Time Series Analysis of

KOSPI 200 data with Halloween Effect



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GRADUATE SCHOOL OF INTERDISCIPLINARY MANAGEMENT

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Contents



- Introduction(NAMGYU LEE)
- Data overview (KEONWOO LEE)
- Research goals(KEONWOO LEE)
- EDA (HEEJIN KIM)
- Analysis result(NAMWOO KWON)
- Conclusion (NAMWOO KWON)

Introduction Backgroud of Study

Ջ Seasonality Definition

'Seasonality' refers to the phenomenon where a certain pattern appears in the rate of return or trading volume of the financial market depending on a specific time or season

[Example of Seasonality]

① Month-End Effect ② Day-Of-the-Week Effect ③ Overnight Strategy ④ Luch Effect

Mathematical Properties The Importance of seasonality

- ☑ It plays an important role in helping investors predict market trends and establish strategies
- ☑ The Halloween effect is the most well-known example of seasonality

炒 What is Halloween Effect?

- ☑ The Halloween effect is a theory that returns in the stock market from November to April are relatively higher than other periods
- ☑ The concept was initially seen as a type of private investment strategy, but later gained academic attention

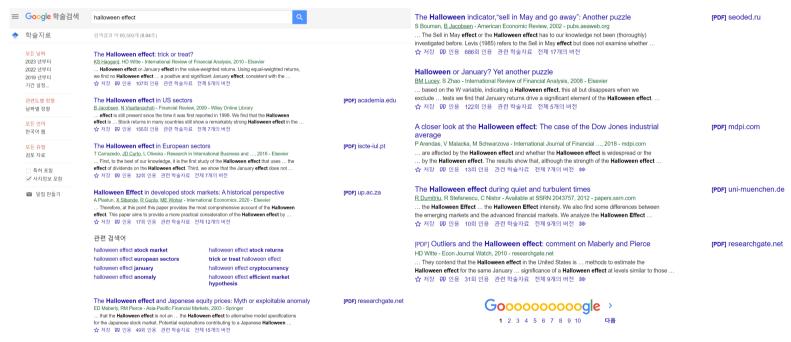
Int

Introduction

Current State of Research

☆ Global research trends

☑ Using Google Scholar, approximately 20 pages of research materials, with 18 entries per page



National research trends

- ☑ Unable to find scholarly articles on the subject
- ☑ However, sector-specific existence of the effect has been suggested through analyses found in economic blogs and newspaper articles

Introduction Current State of Research

Solution Example of Halloween effect analysis in global stock markets

* Source: seasonax.com

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%

Data Overview KOSPI 200

☆ Why KOSPI 200?

☑ The best-known which comprises the 200 largest publicly-traded common stocks traded in Korea, tracking roughly 70% of the market value of the overall Korean Stock Exchange(Large Capital Stocks)

[KOSPI 200 Composition]

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원대금보비스						
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Data Overview Dataset

Ջ Dataset Configuration

- ☑ Consists of KOSPI 200 data from February 1, 1990 to November 1, 2023(406 rows)
- ☑ Using the date and closing price portion of the dataset
- ☑ Analyze using log returns : Suitable for analyzing the cumulative effect of returns over time

[KOSPI 200 Dataset]

* Source: investing.com

날짜	종가	시가	고가	저가	거래량	변동 %
2023-11-01	334.23	307.55	335.53	307.35	80.86M	9.38%
2023-10-01	305.56	322.61	329.06	305.14	2.03B	-6.47%
2023-09-01	326.71	334.11	346.29	324.73	1.89B	-2.40%
2023-08-01	334.75	347.35	351.23	325.74	2.67B	-3.15%
2023-07-01	345.62	340.26	347.18	330.33	3.28B	2.27%
2023-06-01	337.95	338.36	348.18	335.04	2.47B	-0.35%
2023-05-01	339.12	326.99	342.51	321.61	2.11B	3.88%
2023-04-01	326.46	323.18	335.77	317.78	3.43B	1.38%
2023-03-01	322.03	315.3	322.54	304.63	2.79B	2.30%
2023-02-01	314.8	320.54	326.73	311.63	2.51B	-0.78%
2023-01-01	317.26	292.9	329.71	284.32	2.35B	8.99%
2022-12-01	291.1	325.37	325.49	291.1	2.29B	-9.31%
2022-11-01	321	300.53	324.73	297.62	3.52B	7.15%
2022-10-01	299.58	286.25	300.05	282.04	2.36B	6.48%
2022-09-01	281.36	318.74	319.37	278.39	2.63B	-12.88%
2022-08-01	322.96	322.14	333.47	315.48	2.91B	-0.11%
2022-07-01	323.31	308.72	325.83	300.82	2.42B	5.24%
2022-06-01	307.2	352.29	353.93	304.13	3.05B	-13.35%

