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PERSPECTIVES

Nonsecular Regularities in Returns and Volume

Laura Frieder and Avanidhar Subrahmanyam

Past analyses of U.S. stock return behavior have found economically and statistically higher returns on days preceding holidays on which the market is closed than on other trading days (for instance, Lakonishok and Smidt 1984; Cervera and Keim 2000). Evidence that stock returns are economically and statistically higher on days preceding secular and religious closed-market holidays was first found by Fields (1934). Possible reasons include speculators wanting to cover short positions before closed-market days and positive sentiment before a festive occasion.

Although previous papers have provided important evidence on return anomalies, the issue of whether market closure per se or the nature of the impending occasion (e.g., Christmas) causes the anomalous return patterns has not been addressed. Therefore, we set out to analyze how the equity market behaves around religious and cultural occasions at times when the market remains open.

Literature on the relationship between religion and the stock market is minimal, but a relevant strand of research has documented the role of "mood" in equity returns. Kamstra, Kramer, and Levi (2001) argued that returns are affected by the trading of investors plagued by "seasonal affective disorder." Inasmuch as religious and cultural occasions embody different emotions for various market participants, eliminating closed-market holidays and focusing on open-market holidays allowed us to determine whether returns and trading activity are affected *on the occasion* by the festive or solemn nature of the occasion. Consequently, our work also sheds light on the role of investor sentiment in the financial markets.

The Study

We considered the open-market occasions in the U.S. equity market of St. Patrick's Day and the Jewish High Holy Days of Rosh Hashanah and Yom Kippur. We chose these days because the Irish and

Jewish groups that celebrate these holidays are well established in the New York area and, indeed, around the country.¹ Although the market is open on other religious occasions, such as the Muslim Ramadan period and the Jewish periods of Passover and Chanukah, examination of these occasions is hindered by the fact that they are observed over a period of several days. In addition, results pertaining to the Christian occasion of Maundy Thursday (many Christians observe Holy Thursday in commemoration of the Last Supper) are affected by the closed-market days of Good Friday and Easter that occur just after Maundy Thursday.

St. Patrick's Day, traditionally a Catholic holy day, was first celebrated in the United States nearly 300 years ago. Since then, the day has also become a secular occasion for celebrating through drink, parties, and parades. Rosh Hashanah is the Jewish New Year and signifies God's creation of the world. Many Jews spend the day in prayer for a good year. Like the secular New Year's Day, Rosh Hashanah is a joyous occasion. In contrast, Yom Kippur, the Day of Atonement, is the most austere holy day in the Jewish tradition. It occurs nine days after Rosh Hashanah as a solemn day of fasting and repentance for past misdeeds. Yom Kippur is a time to reflect on one's sins (often in worship) and ask God's forgiveness so as to begin the next year with a clean slate. Of these three occasions, St. Patrick's Day and Rosh Hashanah are festive whereas Yom Kippur is solemn.

To capture the effects of investor sentiment as it pertains to each holiday, we examined U.S. equity returns for a two-day window on either side of the occasion. If the holiday fell on a trading day, the regression to isolate the effect of the holiday on trading activity (volume) was

$$DV_t = \alpha + \beta D_t + \varepsilon_t, \quad (1)$$

where

DV_t = percentage change in volume on day t

D_t = 1 if day t was one of the special occasions (otherwise, 0)

ε_t = the residual

Similarly, the regression to capture the return effect was

$$R_t = \alpha + \beta D_t + \varepsilon_t, \quad (2)$$

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where

R_t = S&P 500 Index return on day t

D_t = 1 if day t was an occasion (otherwise, 0)

We also ran the regression for the days surrounding the occasion ($t - 2$, $t - 1$, $t + 1$, and $t + 2$). Allowing D_t to take on the value of 1 for these days provided the effect of the holiday on market characteristics on the days surrounding the holidays. The intercept, α , represented the overall mean return for the entire sample, and β measured the difference in return between the relevant days and all other days.

We analyzed the full sample for 1946–2000 and also split the sample into equal subperiods to ascertain whether any regularities strengthened or weakened over time.

