Time series analysis of KOSPI 200 Data with Halloween Effect

BAT51701: Time Series Analysis

Gorup 8

Namgyu Lee / 20226009

Heejin Kim / 20226021

Namwoo Kwon / 20236002

Keonwoo Lee / 20236003

Ulsan National Institute of Science and Technology

2023

1. SUMMARY

This study investigates the presence of the 'Halloween Effect' in the South Korean stock market, focusing on the KOSPI 200 index. The 'Halloween Effect' refers to a phenomenon in stock markets where returns are relatively higher during the winter months (November to April). Utilizing KOSPI 200 index data from 1990 to 2023, this research analyzes the variability and average returns during different periods. Statistical methods and time-series analysis are employed to assess the consistency and economic significance of this phenomenon. Furthermore, the impact of global economic conditions, domestic policy changes, and market structural factors on this effect are examined. This study is expected to provide insights into the seasonal patterns of the Korean stock market and offer significant implications for investors.

2. INTRODUCTION

2.1. SEASONALITY

Seasonality refers to patterns or tendencies that recur at specific times. In the stock market, seasonality denotes the phenomenon where stock price movements exhibit consistent patterns during certain periods. These patterns can arise due to a variety of external factors, including economic cycles, political events, and social events. Understanding seasonality is crucial for predicting market trends and developing more effective investment strategies.

In the stock market, seasonality can manifest in various forms. Examples include the 'Halloween Effect,' 'January Effect,' and 'Month-End Effect.' These patterns provide important insights for investors in formulating long-term investment strategies. Seasonality is influenced by factors such as economic cycles, financial reporting schedules, and political events.

2.2. HALLOWEEN EFFECT

The Halloween Effect refers to the tendency of stock markets to yield higher returns during a specific period, namely from November to April of the following year. This phenomenon has been observed in various national stock markets and presents results that differ from traditional investment theories.

Country	Index	period	May-October	November to April	Market return
Average			**0.04%**	**8.37%**	**8.38%**
Canada	S&P/TSX Comp	1970.1 ~ 2017.4	-0.23%	6.19%	5.94%
China	Shanghai Comp	1991.1 ~ 2017.4	0.57%	13.33%	13.97%
France	CAC 40	1987.7 ~ 2017.4	-3.33%	7.95%	4.35%
Germany	DAX 30 TR	1970.1 ~ 2017.4	-1.15%	7.77%	6.53%
Hong Kong	Hang Seng	1970.1 ~ 2017.4	3.94%	7.02%	11.24%
India	Nifty 50	1990.7 ~ 2017.4	6.40%	7.13%	13.98%
Japan	Nikkei 225	1970.1 ~ 2017.4	-2.71%	7.36%	4.45%
Korea	KOSPI	1980.1 ~ 2017.4	0.39%	8.18%	8.60%
Taiwan	TWSE / TAIEX	1970.1 ~ 2017.4	-3.73%	14.18%	9.92%
UK	FTSE 100	1984.1 ~ 2017.4	0.46%	6.62%	6.13%
USA	S&P 500	1970.1 ~ 2017.4	0.75%	6.30%	7.10%

[Table 1 : Halloween effect on global stock markets]

Understanding this phenomenon is crucial for investors. If the Halloween Effect indeed exists, it could provide essential guidelines for developing investment strategies based on market seasonal variability. Additionally, the existence of this effect could challenge conventional financial theories, such as the Efficient Market Hypothesis.

3. DATA OVERVIEW

3.1. KOSPI 200

The data we will analyze is the KOSPI 200. The KOSPI 200 index is a representation of the market capitalization of 200 leading companies in Korea, and it is indexed. The index is announced by the Korea Exchange (KRX) every second for stock index futures and options trading. The selection criteria for the constituent stocks include market representativeness, liquidity, and sector representation (nine sectors). Stocks with high market capitalization and trading volume among all listed stocks are chosen.

The KOSPI index was created by focusing on market representation, liquidity, and sector representation (9 sectors) to select stocks with high market capitalization and high trading volume among all listed stocks. The KOSPI index was created because it was deemed difficult to achieve market representativeness with too many constituent stocks in the KOSPI index. Although it accounts for only 20% of the total number of listed stocks, it represents 70% of the total market capitalization of all listed stocks, aligning with the movement of the comprehensive stock price index.