날짜	종가	시가	고가	저가	거래량	변동 %
1990-02-01	94.06	96.66	96.77	90.87	109.95M	-3.85%
1990-03-01	92.1	96.53	96.53	89.96	142.58M	-2.08%
1990-04-01	74.93	91.77	91.77	74.93	106.94M	-18.64%
1990-05-01	87.67	78.24	87.67	78.24	146.07M	17.00%
1990-06-01	78.05	88.39	89.69	78.05	111.95M	-10.97%
1990-07-01	75.17	78.83	82.36	74.67	81.05M	-3.69%
1990-08-01	66.76	76.47	76.47	64.42	119.44M	-11.19%
1990-09-01	66.88	67.04	69.94	62.26	98.71M	0.18%
1990-10-01	76.32	69.3	88.04	68.3	200.81M	14.11%
1990-11-01	76.82	79.38	79.84	74.05	190.24M	0.66%
1990-12-01	76.61	78.11	80.86	76.26	149.48M	-0.27%
1991-01-01	69.82	74.65	76.77	67.33	131.05M	-8.86%
1991-02-01	74.61	69.48	76.47	69.1	135.89M	6.86%
1991-03-01	72.81	74.87	75.52	71.59	136.87M	-2.41%
1991-04-01	71.24	71.71	72.2	68.11	82.66M	-2.16%
1991-05-01	67.61	71.21	72.13	67.61	81.62M	-5.10%
1991-06-01	67.24	67.76	67.94	65.48	67.38M	-0.55%
1991-07-01	80.6	68.66	83.01	67.15	333.23M	19.87%

Goals Research goals

Research Procedure

- ✓ Verifying the existence of the Halloween effect through a 6-step process
- ☑ We will analyze it through EDA and statistical analysis without any modeling or prediction process

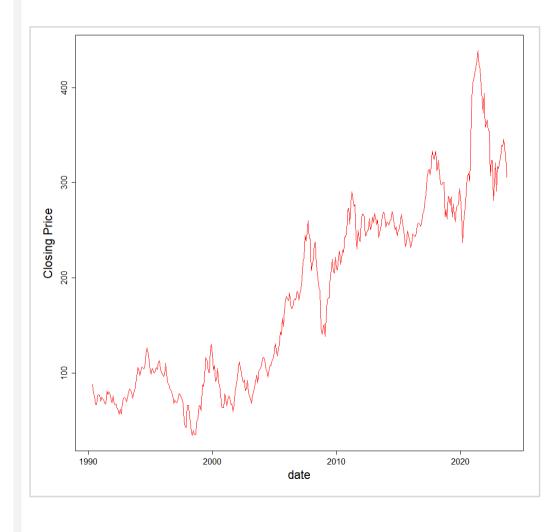


Research Goals

- ☑ This study will verify the existence of the Halloween effect in the KOSPI 200 market
- ☑ To figure out KOSPI 200 has macro-scaled trend or seasonality or not
- ☑ Review whether you should consider the Halloween effect when investing in stocks

IV EDA Closing Price

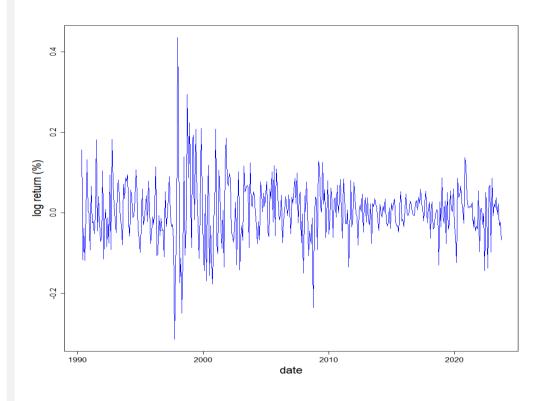
☆ KOSPI 200 Index Closing Price



- ☑ Data exhibits a long-term upward trend
- ☑ There are periods of **significant volatility** triggered by specific events

IV EDA Log Returns

★ KOSPI 200 Index Log Returns (%)