We addressed the problem of outliers by using a χ^2 -test, which tested whether the observed number of days with returns or volume of a particular sign was equal to the expected number of days with that sign (under the assumption that percentage changes in daily volume and returns on event days are random draws from the entire sample). The χ^2 -statistic was calculated as

$$\chi^2 = \frac{2(O - E)^2}{E}, \quad (3)$$

where O denotes the observed number of days with a particular sign and E represents the expected number of days with a particular sign (determined from multiplying the number of event days by the fraction of days with that sign in the full sample).

Results

Table 1 provides the mean and median proportional changes in dollar volume (measured as the percentage change in volume from the previous day) for the market (proxied by the NYSE) and for the five-day event windows (two days before, two days after, and the day of the occasion). The 4.30 percent average change in daily NYSE volume (much higher than the median change) suggests that the distribution of volume changes is characterized by high positive skewness. Note the large average decline in volume for Rosh Hashanah and Yom Kippur; the median volume declines on the latter two occasions are even larger. The decrease in volume on Rosh Hashanah and Yom Kippur is consistent with the notion that traders exit the market for religious observance. In other words, the nonfinancial opportunity cost of trading on the High Holy Days appears to be large for many investors, which leads to a considerable decrease in trading activity on those days.

Table 2 provides the mean daily return for each day of the occasions' event windows. For comparison, note that the S&P 500 daily return for

Table 1. Daily Proportional Changes in Dollar Volume, 1946–2000

Event/Statistic	Change
<i>A. All days in sample period</i>	
Mean	4.30%
Median	0.44
<i>B. Occasion event windows in sample period</i>	
Rosh Hashanah	
Mean	–14.71%
Median	–18.81
Yom Kippur	
Mean	–10.68
Median	–23.73
St. Patrick's Day	
Mean	6.45
Median	5.61

the period averaged 0.033 percent (with a median of 0.043 percent). By and large, the median returns shown in Table 2 often differ appreciably from the mean returns for the holidays, but the medians do confirm the pattern in the means. Specifically, median returns for Rosh Hashanah and St. Patrick's Day are persistently above the median for the full sample, whereas those for Yom Kippur tend to be below the sample median. Mean returns surrounding the festive occasions of St. Patrick's Day and Rosh Hashanah are considerably higher than the market average daily return, whereas those for the somber occasion of Yom Kippur are much lower than the market average.

These return patterns are consistent with the idea that sentiment plays a role in market returns. Also note that the volume patterns in Table 1 are not in step with the return patterns in Table 2; so, even on days when volume is low, returns may be high if order imbalance is tilted to the buy side.

Significance Tests. **Table 3** provides the coefficient estimates of the regressions for proportional changes in daily dollar volume for the full sample period and two subperiods, and **Table 4** provides the same information for returns. Table 3 shows that the effect of St. Patrick's Day on volume was negligible for the full period, but the coefficient on Rosh Hashanah is significantly negative, as indicated by the t -statistic of -5.67 . When Yom Kippur was the regressor, the coefficient for the full period is negative but only marginally significant. The χ^2 -statistics for the full period indicate that the effects of both Rosh Hashanah and Yom Kippur are significant at the 5 percent level, which suggests that some extreme positive observations may be masking a general decrease in volume on Yom Kippur and Rosh Hashanah.

Table 2. Daily Returns for Occasions, 1946–2000

Occasion	Day $t-2$	Day $t-1$	Day t	Day $t+1$	Day $t+2$
Rosh Hashanah					
Mean	0.355	0.280	0.233	0.280	0.137
Median	0.261	0.258	0.254	0.043	0.118
Yom Kippur					
Mean	0.011	0.144	-0.180	-0.179	-0.098
Median	-0.084	0.004	0.008	-0.069	-0.053
St. Patrick's Day					
Mean	0.344	0.379	0.075	0.194	0.073
Median	0.229	0.313	0.241	0.098	0.035