3.2. DATASET

Firstly, the data for this analysis was extracted from a platform called investing.com, which specializes in analyzing financial data and market trends. The KOPI200 dataset consists of 7 columns, including monthly closing price, opening price, high price, low price, trading volume, and volatility data, and comprises 406 rows spanning from February 1, 1990, to November 1, 2023. For the Halloween Effect analysis, we utilized only the date and closing price. Since the Halloween Effect involves the cumulative impact of returns over time, we transformed the data into logarithmic returns for analysis.

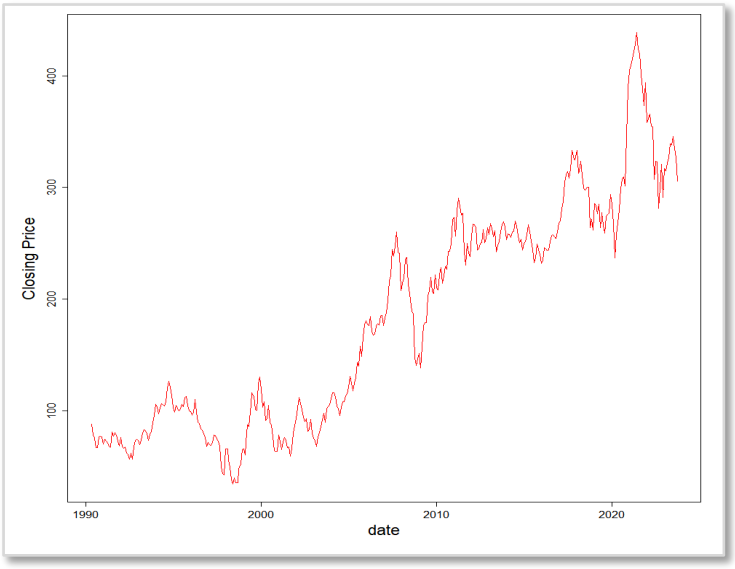
4. RESEARCH GOALS

The research objective is to validate the presence of the Halloween Effect in the KOSPI 200 market. Additionally, we aim to investigate whether the KOSPI 200 exhibits macro trends or seasonality. Through this analysis, we will assess whether consideration of the Halloween Effect is warranted in stock investment decisions for Korean Investors.

5. EDA

The plot on the below depicts the Closing Price of KOSPI 200 from 1990 to 2023. When observed over the long term, the data exhibits an overall upward trend.

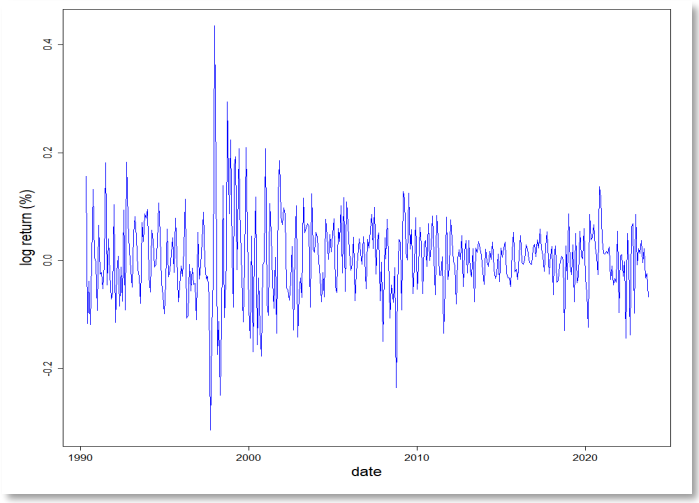
However, there are periods of significant volatility driven by specific events. Notably, a substantial volatility is observed around the year 1997, marked by the IMF economic crisis. Another period of notable volatility occurred in 2008, marked by the financial crisis represented by the collapse of Lehman Brothers. Lastly, a very significant volatility, visually the most pronounced, is evident around the year 2020, marked by the outbreak of the COVID-19 pandemic.



