February 6, 2002

Non-Secular Regularities in Stock Returns:
The Impact of the High Holy Days
on the U.S. Equity Market

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Abstract

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We study how daily returns and volume behave around the Jewish High Holy Days. We find that on both Rosh HaShanah and Yom Kippur, volume is down significantly, relative to that on all trading days in the sample period. When we consider a cumulative measure that allows for preemptive or delayed trading activity, we find that returns are significantly positive around Rosh HaShanah and significantly negative around Yom Kippur. Overall, the results are consistent with our a priori intuition that Jews play a major role in equity trading, so that their sentiment around important Jewish holidays has a significant impact on the U.S. equity market.

Jews are frequently identified by their ambition, respect for money, "commercial reliability," and sense of unity. These characteristics undoubtedly influence the Jewish presence in financial markets. In particular, much of the financial success of Jews in America dates back to their ties with other Jewish international traders from other countries (Sowell, 1994). By 1850, roughly one-third of the American Jewish population was located in New York City. Manhattan's advanced urban setting allowed many Jews to take advantage of the availability of the city's free higher education system and to establish themselves in lucrative occupations. Doing so paved the way to a sound socioeconomic setting within the Jewish community, and a solid foothold on Wall Street. By 1900, Jewish companies such as Goldman, Sachs & Co., Jules, Bache & Co., Heidelbach, Ickelheimer & Co., and Salomon Brothers, among others, had started making significant contributions to investment banking (Sachar, 1993, p. 89).

Despite the fact that they only form approximately one-*fiftieth* of the American population, there is little doubt that Jews are an important force in the financial arena. Indeed, Jewish family incomes, falling around 70% above the national average, are the highest of the predominant ethnic groups in the United States (Sowell, 1981, p. 98). Will Maslow, executive vice-president of the American Jewish Congress, indicated the following in 1975: "The assets at the command of the

Jewish community are considerable. . .If these assets are used prudently. . .American Jewry can continue to exercise an influence disproportionate to its numbers. . ." (Sachar, 1993, p. 826).

Motivated by such observations, our intent is to analyze how the equity market behaves around Jewish holidays. We explore whether returns and daily dollar volume are affected by a change in the trading activity of Jews on and around the Jewish High Holy Days of Rosh HaShanah, Yom Kippur, and Chanukah. We analyze the difference in daily returns to the S&P and percent change in dollar volume for the NYSE between these Jewish holidays and normal trading days.[1]

While related literature on religion and the stock market is minimal,[2] a relevant strand of literature documents the role of mood in equity returns. Hirshleifer and Shumway (2001) show that returns are correlated with cloud cover. In a similar vein, Kamstra, Kramer, and Levi (2001) argue that returns are affected by the trading of investors plagued by Seasonal Affective Disorder (SAD), and Yuan, Zheng, and Zhu (2001) suggest that lunar phases affect stock returns. In the psychology literature, it has been documented that people are less confident when they are in a negative mood (Kramer, Newton, and Pommerenke, 1993; Oakley,

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[1]Admittedly, as we begin this paper in October 2001, our bias could be due to recent and upcoming celebrations.

[2]The only study we are aware of that relates finance to religion is that of Stulz and Williamson (2001), which shows that religion helps explain the cross-sectional variation in creditor rights.

1999), and bad moods have also been shown to negatively affect performance on intelligence tests (Samuel, 1993). Inasmuch as Jewish holidays embody different emotions for Jews, this literature appears related.

Our main results are as follows. Although Chanukah appears to have no significant effect on returns and volume, we notice a significant drop in percent change in dollar volume on both Rosh HaShanah and Yom Kippur. When we include the days surrounding the holidays, these results on volume are less pronounced, although still remarkable. Average return is significantly positive for the days surrounding Rosh HaShanah and significantly negative for Yom Kippur and the day after. Indeed, while the average daily return on the S&P 500 for our sample is about 0.04%, that for the day of and the day following Rosh Hashanah is as high as +0.25%, whereas that for the day of and the day following Yom Kippur is −0.25%.

Our analysis supports the hypothesis that, despite a relatively small population base, Jewish traders have a consequential role in the U.S. equity market. In addition, the positive returns associated with Rosh HaShanah, a serious but festive day, and the negative returns accompanying Yom Kippur, a day of atonement, appear to underscore the importance of investor sentiment in the stock market. The alternative explanation that could arise in readers' minds is that

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our results are capturing regularities in returns at daily, weekly, or monthly horizons. But Rosh HaShanah and Yom Kippur are only nine days apart and do not systematically fall on a specific day of the week. Further, it appears an autumn seasonal is not likely to account for our results, because Yom Kippur and Rosh HaShanah are associated with return effects that are of opposing signs.

As a robustness check on our underlying results, which imply that Jewish stock market participants have a unique and significant effect on U.S. financial markets, we examine the impact of the major Hindu holiday of Diwali on the U.K. stock market, because the proportion of Hindus in the U.K. parallels that of Jews in the U.S. We find that, in both the U.K. and the U.S., the Hindu holidays have no significant impact on either stock returns or volume. We also examine the impact of Maundy Thursday in the two stock markets to discern the impact of Christian sentiment. Our analysis indicates that while trading activity is sluggish on Maundy Thursday, the effect of this occasion on returns is economically and statistically insignificant. Thus, overall, our results support the notion that Jews are a significant presence in the U.S. stock market.

The paper is organized as follows. Section I offers a brief overview of the Jewish holidays we consider and examines the various hypotheses explored in this paper. The data and methodology are described in Section II. Results are

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presented in Section III. Robustness checks are discussed in Section IV, and in Section V, we offer a brief discussion and conclude.

I. Hypotheses

The population of Jews in America has increased dramatically from a recorded 25 in 1654, approximately 100,000 in 1850, nearly one million at the turn of the twentieth century to 5 million by the mid-1900s. At the millennium, the population of Jews in America was just over 6 million.[3] Population estimates are shown in Figure 1.

Please insert Figure 1 here.