Table 3. Regression Analysis: Volume

Variable	Full Sample	1946–1972	1973–2000
Rosh Hashanah	-19.10	-17.11	-21.19
t -Statistic	-5.67**	-2.82**	-8.27**
χ^2 -Statistic	29.00**	13.19**	15.88**
Yom Kippur	-15.07*	-2.06	-25.88
t -Statistic	-1.87*	-0.13	-6.95**
χ^2 -Statistic	24.56**	8.06**	16.91**
St. Patrick's Day	2.07	-2.87	6.90
t -Statistic	0.56	-0.45	1.86*
χ^2 -Statistic	1.30	0.02	3.03*

Notes: Regression Equation 1. If the occasion fell on a weekend, the day was dropped from the sample. The t -statistics were adjusted for heteroscedasticity. Intercept terms were included but are not reported. Point estimates for volume coefficients were multiplied by 100.

*Significant in a two-tailed test at the 10 percent level.

**Significant in a two-tailed test at the 5 percent level.

With the sample split into subperiods, the results are statistically similar to the results for the full period with respect to the Jewish occasions. In the later subperiod, the effect of St. Patrick's Day on volume is marginally significant, and the significance of the negative return effect following Yom Kippur increases substantially. Overall, these results support the conclusion that many investors view the nonfinancial opportunity cost of trading to be high on the High Holy Days, which has a significant impact on trading activity on these days.

Table 4 shows that, although the variable for return when day t was Rosh Hashanah is positive and marginally significant in the full sample (Panel A), results for the other variables on day t in the full period are insignificant. This result appears reasonable: Although volume is down on the High Holy Days, there is no good reason to believe that order imbalance (hence, returns) would be tilted in a particular direction, because traders who observe and celebrate the occasion are expected to be absent from the market.

More information can be extracted by examining the days surrounding the occasions. For instance, Panel A shows that returns in the full period on the two days leading up to St. Patrick's Day and Rosh Hashanah—the festive occasions—are highly significant and positive.² The results support the view that, because these occasions are uplifting, people await them in good spirits, which could be accompanied by an increase in investor confidence and an increase in traders' willingness to invest in risky assets.

The coefficient on Yom Kippur two days before this event is negative but insignificant in the full period and early subperiod (Panel B), which indicates that observers of Yom Kippur are not significantly affected before the Day of Atonement. An optimism bias and short-selling constraints may preclude a negative market effect of Yom Kippur that is symmetrical with the positive effect of the upbeat occasions. The results for the days prior to the occasions tend to be similar in sign in the first half of the period to the results for the full sample, and the Rosh Hashanah and St. Patrick's Day dummies are marginally significant on day $t-2$.

For the later subperiod (Panel C), the results tend to mirror those from the full period in terms of significance. The results for one day before the Jewish occasions are less strong in the later period than in the full period (perhaps because of, in effect, a halving of the sample size).

The coefficients for one day and two days following the occasions in the full period are of the right sign (positive for St. Patrick's Day and Rosh Hashanah, negative for Yom Kippur) but are insignificant. (For day $t+1$, we found these coefficients to be significant at the 10 percent level, however, in a one-tailed test.) In the early half of the period, evidence of any return effect for days following the occasions is minimal. Most of the χ^2 -statistics are insignificant. In the later subperiod, however, the coefficient for the day following Rosh Hashanah is significant and the coefficients on Yom Kippur are statistically significant for both $t+1$ and $t+2$. Thus, in the latter half of the sample period, the results

