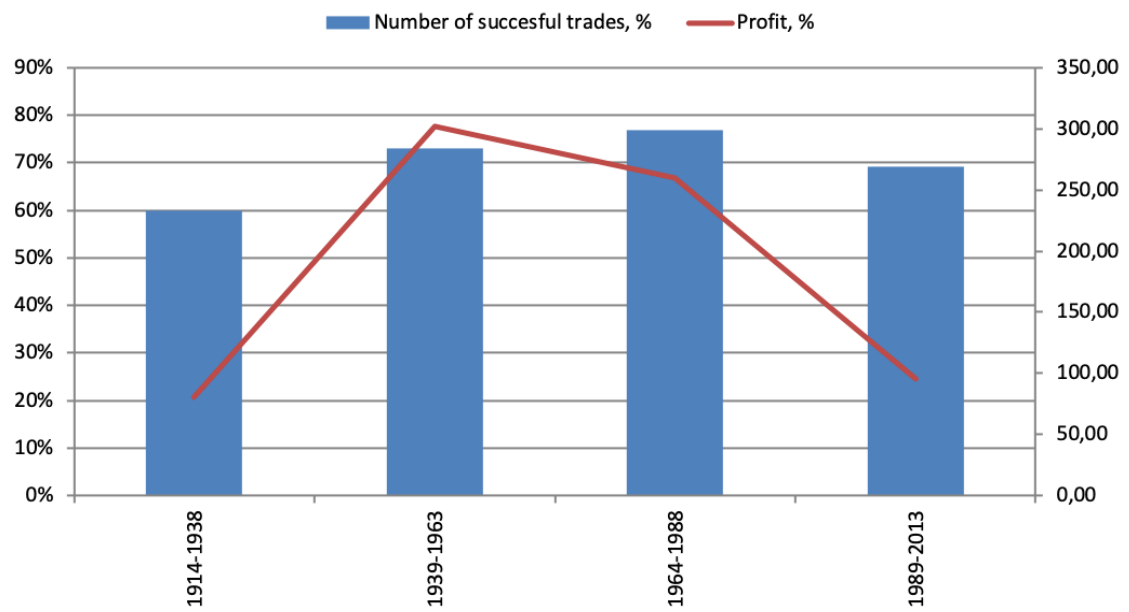
Table 37: T-test of the Halloween effect in the Japanese stock market

Period	Parameter	November to April	May to October
1914-1938	Mean,%	3.09	-1.62
	t-criterion	1.14	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1939-1963	Mean,%	11.20	2.19
	t-criterion	1.38	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1964-1988	Mean,%	9.62	1.95
	t-criterion	2.66	
	Null hypothesis	rejected	
	Anomaly	detected	
1989-2013	Mean,%	3.53	-6.04
	t-criterion	2.08	
	Null hypothesis	rejected	
	Anomaly	detected	

Table 38: Trading simulation results of the Halloween effect in the Japanese stock market

Period	Number of trades, units	Number of successful trades, unit	Number of successful trades, %	Profit, %	Profit % per year	t-test	Result
1914-1938	25	15	0.6	80.43	3.22	1.12	failed
1939-1963	26	19	0.73	302.47	12.10	2.20	passed
1964-1988	26	20	0.77	259.62	10.38	4.85	passed
1989-2013	26	18	0.69	95.36	3.81	1.16	failed

Figure 15: Trading simulation results of the Halloween effect in the Japanese stock market



## C.7 Halloween Effect in the Swiss Stock Market

Table 39: Average returns in the Swiss stock market

Period	November to April	May to October
1916-1940	1.42	-2.68
1941-1965	3.80	1.18
1966-1990	3.81	-0.91
1991-2015	6.05	0.18