The most sacred of the Jewish holidays are the High Holy Days. These include Rosh HaShanah and Yom Kippur. Rosh HaShanah signifies the Jewish New Year and G-d's creation of the world. On this day, Jews celebrate that their behavior can influence their future. Many Jews spend the day in prayer, hoping to be granted a good year. Like the secular New Year, this is an uplifting holiday. In contrast, Yom Kippur, the Day of Atonement, is the most austere holy day in the Jewish tradition. As such, it is a solemn day of fasting and regret for past

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[3]American Jewish Historical Society, American Jewish Desk Reference, The Philip Leff Group, Inc., 1999, 35.

misdeeds. Jews spend Yom Kippur (often in worship) reflecting upon their sins committed over the previous year and asking G-d for forgiveness to begin the New Year with a clean slate. Finally, Chanukah, the eight-day festival of light,[4] celebrates the Jewish defeat of the Syrian tyrant Antiochus IV. Each evening of the eight-day commemoration is spent exchanging gifts and visiting with family and friends.

Based on the observation that they appear to maintain a stong financial influence, we explore the notion that Jews are a decisive force in our equity market, despite their relatively small population in the United States.[5] In order to do this, we look at daily returns and volume around their most highly observed holidays.

Both Rosh HaShanah and Yom Kippur are observed during the day, so we hypothesize that they both have an impact on market returns and volume. Our specific hypotheses are as follows. First, we surmise that the opportunity cost of trading for Jews is great on both of the High Holy Days, so we anticipate a decrease in dollar volume on these days. Further, due to the festive nature of a holiday celebrating the New Year, we expect the days surrounding Rosh HaShanah to yield a positive investor mood, strong overconfidence, and a conse-

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[4]The eight-day holiday represents the small cruse of oil that provided the Jews with eight days of light.

[5]In part, our investigation is motivated by speculation in the popular press that Jewish holidays affect returns. See "Perhaps they should call it the High Holiday Effect" (Robin Blumenthal), *Barron's*, September 20, 1999, p. 13.

quential under-assessment of risk. This is likely to lead to a run-up in the current price and hence yield above average market returns. In contrast, Yom Kippur is a day of regret and atonement for wrongdoing, so we hypothesize that its impact on investor mood and confidence, and, in turn, the stock market, is negative. Finally, we believe that if Chanukah has an effect, it is likely to be marginal when compared to that of the other days. During the several days of Chanukah, many Jews work regularly, celebrating only by night and likely leaving trading unaffected.

II.   Data and Methodology

We examine the average daily return to the S&P over the period July 1962-December 2000 for the Jewish holidays of Rosh HaShanah, Yom Kippur, and Chanukah.[6] We also examine daily percent change in dollar volume on the NYSE over the same period. Our return data is obtained from CRSP, and our volume data is from the New York Stock Exchange website.[7] We employ the following method for determining average daily returns on and around the Jewish holidays that occur during our sample period. We let YOM(-1) represent the day before Yom Kippur, YOM signify the day of the holiday, and YOM(+1) represent the

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[6]We use July 1962 as a starting point due to the availability of daily stock return data in CRSP.

[7]http://www.nyse.com/marketinfo/nysestatistics.html.

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day after. YOMCUM represents data from the day of and the day following Yom Kippur, i.e., YOM and YOM(+1). Similar notation applies to Chanukah and Rosh HaShanah. Our variable ROSHCUM includes ROSH(-1), ROSH, and ROSH(+2).[8] We do not include YOM(-1) in YOMCUM because it is our belief that the behavior of Jews (both in and outside of the stock market) is unlikely to change *before* the day of atonement. ROSHCUM, on the other hand, includes the day before, the first day of, and the day after Rosh HaShanah. In this case, we include ROSH(-1) because we believe that (trading) behavior may be affected by anticipation of the New Year. We exclude ROSH(+1) because it is the second day of the holiday and not viewed as a special day by many of the Reform Jews, a large portion of the Jewish population. Moreover, we assume that the majority of Jewish fund managers who observe the holiday would likely take off only the first day of Rosh HaShanah. To the extent that institutional trading drives the market, this is a relevant and reasonable assumption. Nonetheless, later in the paper, we will report that the results remain largely unaffected by the inclusion of ROSH(+1). Returns on individual days before and after the holidays are provided in detail below.

We use the daily return for the holiday if the holiday falls on a trading day. If the holiday occurs on a closed-market day, it is dropped from our sample, as no

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[8]Please recall that Rosh HaShanah is a two-day celebration.

return or volume data is available. In analyzing the days surrounding the holiday, we use calendar time; that is, we make no adjustment for trading-time. Any of the days surrounding the holiday that fall on a closed-market day are also ignored. For example, if Yom Kippur falls on a Friday, Thursday's return is attached to YOM(-1) and Friday's return is attached to YOM. In this case, YOM(+1) is dropped from the sample, as its return "would be" that yielded by Saturday, a closed-market day. There is a minor problem in aggregating these results over the time period because our samples for days surrounding and including the holiday are "mismatched." In particular, over the sample period, our sample size for YOM(-1) is different from that for YOM, so comparing returns on YOM to those on YOM(-1), for instance, is imperfect. Nonetheless, any spurious effects should be averaged away. Furthermore, disregarding *all* observations that fall on weekends is not a realistic solution because in doing so, we would be eliminating too many data points from an already small sample. We use the same criteria in determining average daily dollar volume surrounding the holidays.[9]

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[9]With respect to our "CUM" variables, we are simply including the data from those days, as well as the holidays in our sample. This provides us with more data points and more legitimate results.

III.   Results

As can be seen in Table 1, over our sample period (July 1962 - December 2000), the mean daily return to the S&P500 is 0.037%. The average change in daily dollar volume is 2.06%. Over the same period, the average daily return for the day before, the first day of, and the day after Rosh HaShanah (ROSHCUM) is 0.255%.[10] Average change in dollar volume is -4.59% for ROSHCUM. Thus, on the days associated with Rosh HaShanah, returns are higher and trading volume is down relative to our entire sample.

Please insert Table 1 here.