Table 4. Regression Analysis: Return

Variable	Day $t - 2$	Day $t - 1$	Day t	Day $t + 1$	Day $t + 2$
<i>A. Full sample period, 1946–2000</i>					
Rosh Hashanah	3.26	2.49	2.04	2.47	1.08
t -Statistic	3.09**	1.81*	1.93*	1.62	1.08
χ^2 -Statistic	7.23**	1.78	4.00**	2.16	0.221
Yom Kippur	–0.18	1.12	–2.09	–2.11	–1.27
t -Statistic	–0.18	0.71	–0.96	–1.42	–1.23
χ^2 -Statistic	1.79	0.101	0.023	2.30	1.57
St. Patrick's Day	3.17	3.48	0.46	1.61	0.44
t -Statistic	2.76**	2.14**	0.36	1.46	0.53
χ^2 -Statistic	4.74**	1.30	2.01	1.20	0.021
<i>B. 1946–1972</i>					
Rosh Hashanah	2.52	2.87	3.11	–0.64	0.05
t -Statistic	1.71*	1.52	2.04**	–0.43	0.04
χ^2 -Statistic	3.53*	1.40	3.41*	0.00	0.054
Yom Kippur	–0.79	0.45	–1.60	2.00	1.51
t -Statistic	–0.51	0.17	–0.40	1.32	1.12
χ^2 -Statistic	2.62	0.243	0.202	0.038	0.112
St. Patrick's Day	2.63	0.84	2.18	1.40	1.26
t -Statistic	1.93*	0.48	2.79**	1.14	1.34
χ^2 -Statistic	1.98	0.003	4.74**	0.080	0.069
<i>C. 1973–2000</i>					
Rosh Hashanah	3.93	2.15	0.97	5.11	2.05
t -Statistic	2.63**	1.08	0.68	2.16**	1.37
χ^2 -Statistic	3.70*	0.522	0.971	4.00**	0.771
Yom Kippur	0.45	1.80	–2.52	–5.82	–3.83
t -Statistic	0.39	1.06	–1.21	–2.68**	–2.85**
χ^2 -Statistic	0.064	0.002	0.386	5.64**	4.26**
St. Patrick's Day	3.68	5.98	–1.26	1.83	–0.36
t -Statistic	2.03**	2.34**	–0.53	1.00	–0.27
χ^2 -Statistic	2.78*	2.68	0.03	0.522	0.003

Notes: Regression Equation 2. Point estimates for return coefficients were multiplied by 1,000. See also notes to Table 3.

*Significant in a two-tailed test at the 10 percent level.

**Significant in a two-tailed test at the 5 percent level.

accord with the mood-based explanation.³ The pattern of coefficient significance levels is more compelling for day $t + 1$ than for day $t + 2$. This finding supports the intuitive notion that effects on returns after an occasion have a short life (no more than a day) relative to anticipatory effects. Overall, the results for days following the occasion are consistent with the notion that traders reentering the market after Rosh Hashanah are in an upbeat frame of mind whereas the behavior of those reentering after observing Yom Kippur appears to reflect the solemn nature of that occasion. Perhaps the process of self-reflection in Yom Kippur causes investors to become more insecure and more risk averse, with a decreased desire to hold risky securities. The

result could be the increase in selling reflected in Table 1 and a consequential decline in prices. The opposite results for Rosh Hashanah can be explained analogously.

We found the absolute average returns surrounding all three occasions to be surprisingly large and to deviate in an economically significant manner from the market's overall mean return. For example (specifics not tabulated here), the average S&P 500 return on the two days preceding Rosh Hashanah was 13 times the average return on this index for the entire period, whereas the average absolute return on Yom Kippur was about 6 times the market mean.

Robustness. Although day-of-the-week and seasonal effects in returns have been documented (French 1980), such secular return regularities are unlikely to account for our results. For example, there is no good reason to believe that returns happen to be systematically high in mid-March.⁴ Furthermore, Rosh Hashanah and Yom Kippur are only nine days apart, and given that returns are significantly positive around Rosh Hashanah and negative around Yom Kippur, an autumn seasonal effect (if one exists at all) is not likely to be responsible for both sets of returns. Nonetheless, results of regressions (unreported) that included monthly and day-of-the-week dummies showed that the results reported here remain robust to including proxies for return seasonalities.⁵

Data from the Share and Convertible Index (SCI), a major Israeli stock index, support the findings presented here.⁶ The average return for the 1946–2000 period for the SCI was 0.144 percent (0.033 percent in the U.S. data), but for the day following Yom Kippur, the average return was –0.504 percent (–0.179 percent in the U.S. data shown in Table 2). Although we found this return to be statistically insignificant, it is economically significant. For the day following Rosh Hashanah, the average return was 0.827 percent in the SCI data. As with Yom Kippur, the large positive return in the SCI data over Rosh Hashanah, as compared with the average return over the entire sample period, appears to be economically significant. In addition to suggesting that our results for the U.S. sample can be extended to an alternative sample, the economic significance of these results for the Israeli market lends support to the notion that the mood of market participants influences returns.