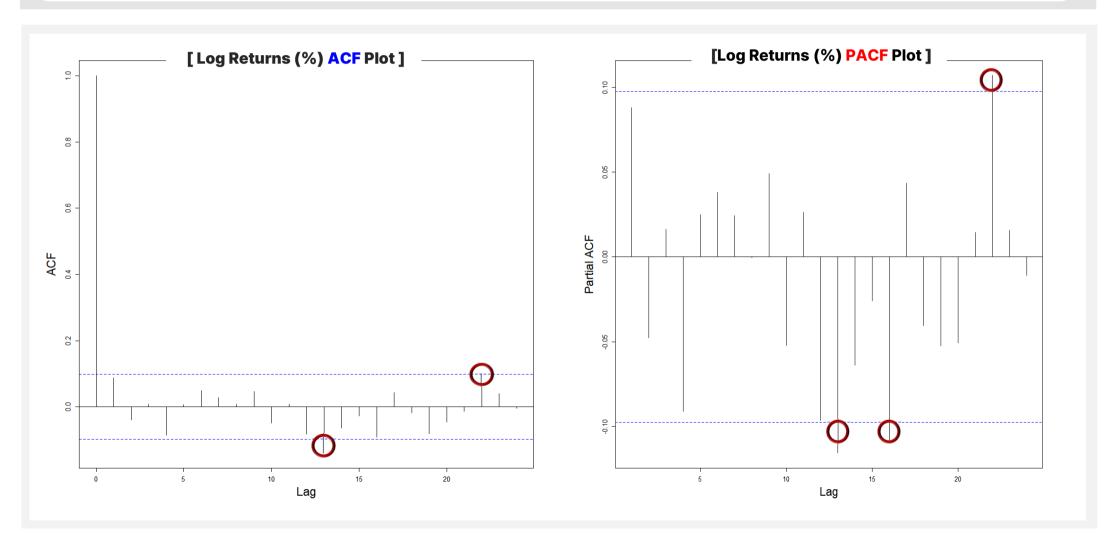
- ✓ Log Returns (%) generally are more suitable for statistical analysis than Simple Returns due to their properties of compounding and normal distribution
- ☑ Plot shows short-term fluctuations, but does not show a specific trend in the long term.

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

☑ Statistics shows distribution with a mean of 0,
a small standard deviation, and a slight rightward
skewness, showing a slightly leptokurtic distribution

IV EDA Normality review

To determine whether certain lags observed in the ACF and PACF are merely coincidental or represent significant components, further analysis is required





Since the p-value is 0.01, we can reject the null hypothesis and accept H1 that the KOSPI 200 Log Returns(%) Data is stationary

[Unit Root Test]

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

✓ Null Hypothesis (H0)

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

✓ Alternative Hypothesis (H1)

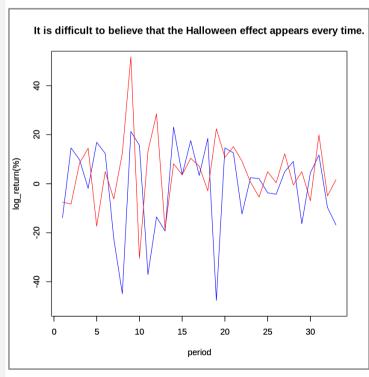
The time series data does not contain a unit root, indicating that it is stationary.

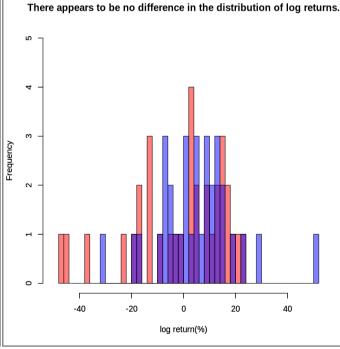
So far, We have not detected seasonality in the ACF and PACF plots, nor through the ADF test.

Is the Halloween effect truly present?

Although the t-test says there is no Halloween effect, it shows that investing only from November to April is better in terms of average, maximum, and minimum returns

May ~ October VS November ~ April (1990.05 ~ 2023.04)





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

H0: RNov2Apr - RMay2Oct≥ 0

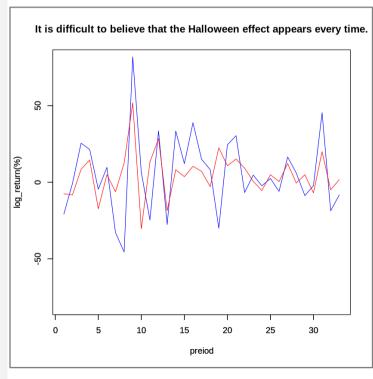
Statistics	Value
T-statistic	1.478
P-value	0.07