Figure 16: Average returns in the Swiss stock market during

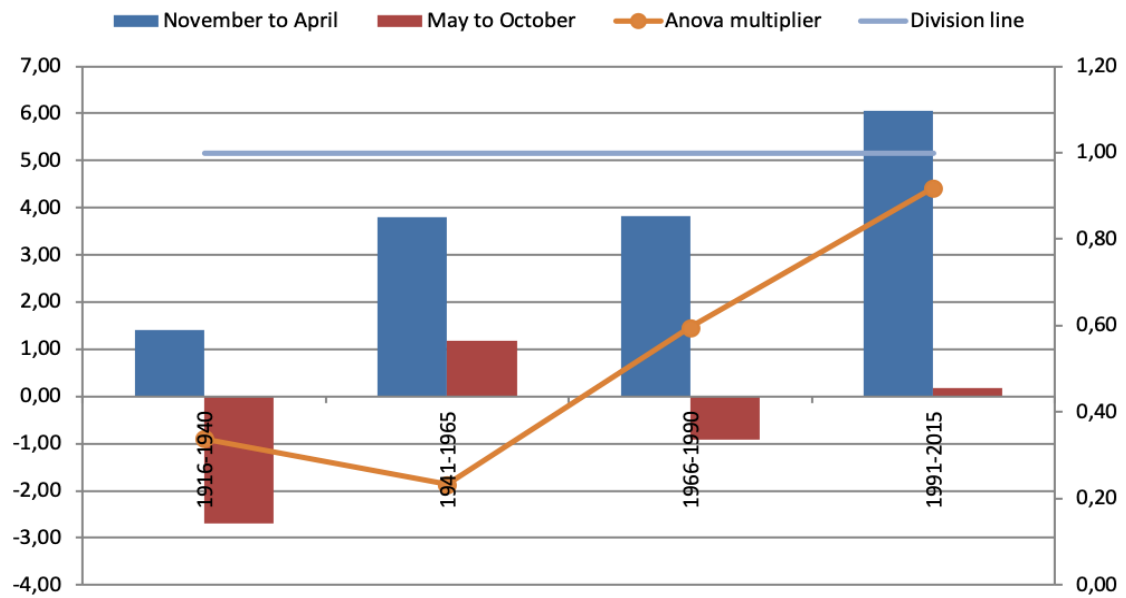


Table 40: ANOVA test of the Halloween effect in the Swiss stock market

Period	F	p-value	F critical	Null hypothesis	Anomaly	Anova multiplier
1916-1940	1.37	0.25	4.05	not rejected	not confirmed	0.34
1941-1965	0.94	0.34	4.04	not rejected	not confirmed	0.23
1966-1990	2.41	0.13	4.04	not rejected	not confirmed	0.60
1991-2015	3.72	0.06	4.04	not rejected	not confirmed	0.92

Table 41: Mann-Whitney test of the Halloween effect in the Swiss stock market

Period	Adj. H	d.f.	p-value	Crit. value	Null hypothesis	Anomaly	Kruskall multiplier
1916-1940	1.54	1	0.21	3.84	not rejected	not confirmed	0.40
1941-1965	0.51	1	0.47	3.84	not rejected	not confirmed	0.13
1966-1990	1.79	1	0.18	3.84	not rejected	not confirmed	0.47
1991-2015	2.88	1	0.09	3.84	rejected	confirmed	0.75

Table 42: T-test of the Halloween effect in the Swiss stock market

Period	Parameter	November to April	May to October
1916-1940	Mean,%	1.42	-2.68
	t-criterion	1.13	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1941-1965	Mean,%	3.80	1.18
	t-criterion	0.84	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1966-1990	Mean,%	3.81	-0.91
	t-criterion	1.45	
	Null hypothesis	not rejected	
	Anomaly	not detected	
1991-2015	Mean,%	6.05	0.18
	t-criterion	1.70	
	Null hypothesis	not rejected	
	Anomaly	not detected	

Table 43: Trading simulation results of the Halloween effect in the Swiss stock market

Period	Number of trades, units	Number of successful trades, unit	Number of successful trades, %	Profit, %	Profit % per year	t-test	Result
1916-1940	24	15	0.63	35.43	3.54	0.78	failed
1941-1965	26	18	0.69	102.61	10.26	2.50	passed
1966-1990	26	15	0.58	102.92	10.29	1.64	failed
1991-2015	26	21	0.81	163.38	16.34	2.92	passed

Figure 17: Trading simulation results of the Halloween effect in the Swiss stock market