[Table 2 : The Closing Price of KOSPI 200(1990-2023)]

Let's examine KOSPI 200 from the perspective of returns. The plot on the below represents the logarithmic return plot of KOSPI 200 as mentioned earlier. Log return is calculated taking compounding effects over time into account and, as it follows a normal distribution, is generally considered more appropriate for analyzing long-term data compared to simple return.

While the below plot exhibits short-term volatility, but it does not exhibit a specific trend when viewed over the long term.



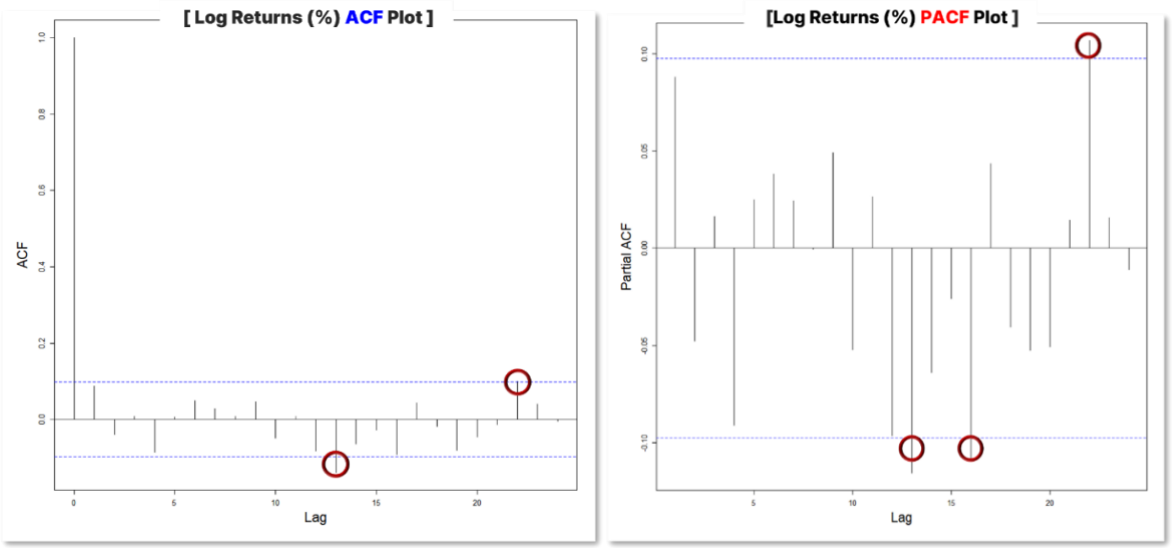
[Table 3 : Log Return Plot of KOSPI200(1990-2023)]

Mean	Median	Min	Max	Standard Deviation	Skewness	Excess Kurtosis
0	0	-0.31	0.44	0.08	0.39	0.69

[Table 4 : Statistic of Log Return Plot]

Statistically, the plot has a mean of 0 and shows small standard deviation of 0.08. Skewness is 0.39 which means a slightly right-skewed shape and Excess Kurtosis is 0.69 which indicates a distribution slightly more peaked than a normal distribution. However, it is challenging to consider these levels as extreme.

To check the stationarity of the data, we examined the ACF and PACF plots. While some lag values in both the ACF and PACF plots exceed the confidence interval, there does not appear to be any specific pattern or seasonality. Further data analysis seems to be necessary to determine whether these anomalies are coincidental or significant.



[Table 5 : ACF & PACF Plot]

To check whether there is Unit root or not. we conducted the Augmented Dickey-Fuller (ADF) test. The ADF test is performed to assess the stationarity of time series data. The null hypothesis is that the time series data has a unit root and is non-stationary, while the alternative hypothesis suggests that the time series data does not have a unit root and is stationary.

Null Hypothesis (H0)

The time series data contains a unit root, implying that it is non-stationary.

Alternative Hypothesis (Ha)

The time series data does not contain a unit root, indicating that it is stationary.

The results of the ADF test indicate that the Dickey-Fuller value is -4.867, which is very low. Additionally, the p-value is 0.01. Therefore, we can reject the null hypothesis, concluding that the time series data is stationary.