For Yom Kippur, the mean daily return for the holiday and the day following (YOMCUM) is -0.250%, to be compared to the overall sample mean of $+0.037\%$. The average change in dollar volume for YOMCUM is 7.53%. Unlike the case of ROSHCUM, dollar volume increases, and returns are significantly negative for the days we attach to Yom Kippur. Figures 2 and 3 illustrate the magnitude of these results.

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[10]When we use the average daily return from the day before to the day after Rosh HaShanah, our average daily return is still positive, only slightly less significant. Percent change in dollar volume becomes positive, although still lower than the average for the entire sample period.

Prima facie, the return for the Rosh HaShanah holiday appears significantly positive relative to the average day, while that for the Yom Kippur holiday is overwhelmingly negative. To further explore this result, we dissect the group of days encompassing the holidays. We find that the average daily returns are 0.231%, 0.219%, −0.003%, and 0.319% for the day before, the first day of, the second day of, and the day after Rosh HaShanah, respectively. The returns are consistent with the idea that there are two groups of Jewish traders. The first group does not leave the market to observe the holiday. Although they are not practicing Jews, they still are aware of the New Year, which they initiate by purchasing equities, therefore pushing up prices. The second group of traders does, in fact, exit the market to celebrate Rosh HaShanah. When they re-enter after the holiday, they, like the first group, begin their new year with primarily buy-side trading.

For the same days, however, average change in dollar volume is 1.09%, −18.72%, 17.99%, and 3.98%, respectively. The volume pattern supports the notion that many Jewish traders exit the market to observe the first day of Rosh HaShanah. On the second day, many of the Jews come flooding back in. It is likely that on the day following the two-day holiday, the remainder of those who exited the market re-enter. Given the large swings in dollar volume, it is likely to be the

Jewish fund managers who are not afforded a two-day absence from work to celebrate holiday that drive this result. Nonetheless, the volume pattern need not be directly related to returns. Even on days when volume is low, returns could be up if order balance is tilted to the buy-side.

For the day before, day of, and day following Yom Kippur, the mean daily return is 0.131%, −0.147%, and −0.354%, respectively. The return pattern supports the notion that on the day of atonement and the day after, Jews are solemn; it appears that this psychologically plausible behavioral bias does, in fact, affect prices. The average change in dollar volume for these three days is 7.01%, −23.6%, and 38.6%, respectively.[11] Volume is up slightly on the day prior to Yom Kippur. This could be the effect of "forced" trading by those Jews who know they will be unable to trade the following day for religious reasons, and compensate by altering their positions the day before. The decrease in volume on Yom Kippur appears to be the result of Jewish traders exiting the market. Likewise, the large reversal the day after is most likely from them reentering the market.

Please insert Figure 2 here.

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[11]We also look at the first day of Rosh HaShanah and the day after the holiday. Our results are statistically less significant in the regressions, but economically more so, with an average daily return of 0.268%.

The average daily return for Chanukah is 0.043%, hardly different from that for the overall sample mean of +0.037%. Similarly, the average change in dollar volume, 5.09%, does not deviate much from that of the entire sample. Due to the apparent lack of significance of this holiday, we focus on the other two holidays for the remainder of the paper. The unsurprising insignificance of this holiday with respect to the stock market is probably due to the fact that Chanukah is celebrated primarily in the evening. Many Jews go about their work day during this holiday as if it were a normal day, thus leaving trading and the market unaffected. While this interpretation appears reasonable, it should be viewed with caution, since the eight-day celebration for Chanukah could well diffuse return and volume effects, thereby making them difficult to detect.

Please insert Figure 3 here.

In this section, we report the results of regressions that use the S&P daily return (SPRET) and percentage change in dollar volume (DVOL) as dependent variables.[12] Details are provided in Tables 2A and 2B. We begin by looking at the impact of the holidays in isolation. Our rationale for this is to consider the behavior of returns and volume on days when Jews have exited the market. In particular, using ROSH as an explanatory variable in the return regression yields

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[12]Since the Durbin-Watson statistics were within normal bounds (ranging from 1.83 to 2.35) we used a simple OLS estimation procedure.

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a positive, but insignificant, t-statistic of 1.03. When YOM is the regressor, our coefficient is negative but, again, insignificant. Despite their insignificance in the return regressions, both ROSH and YOM are significant in the regressions using DVOL as the dependent variable. The coefficient on ROSH has a t-statistic of -4.32 and that on YOM generates a t-statistic of -5.34. Thus, it is clear that, despite their numerical minority relative to the U.S. population, Jews are dominant participants in the U.S. equity market.

Please insert Table 2A here.

Next, we look at what happens to returns and volume when we include days surrounding the holidays. We begin with ROSHCUM (comprised of the returns on the day before, the first day of, and the day after Rosh HaShanah) as our explanatory variable in our regression using SPRET as the left-hand side variable. We do account for a potential time trend, although not doing so yields extremely similar results. Again, despite the fact that Rosh HaShanah is a two-day holiday, most Reform Jews, a large contingent of the Jewish population, only celebrate it for one day. Moreover, we surmise that many of the Jewish institutional traders do not take off both days to celebrate.[13] Thus, in regression results to follow, we ignore day two of the holiday. The coefficient on ROSHCUM is positive

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[13]This is supported by the fact that the average return on day two of the holiday is so close to zero.

and significant, as suggested by a t-statistic of 2.14. We also regress SPRET on YOMCUM, as defined above. The coefficient on the independent variable is again significant, although this time negative, with a t-statistic of -2.31. These results are consistent with the hypothesis that mood does, in fact, influence returns.

We run the same regressions using dollar volume (DVOL) as the dependent variable. When we regress DVOL on ROSHCUM, the coefficient is significantly negative, as indicated by a t-statistic of -2.40. When using YOMCUM as the regressor, however, the coefficient is positive, although insignificant. Results are presented below.

Please insert Table 2B here.

