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Impact of Important Calendar Dates on the Stock Market

Introduction

Investors are always looking for patterns or irregularities in the stock market that they can leverage to maximize their return. The market is highly unpredictable, and it is advantageous for any investor to look for proxy variables that can help increase returns. One type of market pattern that has received significant attention is the so-called "calendar effect," which compares stocks returns on specific calendar days (such as holidays) to returns on other days of the year.

The impact of the Jewish High Holy Days (Rosh Hashanah and Yom Kippur) on the stock market is an example of a calendar effect. Rosh Hashanah (Judaism's New Year holiday) and Yom Kippur (the Jewish Day of Repentance) occur in the fall, nine days apart. Investors, over the years, have come up with the adage "sell on Rosh Hashanah, buy on Yom Kippur," as they believe that prices tend to go down during the days between these two holidays. These investors' claims have been backed up by studies such as Frieder and Subrahmanyam (2001). However, there is a replication crisis for statistical research, as researchers can mine the data in order to find statistical patterns. This paper, by studying the largest available data set for daily returns, will seek to test the validity of previous literature and help to better assess whether holidays have a significant effect on daily returns for the S&P 500.

Literature Review

Frieder and Subrahmanyam (2001) studied the effect of the high holidays (as well as Chanukah) on the U.S. Equity Market. The authors found that trading volume decreases on both Rosh Hashanah and Yom Kippur, and that the strategy of selling before Rosh Hashanah and buying after Yom Kippur would benefit investors in a statistically and economically significant manner. Yatrakis and Williams (2010) conducted similar research, analyzing the daily returns for the Dow Jones Industrial Average (DJIA) between 1907 and 2008. The authors concluded that a strategy of selling short before Rosh Hashanah and covering after Yom Kippur would produce statistically and economically significant results.

Further research has been conducted to determine the effect of other religious holidays on asset prices. Ahmed, Alrashidi, and Beneid (2014) looked at changes in the stock market's returns and volatility from Islamic mutual funds during Ramadan. The authors analyzed equity funds data during a short time period January 2004 through December 2009, and found no empirical evidence that Ramadan affects Islamic equity fund performance, though they did find evidence that volatility of stock returns decreases during the month of Ramadan. However, these results could be inconclusive due to the short time period the authors studied. Bergsman and Jiang (2015) broadened their dates of interest to include a variety of New Year holidays from several different religions and cultures. They analyzed data from 11 major international markets between 1991 and 2011 and looked for a relationship between cultural New Year holidays that do not occur on January 1 (Chinese, Islamic, Jewish, Korean, Sinhalese, and Thai new year holidays) and stock market performance. The authors concluded that stock markets outperform during the months in which one of the aforementioned cultural new year holidays occurred.

Some researchers have also considered whether notable calendar dates that are not holidays affect the stock market. Berumet, Dogan, and Onar (2010) studied the effects of daylight savings time changes on stock market volatility. Based on data from 1967 to 2007, the authors did not find evidence that daylight savings time changes affected stock volatility or returns. Further, Vahamaa and Peltomaki (2010) looked at the effect of Friday the Thirteenth on stock market returns and found that Fridays the Thirteenth did not produce statistically significantly different returns from other Fridays during the period studied. In somewhat similar fashion, Yuan, Zheng, and Zhu (2016) looked at the relationship between stock market returns in 48 different countries and lunar phases. The authors analyzed data from two global portfolios (one equal-weighted and one value-weighted) and found that stock returns were higher on the days around a new moon than on the days around a full moon. The authors also noted that this effect was independent of announcements of macroeconomic indicators, global shocks, and calendar-related events such as the day-of-the-week effect and the holiday effect.

Other researchers have conducted studies that examine the relationship between significant calendar dates and other phenomena, such as birth rates. Levy, Chung, and Slade (2011) studied the impact Valentine's Day and Halloween have on births. Based on data from an 11-year period, the authors found an increase in births on Valentine's Day and a decrease in births on Halloween. This paper will expand on Levy, Chung, and Slade's work by examining the relationship between Valentine's Day, Halloween, and stock market returns.