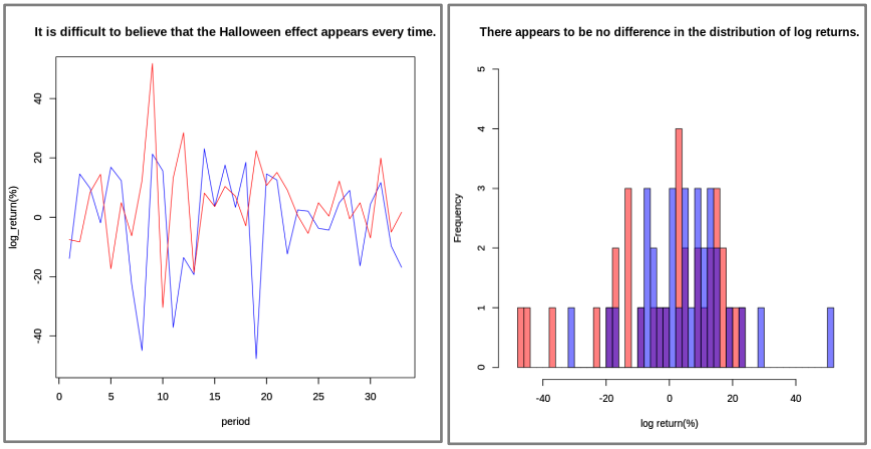
Dickey-Fuller	Lag order	P-value
-4.867	24	0.01

[Table 6 : ADF TEST Result]

So far, we have examined the ACF and PACF plots as well as conducted the ADF test on the Log Return data. From the visual inspection of the data, it appears to be stationary and devoid of seasonality.

6. ANALYSIS RESULT

The returns from November to April, when the Halloween effect is observed, and the returns from May to October, when the Halloween effect is not observed, were compared annually in the KOSPI200 from May 1990 to April 2023. Looking at the line graph and histogram in Table 7, the returns from November to April are in red, and the returns from May to October are in blue. Returns from November to April do not clearly outperform those from May to October.



<Table 7 : Halloween effect comparison graph 1>

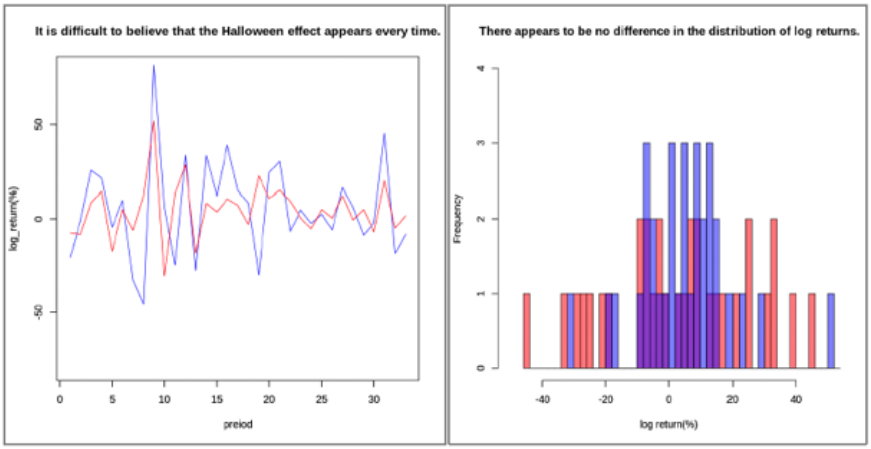
However, looking at Table 8, the geometric mean, maximum return, and minimum return from November to April are better than those from May to October. Therefore, we performed a t-test to see whether the return from November to April minus the return from May to October was greater than 0. This tests whether the average return from November to April is greater than the average return from May to October. As a result, the p-value is greater than the significance level of 0.05, so the null hypothesis is accepted, so it cannot be said that the returns are on average greater than the returns from May to October.