Due to the small sample size of holidays, our regressions lack power, and our R^2s are low. In order to get stronger confirmation that returns and volume differ between Jewish holidays and the entire sample of trading days, we invoke difference in means tests. Results are detailed in Table 3. As can be seen, on Rosh HaShanah, dollar volume is significantly less than on the average trading day, although average daily return is slightly larger (yet, by an insignificant amount). On Yom Kippur, dollar volume is significantly different and, in fact, much smaller than that on the average trading day. Average daily return is also smaller, but

only marginally so. When we include the returns from the days surrounding Rosh HaShanah (those included in ROSHCUM), the average return is significantly greater than that for the entire sample, as indicated by a t-statistic of 2.23; dollar volume is significantly lower (the t-statistic is -3.26).[14] When we combine the returns of Yom Kippur and the day following (represented by YOMCUM), again, our returns are significantly smaller than on normal trading days; in fact, they are significantly negative. This is reflected in a t-statistic of -2.28.[15] On the other hand, the average dollar volume becomes marginally greater than that for the entire sample. Perhaps the influx of trading by Jews post-holiday crowds out the effect of them exiting the market the day before.

Please insert Table 3 here.

IV.   Robustness Checks

We first discuss the possibility that seasonality in returns is responsible for our results. Secular regularities in returns, however, are unlikely to shed further light on our results. Rosh HaShanah and Yom Kippur are only nine days apart, but

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[14]When we include the day before, both days of, and the day following Rosh HaShanah, our results yield the same sign, but are less significant.

[15]It is also worth documenting that the average return for the days encompassed in our variable, ROSHCUM, is greater than that over the entire sample in 54 of the 78 cases for which we have data, and the average return for the days included in YOMCUM is less than that over the entire sample approximately 65% of the time.

given that returns are significantly positive around Rosh HaShanah and significantly negative around Yom Kippur, it is highly unlikely that an autumn seasonal effect (if one exists at all) is responsible for both sets of returns.

Another way to check for robustness is to study other Jewish religious occasions. To the best of our knowledge, the only other occasion that is observed with similar intent is Passover. Yet, the days of Passover often overlap the Easter holiday. Thus, the effects of this holiday are likely to be nebulous and confounded with those driven by Easter. This problem is exacerbated by the interruption in trading on Good Friday, when the market is closed. In order to avoid this problem, we look elsewhere for a robustness check. In the early years of this sample (until 1952), the market was open for trading on Saturdays. Given that Saturday is Shabbat, one way to check if the Jews are major market influencers is to analyze trading on Saturdays. We hypothesize that volume will be down on Saturday, but we have no "traditional" reason to believe that returns should behave systematically. One behavioral possibility would be that the enthusiasm that accompanies the end of the work week would lead to trading that pushes up prices. Results for Saturday are given in Table 4.

Please insert Table 4 here.

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Volume is down substantially on Saturdays relative to week-day trading. It would be naïve to assume, however, that the lack of Jewish participation is solely responsible for the t-statistic of -63.18. More likely, as it is a weekend, many institutional traders, regardless of religious affiliation are away from work and are not trading. Average daily return is significantly higher than that on the average day, as indicated by a t-statistic of 2.34. So, the evidence from the Saturday test supports our dual hypotheses that Jews are major players in financial markets and that mood plays a role in dictating returns. But, these results are far from conclusive. Consequently, we now consider an out of sample test.

Recall that our initial sample period employs S&P returns from July 1962-December 2000. As a robustness check, we look at data starting in January 1946.[16] Pre-World War II data is disregarded because, ex-ante, we surmised that the influence of the Jewish population base was too small prior to their fleeing the Holocaust. As indicated above, the Jewish population did not reach five million until around 1950.[17] Results for average daily return and percent change in dollar volume over this period are presented in Table 5.

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[16]Daily return data for the S&P 500 during the period 1946-1962 is obtained directly from Standard & Poor's Corporation.

[17]Admittedly, 5 million is an arbitrary reference point, but given World War II, it is a reasonable point at which to consider the role of Jewish stock market participants in America. Admittedly, adding only 16 years of data is not an optimal robustness check. Given this, we do look at results from 1928-2000, the entire period for which data is available. As we suspected, our results are similar but, in fact, weaker. We attribute this to the lack of a significant number of Jews in America prior to World War II.

Again, we see similar results. On both holidays, volume is down substantially. In particular, the average change in dollar volume on Rosh HaShanah is −14.70%, while that on Yom Kippur is −15.05%. Moreover, on Rosh HaShanah, average daily returns are high, and on Yom Kippur, they are negative. The cumulative variables, ROSHCUM and YOMCUM, also closely follow those from the initial sample period. The average daily return around Rosh HaShanah is 0.262%, and that around Yom Kippur is −0.182%. As is obvious from Tables 6A and 6B, the regression results are also similar to those from the original sample.

Using average daily return as the dependent variable and ROSHCUM as the independent variable yields a significantly positive coefficient with a t-statistic of 2.78. YOMCUM as a regressor is accompanied by a significant t-statistic of −2.12. Employing either of the days in isolation (ROSH or YOM) for right-hand side variables does not generate significant t-statistics; again, however, this is likely an artefact of a small sample of days where ROSH and YOM equal unity. As is seen below, in the regressions employing dollar volume as the dependent variable, our t-statistics on the coefficients for Rosh HaShanah and Yom Kippur

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are both significantly negative, with values of -3.35 and -3.21, respectively. Overall, these results are extremely close to those obtained using the period 1962-2000.

Please insert Table 6B here.

Again, given the low power of ordinary least squares under the conditions of this study, our regression results are not conclusive. So, as before, we invoke equality of means tests to determine if there is a significant difference between average daily return and dollar volume on days of Jewish holidays relative to all trading days throughout the sample period. Results for the 1946-2000 are reported in Table 7.

Please insert Table 7 here.

As compared to our results from the original sample, there is little change. The equality of means test with respect to average daily return generates significant t-statistics for both ROSHCUM and YOMCUM. The t-statistics for these variables are 2.90 and -2.00, respectively. As in the earlier sample, however, returns on Rosh HaShanah and Yom Kippur, in isolation, are not significantly different from the mean of the entire sample. For percent change in dollar volume,

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our results are again similar to those presented above. The variables ROSH and YOM in isolation yield t-statistics of -5.30 and -5.19, somewhat smaller in magnitude than in the original sample, yet nonetheless significant. The t-statistics for ROSHCUM and YOMCUM, -3.56 and 1.84, respectively, are marginally larger in absolute value than in the previous sample. Again, our results appear to hold even after extending the sample.