This paper will build on the existing literature by analyzing the effect significant calendar dates—including Rosh Hashanah, Yom Kippur, Valentine's Day, Halloween, Friday

the Thirteenth, St. Patrick's Day, April Fool's Day, and Daylight Savings Mondays (the day after a Daylight Savings time change)—have on S&P 500 prices. This research will seek to replicate existing studies using a longer time frame than current literature has used to analyze the effect of various important calendar dates on S&P 500 prices. Additionally, this paper will seek to provide more information regarding the effect Valentine's Day, Halloween, St. Patrick's Day, and April Fool's Day have on the stock market. This paper will also seek to determine whether an investor whose strategy involves buying and selling based on stock market variations related to calendar dates could receive higher returns than an investor who sticks to a buy-and-hold strategy.

Data

This paper uses data from Wharton Research Data Services (WRDS), which has stock price data available for the period from 1926 to 2016. In total, there are 24,038 observations in this data set, including data for Valentine's Day in 67 of the years and for Halloween in 68 of the years (since Valentine's Day and Halloween occasionally take place on days when the markets are closed, there are no returns on those days every year). Data for St. Patrick's Day was available in 69 of the years, and 67 years' worth of data for April Fool's Day exists. There were 156 Fridays the Thirteenth during the period studied. For the Jewish High Holy Days, which span ten days each year, return data existed for each of the 91 years studied. Additionally, data for Daylight Savings Mondays existed in all 91 years between 1926 and 2016 for both spring and fall time changes.

Methods

This paper studied security price information for the S&P 500 (value-weighted return including dividends) from the Wharton Research Data Service's CRSP database and

calculated the return between Rosh Hashanah and Yom Kippur (inclusive). To calculate the total return between these two holidays, the daily returns for each trading period were added to one and then multiplied together. If, for example, during a three-day trading period, Day 1 was up 2%, Day 2 was down 3%, and Day 3 was up 4%, then the overall gross return is (1.02*0.97*1.04) = 1.029. Thus, the net return for this period was 0.029, or 2.9%.

In years where Rosh Hashanah or Yom Kippur fell on a non-trading day, data for the interval surrounded by the High Holy Days was used. For example, Rosh Hashanah fell on a day when markets were closed in 1937 (September 6), so only the interval between September 7 and Yom Kippur (September 15) were considered. Similarly, when Yom Kippur fell on a non-trading day (such as October 12, 1940), the endpoint for the interval of interest was October 11. Since Rosh Hashanah and Yom Kippur are always the same number of days apart (Rosh Hashanah, Yom Kippur, and the days in between are known as the Ten Days of Repentance) this means that the number of *trading days* separating Rosh Hashanah and Yom Kippur differed from year to year, depending on the day of the week on which Rosh Hashanah occurred (as well as any other market closures during the relevant interval). In order to correct for this discrepancy, the n^{th} root of the total returns between Rosh Hashanah and Yom Kippur was taken, where n is the number of trading days in the interval between the holidays (inclusive) which gives us the geometric average daily return.

This paper used a difference-of-means test to calculate the significance of Jewish High Holy Days, Valentine's Day, Halloween, St. Patrick's Day, April Fool's Day, Friday the Thirteenth, and Daylight Savings Mondays (in both the spring and fall) on S&P 500 prices. The test statistic was computed based on the average daily return for Valentine's Day,

Halloween, St. Patrick's Day, April Fool's Day, Friday the Thirteenth, Daylight Savings Mondays, or the period between Rosh Hashanah and Yom Kippur (μ_1) and the average daily return for 1926-2016, the entire time period studied (μ_2).

Results

The difference-in-means tests yielded statistically significant results for the Jewish High Holy days, April Fool's Day, and Daylight Savings Mondays (springtime Mondays at the 10% significance level, fall time changes at the 5% level) but did not show statistically significant results for Halloween, Valentine's Day, St. Patrick's Day, or Friday the Thirteenth. Over the course of the 24,038 trading days contained in the data set, the average daily return for the S&P 500 was 0.042% with a variance of 0.013%. The minimum daily return was -19.46% and the highest daily return was 16.81%. For the period between the Jewish High Holy Days, the average daily return was -0.084% (the complete summary statistics for returns between the Jewish High Holidays as well as for Halloween, Valentine's Day, St. Patrick's Day, April Fool's Day, Friday the Thirteenth, and Daylight Savings Mondays are shown in Table 1).