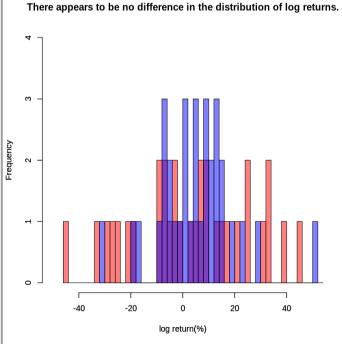
Analysis Result Analysis Halls

Analysis Halloween Effect

Since May 1990, there has been no significant difference in returns between those that applied the Halloween effect and those that did not

Buy & Hold Strategy VS Halloween Effect (1990.05 ~ 2023.04)





Buy & Hold Strategy					
Period	G.Mean	St. Dev	Skew	Max	Min
1-year	1.022	0.259	0.511	0.817	-0.455
Halloween Effect					
1-year	1.037	0.147	0.510	0.518	-0.304

H0: RHalloween - Rbuy&Hold ≥ 0

Statistics	Value
T-statistic	-0.114
P-value	0.545

We backtested from May 1990 to April 2023.

The strategy of investing from May to October for a year and the strategy of investing continuously for a year were compared with the Halloween strategy.

Even if the Halloween effect is applied from May 1990, it is difficult to expect higher returns from KOSPI 200.

Analsysis Result Analysis Liella

Analysis Halloween Effect

If high positive returns occur in the month when the Halloween effect appears, the value of the coefficient will also increase.

So we analyzed the Halloween effect using a linear regression model

Return at time t

$$t = 1 : Nov \sim Apr$$

 $t = 0 : May \sim Oct$

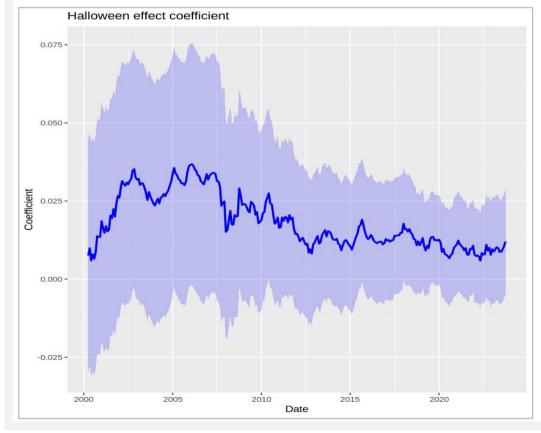
$$R_t = \alpha + \beta Hal_t + \varepsilon_t$$



Coefficient not large enough Coefficient is not significant

Let Rt be the monthly log return(1990.05 ~ 2023.04)

[Train a model with 10 years of data]



[Train a model with full data]

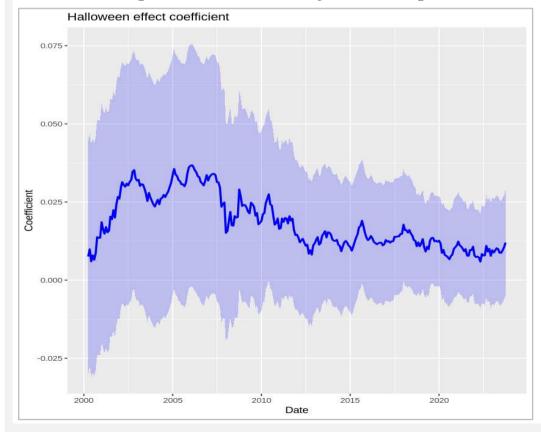
Statistics	Value
n	22
alpha	-0.004
P-value (alpha)	0.4591
beta	0.015
p-value (beta)	0.0468



Coefficient not large enough Coefficient is not significant

Let Rt be the Continuous Compound Monthly returns (1990.05 ~ 2023.04)

[Train a model with 10 years of data]



[Train a model with full data]

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

Conclusion Is the Halloween effect reliable?

We recommend in the KOSPI 200 Index as a long-term investment.

No significant difference between the Buy & Hold Strategy and the Halloween Effect Strategy,
The Buy & Hold Strategy with lower commissions is lower.

May~Oct VS Nov~Apr

- ☑ The average, maximum, and minimum returns from 11 to 4 are better than those from 5 to 10
- But not statistically significant

冷 Buy & Hold VS Halloween Effect

- ☑ The investment performance of the Buy & Hold strategy and the Halloween effect strategy in the KOSPI 200 were not significant.
- ☑ And there were difficulties in analyzing the linear regression model.

Q&A