Thus, our results appear to be fairly robust. Yet, for an additional robustness check, we examine return and volume data from control groups over other religious holidays. Unfortunately, the market is closed on both Good Friday and Christmas, thus precluding the possibility of examining the most highly observed religious occasions in Christianity. Despite this, we do, in fact, look at the day prior to Good Friday, Maundy Thursday. Many Christians observe Holy Thursday in commemoration of the Last Supper.[18] For another control, we entertained the possibility of employing the major Islamic holy days (Id-ul-Fitr and Id-ul-Zuha), but although the market is open on these days, we do not believe that this is a legitimate control group, because the significant holidays of the Muslim tradition precede an entire month of Ramadan fasting. Still, we are interested in looking at returns around other religious holidays of shorter duration. Conse-

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[18]We cannot consider Christmas Eve day because the market is only open during the morning of Christmas Eve Day.

quently, we choose the most important Hindu holiday, namely, Diwali as a second control. Regression results for Maundy Thursday and Diwali are documented in Table 8.

Please insert Table 8 here.

As can be seen, there is no significant effect of the Hindu holiday on returns or volume. Interestingly, however, while the Thursday preceding Good Friday is not associated with any significant return pattern, there is a significant drop in volume on this day. To see if this volume result is a Thursday regularity, in Table 9 we document the mean volume change on all Thursdays (together with the means around the Hindu holiday and Maundy Thursdays).

Please insert Table 9 here.

The table indicates that the average volume change on Thursdays is significantly lower than that in the overall sample. But the average volume change on Maundy Thursdays is still lower, and, in fact, negative, whereas the average volume change on normal Thursdays is slightly positive. A t-test of the mean difference between volume change on Thursdays preceding Good Friday and all Thursdays yields a t-statistic of -2.27 (not shown in the tables). This suggests

that volume indeed drops significantly on Thursdays before Good Fridays. Although this indicates that our findings may generalize to other religious holidays, it should be borne in mind that our control is imperfect, in that it is impossible to observe how the market would actually behave on Good Friday, the more significant holy day, because the market is closed on that day. What is more, the Jewish holidays we employ are not subject to biases inflicted by regularities in daily returns or volume, as they do not systematically fall on a given day of the week, as does Maundy Thursday.

As another robustness check we analyze data from the Share and Convertible Index (SCI), a major Israeli stock index.[19] Unfortunately, we are limited to return data, as volume data were not provided to us. What is more, we are restricted to a sample period between 1984-2001. Given that the Israeli stock market is closed on Yom Kippur, we consider what happens to returns on the day following this holiday. Although not reported in a table, the average return over the entire period of the Israeli stock index is 0.144%, but for the day following Yom Kippur, the return is -0.504%. In our regression, the coefficient on YOMCUM is negative, although insignificant. Similarly, our t-statistic generated from a difference in means test is statistically insignificant. Nonetheless, the average returns presented above clearly indicate that the negative return on

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[19]We thank Gene Kandel of Hebrew University for supplying us with these data.

the day following Yom Kippur is economically significant. We attribute the lack of statistical significance to the small sample. For Rosh HaShanah, the regression coefficient is positive and marginally significant (our t-statistic is 1.80). The average return for ROSHCUM over the sample period is 0.827%. The t-statistic generated from a difference in means test in this case is 1.75, only marginally statistically significant, but, again, this is likely due to the small sample. Still, as with Yom Kippur, the large positive return over Rosh HaShanah, as compared with the average return over the entire sample period, appears to be economically significant. Besides suggesting that our results are robust to the alternative sample of Israeli stocks, perhaps more importantly, the economic significance of these results lends support to the notion that Jewish sentiment influences returns.

To investigate if Jews have a significant influence in financial markets other than those in the United States, we consider data from the London Stock Exchange. Again, we only consider return data, but this sample begins in 1969.[20] Over the entire sample period, the average daily return to the UK FT-Actuaries All-Share index is 0.040%. We run the same regressions as in Section III which yield negative coefficients on *both* ROSHCUM and YOMCUM. Both coefficients are only marginally significant. (The t-statistics are −1.85 and −1.75, respectively.) The average daily return for ROSHCUM is −0.189%, and that for YOM-

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[20]We obtained these data from Global Financial Data, Inc.

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CUM is -0.222%. A difference in means test for these variables relative to the average return over the entire period generates insignificant t-statistics. Despite these insignificant results, the marginal significance of the negative coefficients for *both* Holy Days in England is somewhat curious. (Consistent with our hypothesis that Rosh HaShanah puts traders in a positive frame of mind, the average return in the U.S. is positive on the days surrounding Rosh HaShanah.) To explore this issue further, we look at the average return to the UK index over the period September 1 through October 31, for all the years in which we have data. The average return over this period is negative, -0.038%, and a difference in means test between ROSHCUM and this period is insignificant. This is also true for YOMCUM. Thus, our negative results in England appear, at least in part, to be driven by an autumn seasonal effect. Given the lack of significance, especially once we account for the negative returns associated with September and October in England, the Jewish High Holy Days clearly have a more pronounced impact on the United States equity market. The fact that our results are not robust to all markets underscores the role of Jews in American financial markets.

As a final robustness check, we look at what happens to the UK index around the Hindu holiday of Diwali. We determine this to be a close comparison to what happens to the U.S. market around Jewish holidays, because Indians represent

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just under 1.5% of the population in Britain, a percentage approximating that of Jews in America. Since many of the Indians came to the UK (often as factory workers) during the Fifties and Sixties, looking at data beginning in 1969 is reasonable. The average return to the UK FT-Actuaries All-Share index on the days encompassing Diwali is -0.218%, and our t-statistic suggesting a difference in means between the average return over Diwali and over the entire sample is -0.90. Clearly, despite the similar proportion of Indians in Britain to Jews in America, the Hindus do not affect the UK index. We also look at the return over Maundy Thursday relative to the average return on Thursdays throughout the sample period of the UK index. As expected, the difference is insignificant.