S&P 500 returns between Rosh Hashanah and Yom Kippur are lower than during a typical period of the same length at the 5% significance level. Therefore, this research suggests that the adage "Sell on Rosh Hashanah, Buy on Yom Kippur" carries some truth. Additionally, April Fool's Day yields statistically significantly higher returns than a typical trading day at the 5% alpha level, suggesting that returns tend to be higher on April Fool's Day than on other trading days. Spring Daylight Savings Mondays (clocks move forward one hour in the middle of the night, resulting in one fewer hour of sleep) yielded below-average daily returns that were statistically significant at the 10% significance level, but

not at the 5% level. Fall Daylight Savings Mondays (clocks move back an hour in the middle of the night, resulting in one extra hour of sleep) yielded below-average daily returns as compared with a typical trading day, and gave results that were statistically significant at the 5% level. None of the other calendar dates studied showed results that differed significantly from average daily S&P 500 returns at the 10% level.

Conclusions

Based on this paper's findings, the Jewish High Holidays, April Fool's Day, and Mondays after twice-annual Daylight Savings time changes have a significant impact on S&P 500 prices, while Halloween, Valentine's Day, St. Patrick's Day, and Friday the Thirteenth do not. This information might lead a savvy investor to consider selling on Rosh Hashanah and buying on Yom Kippur as well as buying when the market opens on April Fool's Day and selling when the market closes. An astute investor might also consider shorting on Daylight Savings Mondays. The difference in returns during the Jewish High Holidays is both statistically and economically significant: the average return between the High Holidays is -0.084%, and the average number of trading days between Rosh Hashanah and Yom Kippur is 8.5. Therefore, we can calculate expected returns for a "Sell on Rosh Hashanah, Buy on Yom Kippur" investment strategy in a typical year as follows:

$$(1-0.00084)^{8.5}=0.009929=0.9929\%$$

Thus, an investor who sells $100 worth of stock on Rosh Hashanah could expect to buy that stock back on Yom Kippur for $99.29, earning a profit of 71 cents. For a short period of time (just 6-8 trading days) this is a very significant return. Compare this with the typical return for an 8.5-day trading period, where the average daily return is 0.042%:

$$(1+0.00042)^{8.5} = 1.0036$$

During a typical 8.5-day trading period, an investor can expect to earn 36 cents on a $100 investment, which is slightly more than half the earnings obtained by investing based on the Jewish high holy days. Thus, the strategy of "Buy on Rosh Hashanah, sell on Yom Kippur" is beneficial to investors, producing significant positive returns as compared with a buy-and-hold strategy.

On April Fool's Day, the average return is 0.327%, meaning an investor can expect to earn about 33 cents in one day from a $100 investment. On a spring daylight savings Monday, the average return is -0.11%, while the average return on a fall daylight savings Monday is -0.40%. This means that an investor can expect to lose about 11 cents from a $100 investment on a springtime daylight savings Monday and can expect to lose about 40 cents from a $100 investment on an autumn daylight savings Monday. The expected return for a typical trading day is 0.042%, which gains an investor 4 cents from a $100 investment—a noticeably different result from the April Fool's Day and Daylight Savings Monday averages. Thus, we conclude that investing based on April Fool's Day, daylight savings Mondays, and the Jewish High Holidays yield statistically and economically significant returns.

Data Table

Calendar Day	Observations	Mean	Std. Dev.	Min	Max	T-stat	P-value
All Trading Days (1926-2016)	24038	0.04%	1.14%	-19.46%	16.81%		
Jewish High Holidays	91	-0.08%	0.56%	-2.99%	1.44%	-2.11	0.04
Halloween	68	0.25%	1.19%	-2.48%	5.29%	1.45	0.15
Valentine's Day	67	-0.07%	1.03%	-5.49%	2.13%	-0.91	0.37
St. Patrick's Day	69	0.16%	1.23%	-4.04%	3.56%	0.78	0.44
April Fool's Day	67	0.33%	1.13%	-2.49%	5.14%	2.06	0.04
Friday the Thirteenth	156	0.02%	1.08%	-6.09%	3.45%	-0.28	0.78
Daylight Savings (Spring)	91	-0.11%	0.81%	-2.51%	2.09%	-1.76	0.08
Daylight Savings (Fall)	91	-0.40%	1.89%	-11.68%	2.22%	-2.21	0.03

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