Conclusion

The cultural significance of holidays that are not observed nationally piqued our curiosity about

their impact on the U.S. equity market. Thus, we endeavored to find out what happens to financial markets when the mood of a large group of traders might affect the market before, during, or after a religious or cultural occasion. The results we presented shed light on this thought-provoking issue. The anticipatory return effects of the two festive occasions we studied, St. Patrick's Day and Rosh Hashanah, are strong. The price pattern before these occasions indicates that people look forward to them, which is reflected in their trading. We propose that optimism and/or increased investor confidence (and consequently decreased risk aversion) accompany these festive occasions, which is seen through enhanced buying of risky assets and a concomitant run-up in prices. Volume drops on Rosh Hashanah and Yom Kippur, which highlights the notion that nonfinancial opportunity costs are important. Our results have implications for practitioners who wish to forecast trading activity (and, in turn, liquidity) as well as returns.

Further exploration of the connection between equity markets and cultural or religious occasions could be attempted by examining returns and volume at the level of individual securities. Certain stocks may be more affected by religious or secular occasions than others. Along this line, Loughran and Schultz (2002) documented the interesting finding that Yom Kippur affects trading volume disproportionately in stocks whose companies are headquartered in cities with high Jewish populations; extending such an analysis to returns would be worthwhile.

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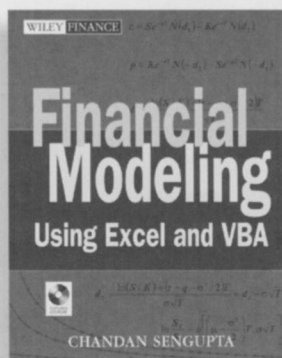
Notes

1. See, for instance, Waldinger (1995) and Sachar (1993) for religious demographic data. As documented in census data, as of 1990, 15.6 percent of the U.S. population was of Irish descent, second only to those of German descent (23.2 percent). Furthermore, the Jewish population nationwide climbed from 3.5 million in 1930 to about 6 million in 2000. Although this number represents only 2 percent of the U.S. total population, Jews constitute about 12.5 percent of the total population of New York City (see www.cnn.com/2003/US/Northeast/06/17/ny.pop/).
2. Although not reported, a test of unequal variances of returns showed that the standard deviation for the group of holidays is not significantly different from that of the entire sample. The implication is that unequal volatility in the full period and the days surrounding the occasions is not likely to be driving the statistical results.
3. Note also that the increased significance of Yom Kippur in the later subperiod coincides with an increase of Jews in the U.S. population (see Note 1) and a general increase in trading activity in equity markets (Jones 2002).
4. Although St. Patrick's Day is observed on 17 March, the parade corresponding to this occasion actually occurs in New York City on 16 March.
5. Specific results of these tests are available from the authors. We also confirmed the documented evidence of higher-than-average returns on days surrounding the prominent and uplifting closed-market holidays of Christmas and Independence Day, which do not fall on specific days of the week.
6. We thank Gene Kandel of Hebrew University for supplying us with these data.

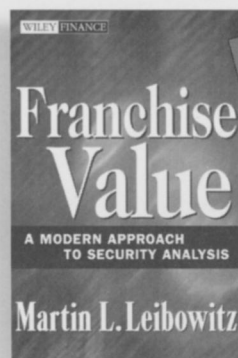
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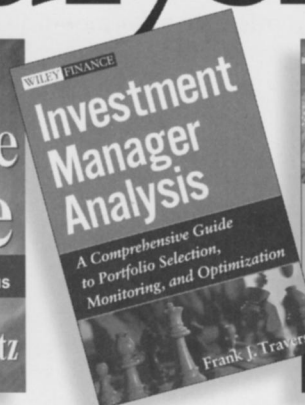
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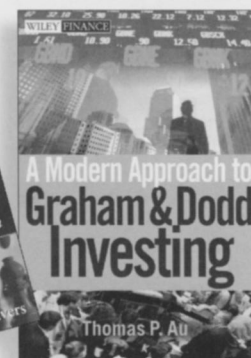
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