V. Discussion and Conclusion

Given that Jews have a significant presence in U.S. financial markets, it is reasonable to hypothesize that Jewish sentiment could have a major impact on the U.S. equity market. We investigate this hypothesis by examining returns and volume around major Jewish holidays on which the U.S. stock market remains open. Our analysis indicates that on Yom Kippur, volume and stock prices decline, and that this return is economically significant in that average decline in stock prices on Yom Kippur is about eight times greater than the average (positive) stock mar-

ket return over the entire sample period. On Rosh HaShanah, volume is down, but returns are positive, again to an extent eight times greater than the average return for the entire sample. Although a decline in dollar volume is anticipated, we are surprised by the fact that Rosh HaShanah has a stronger impact on volume than Yom Kippur. This holiday is generally taken less seriously than Yom Kippur, so it seems that fewer Jews would exit the market.

The influence of the holidays on dollar volume becomes more clear when we use our cumulative variables, YOMCUM and ROSHCUM, which measure returns and volume on days including and surrounding the holidays. Using YOMCUM results in a slight positive change in average dollar volume that is not significantly different from that on normal trading days. This indicates that although several Jews leave the market to observe the holiday, their "welcome-back trading" offsets the trading volume drop during the day of the holiday. The change in volume associated with the variable ROSHCUM remains negative and is significantly different from that on normal trading days, perhaps indicating that traders who exit the market on Rosh HaShanah do not return to the market in a timely way.[21]

The return results are more thought-provoking. Average daily return is negative on Yom Kippur and positive on Rosh HaShanah, although less significantly.

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[21]This observation suggests an investigation of how long such investors do take to return to the market. Trading volume has so many determinants, however, that it would be difficult, if not impossible, to tease out such re-entering effects over longer horizons.

When we consider the cumulative variables, however, the effects are magnified. This result lends itself to a behavioral explanation. It appears that because Rosh HaShanah is a festive holiday, returns are high. The fact that returns are significantly higher when we include the days surrounding Rosh HaShanah is consistent with this reasoning, as Jewish traders could be anticipating the celebration. The strong negative return associated with Yom Kippur and the day following is also in line with our behavioral explanation. The below-average return could result from the introspection and repentance that accompanies the austere holiday. Consideration of order imbalances on and around these holidays would shed further light on this issue. We leave this for a future study, since order imbalance data are not yet available for a sufficiently long time-period.

Our study is important especially in light of the continuing debate on market efficiency. We show that markets appear to behave in a predictable fashion around the High Holy Days. There have been many anomalies discovered over the years, many of which cannot be fully and legitimately explained. We present a plausible psychological reason for why the market may behave in a predictable manner around Jewish holidays. In particular, our proposed explanation is that the market is up around days of celebration and festivity because Jewish stock market participants are in a positive frame of mind and more confident, but the

market is down the during solemn days of atonement because these participants are in a more neutral, and perhaps even negative, state of mind. It would be interesting to further explore this topic by examining returns and volume at the micro-level of individual equities. Perhaps certain companies, such as those with Jewish CEO's, are affected more by these psychological biases. Overall, despite opposition by traditionalists, our investigation supports the view that behavioral theories provide a viable avenue to explaining market movements.

The results of our study support the notion that Jews are an important force in financial markets. It appears that their substantial influence in the financial arena carries over to the U.S. equity market. To be fair, it is not, in itself, surprising that volume falls on Jewish holidays. What cannot be overlooked, however, is the striking impact of the Jewish holidays on volume and returns, despite the numerical insignificance of Jews in America. Given these effects, an important yet provocative issue is whether the market should be closed on the Jewish High Holy Days. Another question raised by this study is if the market were open on other major religious occasions such as Christmas, would the return effects be as strong? More generally, an interesting question is whether the influence of Jewish investors on financial markets dominates that of Christian investors despite the fact that Jews form only about 2% of the U.S. population.