May ~ October					
Period	G.Mean	St. Dev	Skew	Max	Min
1-year	0.966	0.185	-0.876	0.231	-0.476
November ~ April					
1-year	1.037	0.147	0.510	0.518	-0.304

Statistics	Value
T-statistic	1.478
P-value	0.07

<Table 8 : Halloween effect return statistics 1>

From May 1990 to April 2023, we compared the returns each year between investing in the KOSPI 200 using the Halloween effect and investing in the KOSPI 200 in general. Looking at the line graph and histogram in Table 9, investments made using the Halloween effect are displayed in red, and investments made in general in the KOSPI 200 are displayed in blue. Investing in the KOSPI 200 using the Halloween effect certainly does not exceed the rate of return of investing in the KOSPI 200 in general.



<Table 9 : Halloween effect comparison graph 2>

Even if we compare the geometric mean return, maximum return, and minimum return of the two investment strategies, we can see that it is difficult to clearly say which investment strategy is better. And as a result of the t-test, at the confidence level of 95%, the p value is greater than

the significance level, so it cannot be said that it is better to adopt the null hypothesis and apply the Halloween effect to invest in KOSPI 200.

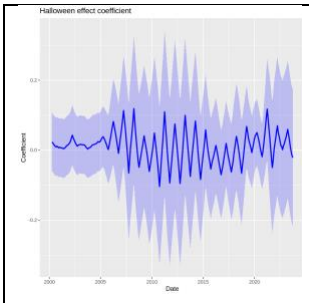
May ~ October					
Period	G.Mean	St. Dev	Skew	Max	Min
1-year	0.966	0.185	-0.876	0.231	-0.476
November ~ April					
1-year	1.037	0.147	0.510	0.518	-0.304

Statistics	Value
T-statistic	1.478
P-value	0.07

<Table 10 : Halloween effect return statistics 2>

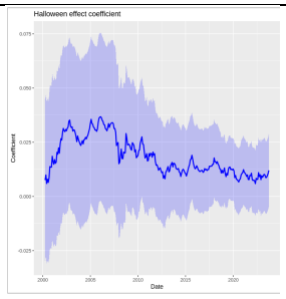
We analyzed the Halloween effect using a linear regression model, similar to the paper <The Halloween indicator, “Sell in May and Go Away”: Everywhere and all the time> that introduced the Halloween effect. Whether or not it falls within the period in which the Halloween effect appears was set as a dummy variable, and the monthly log return for that month was set as the dependent variable. And we checked the coefficient of the dummy variable every 10 years in the data from May 1990 to April 2023. If the Halloween effect is large in KOSPI 200, the coefficient of the dummy variable should have a large positive value, but if you look at the line graph in Table 10, you can see that it does not have a large positive value and sometimes has a negative value. And when all data from May 1990 to April 2023 are used in the linear regression model, the coefficient of the dummy variable has a low positive value of 0.015.

And we set the dependent variable of the linear regression model to the monthly continuous compound rate of return as in the paper and checked the coefficient of the dummy variable. Looking at the line graph in table 11, the coefficient of the dummy variable shows a consistently low positive value every 10 years. And when all data is used, the coefficient of the dummy variable has a very low positive value of 0.0065, but the p-value is higher than 0.05, so it cannot be considered a significant result at the 95% confidence level.



[Train a model with full data]

Statistics	Value
n	22
alpha	-0.004
P-value (alpha)	0.4591
beta	0.015
p-value (beta)	0.0468



Statistics	Value
n	402
alpha	1.933
P-value (alpha)	0.000
beta	0.0065
p-value (beta)	0.951

<Table 11: Halloween effect Dummy Variable’s Coefficient >

7. CONCLUSION

We tried various statistical analysis methods to determine whether the Halloween effect appears in the KOSPI 200, but the Halloween effect was not found to be significant in all analyses. This may be due to the unique characteristics of the Korean financial market. One of the reasons why the Halloween effect occurs is that events that stimulate consumer spending, such as Halloween Day, Singles' Day, Black Friday, and Christmas, are concentrated from November to April. However, the representative companies that make up the KOSPI 200 are mainly B2B rather than B2C, so they do not have much to do with promoting consumption by individual consumers. And even if companies announce good performance at the end of the year, the performance may not be returned to shareholders in the name of Korea Discount. Therefore, we recommend not applying the Halloween effect when investing in the KOSPI 200 Index. Not only does the Halloween effect strategy not show significant performance in the KOSPI 200, but applying the Halloween effect may result in higher commissions than existing strategies.