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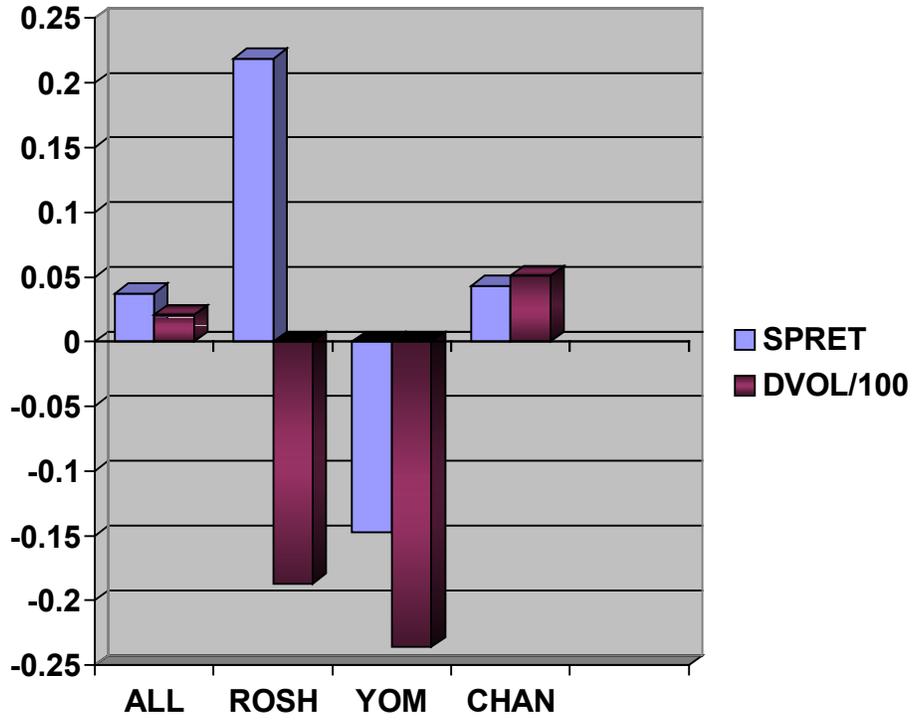
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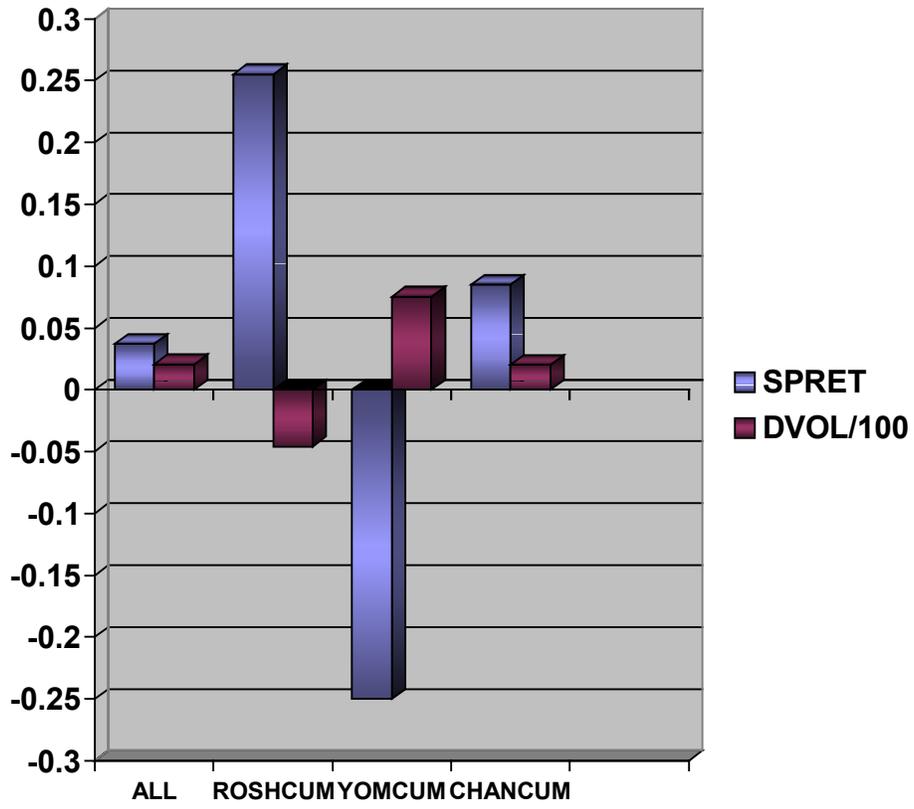
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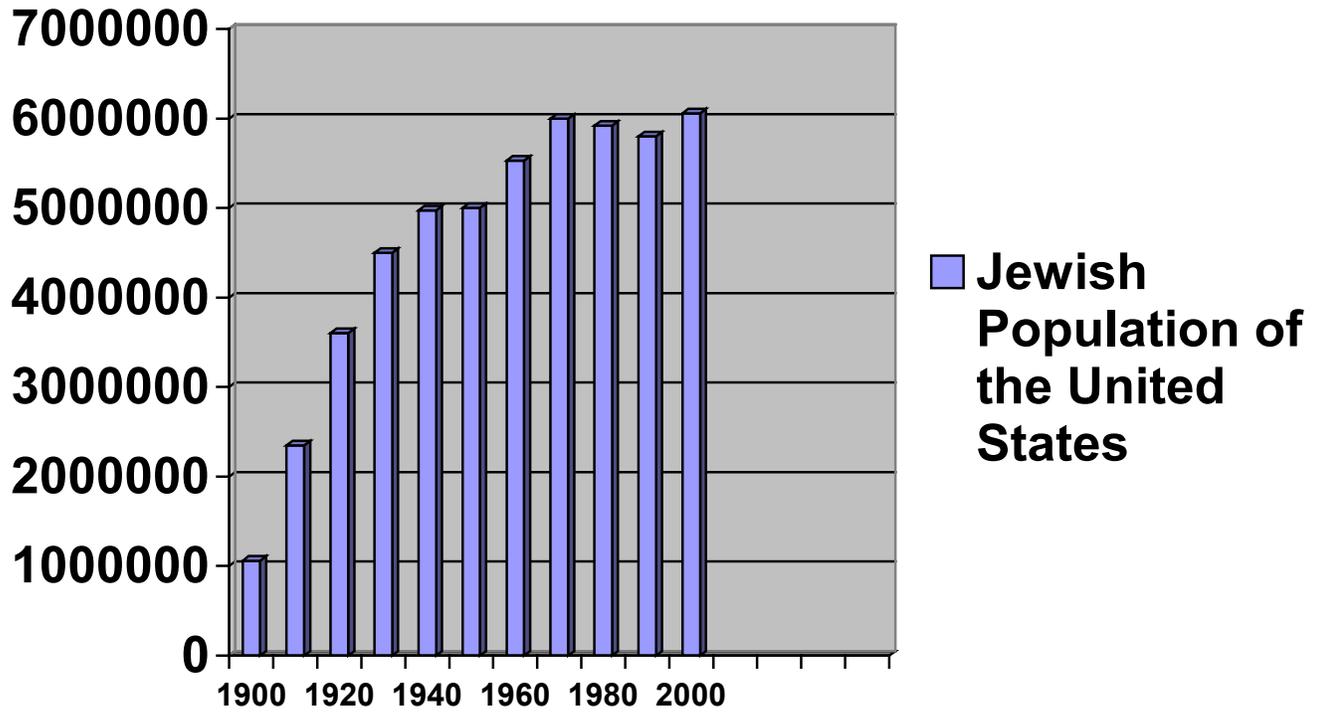
Figure II

Figure III

Table 1

Table 1 reports mean values for SPRET and DVOL for the holidays and normal trading days over sample period July 1962-December 2000. SPRET is the average daily return (%) to the S&P, DVOL is the percentage change in dollar volume to the NYSE, NORMAL is for all trading days in the sample, ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday. T-statistics from testing whether the mean is different from zero are reported in parentheses.

	SPRET	DVOL
NORMAL	0.0368 (4.02)*	2.06 (8.25)*
ROSH	0.2185 (2.48)*	18.72 (0.55)
YOM	-0.1468 (-0.88)	-23.58 (-8.03)*
CHAN	0.0429 (0.22)	5.09 (0.63)
ROSHCUM	0.2552 (2.64)*	-4.59 (-2.28)*
YOMCUM	-0.2504 (-2.01)*	7.53 (1.40)

*indicates significance at α=.05

Table 2A

Table 2A gives regression results, using SPRET as the dependent variable. We regress SPRET on an intercept, a time trend, and, in turn, the variables ROSH, YOM, ROSHCUM, and YOMCUM. SPRET is the average daily return to the S&P over the sample period July 1962-December 2000, and ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday. All coefficients are multiplied by 100. T-statistics are reported in parentheses.

	SPRET	SPRET	SPRET	SPRET
INTERCEPT $(*10^4)$	1.1514 (0.63)	1.0624 (0.58)	0.9352 (0.51)	1.2384 (0.67)
ROSH	0.182 (1.03)			
YOM		-0.186 (-1.05)		
ROSHCUM			0.220 (2.14)*	
YOMCUM				-0.290 (-2.31)*
Adj. R^2	0.0002	0.0002	0.0005	0.0006

*indicates significance at α=.05

Table 2B

Table 2B gives regression results, using DVOL as the dependent variable. We regress DVOL on an intercept, a time trend, and, in turn, the variables ROSH, YOM, ROSHCUM, and YOMCUM. DVOL is the percentage change in dollar volume to the NYSE over the sample period July 1962-December 2000, and ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday. All coefficients are multiplied by 100. T-statistics are reported in parentheses.

	DVOL	DVOL	DVOL	DVOL
INTERCEPT	1.924 (3.85)*	1.925 (3.86)*	1.922 (3.85)*	1.845 (3.69)*
ROSH	20.833 (-4.32)*			
YOM		-25.718 (-5.34)*		
ROSHCUM			-6.701 (-2.40)*	
YOMCUM				5.492 (1.61)
Adj. R^2	0.0017	0.0027	0.0004	0.0001

*indicates significance at α=.05

Table 3

Table 3 presents t-statistics testing differences in means between the entire sample and days of Jewish Holidays. SPRET is the average daily return to the S&P over the sample period July 1962-December 2000, and DVOL is the percent change in dollar volume for NYSE. ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday.

	SPRET	DVOL
ROSH	1.49	-9.42*
YOM	-1.08	-8.53*
CHAN	0.03	0.37
ROSHCUM	2.23*	-3.26*
YOMCUM	-2.28*	1.05
CHANCUM	0.44	-0.02

*indicates significance at α=.05

Table 4

Table 4 reports mean values for daily returns and volume on Saturday (the market was open Saturdays from 1946-1952).   T-statistics from testing whether the mean is different from zero are reported in parentheses. In the bottom row of the table, we present the results of an equality of means test relative to all trading days over the sample period. SPRET is the average daily return (%) to the S&P, DVOL is the percentage change in dollar volume to the NYSE, NORMAL is for all trading days in the sample, and SAT represents the variable indicating Saturday.

	SPRET	DVOL
NORMAL	0.0346 (4.71)*	3.63 (12.64)*
SAT	0.1819 (2.92)*	-58.50 (-62.41)*
T-test for differences in means	2.34*	-63.18*

*indicates significance at α=.05

Table 5

Table 5 reports mean values for SPRET and DVOL for the holidays and normal trading days over sample period 1946-2000. SPRET is the average daily return (%) to the S&P, DVOL is the percentage change in dollar volume to the NYSE, NORMAL is for all trading days in the sample, ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday. T-statistics from testing whether the mean is different from zero are reported in parentheses.

	SPRET	DVOL
NORMAL	0.0346 (4.71)*	3.63 (12.64)*
ROSH	0.2332 (2.18)*	-14.70 (-4.33)*
YOM	-0.1799 (-1.20)	-15.05 (-4.26)*
ROSHCUM	0.2624 (3.37)*	-3.33 (-1.73)**
YOMCUM	-0.1819 (-1.70)**	11.13 (2.76)*

*indicates significance at $\alpha=.05$ **indicates significance at $\alpha=.10$

Table 6A

Table 6A gives regression results, using SPRET as the dependent variable for the sample period 1946-2000. We regress SPRET on an intercept, a time trend, and, in turn, the variables ROSH, YOM, ROSHCUM, and YOMCUM. SPRET is the average daily return to the S&P over the sample period July 1962-December 2000, and ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday. All coefficients are multiplied by 100. T-statistics are reported in parentheses.

	SPRET	SPRET	SPRET	SPRET
INTERCEPT (*10^4)	1.7042 (1.16)	1.8000 (1.22)	1.5784 (1.07)	1.8521 (1.26)
ROSH	0.199 (1.41)			
YOM		-0.217 (-1.47)		
ROSHCUM			0.229 (2.78)*	
YOMCUM				-0.219 (-2.12)*
Adj. R^2	0.0001	0.0001	0.0005	0.0003

*indicates significance at α=.05

Table 6B

Table 6B gives regression results, using DVOL as the dependent variable for the sample period 1946-2000. We regress DVOL on an intercept, a time trend, and, in turn, the variables ROSH, YOM, ROSHCUM, and YOMCUM. DVOL is the percentage change in dollar volume to the NYSE over the sample period July 1962-December 2000, and ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday. All coefficients are multiplied by 100. T-statistics are reported in parentheses.

	DVOL	DVOL	DVOL	DVOL
INTERCEPT	7.693 (13.42)*	7.676 (13.40)*	7.697 (13.42)*	7.609 (13.27)*
ROSH	-18.421 (-3.35)*			
YOM		-18.382 (-3.21)*		
ROSHCUM			-6.999 (-2.18)*	
YOMCUM				7.781 (1.94)**
Adj. R^2	0.0053	0.0053	0.0049	0.0048

*indicates significance at α=.05, **indicates significance at α=.10

Table 7

Table 7 presents t-statistics testing differences in means between normal trading days, i.e., non-Jewish holiday trading days, and days of Jewish Holidays. SPRET is the average daily return to the S&P over the sample period 1946-2000, and DVOL is the percent change in dollar volume for NYSE. ROSH signifies the day of Rosh Hashanah, ROSHCUM represents the first day of Rosh Hashanah and the day following, YOM is the day of Yom Kippur, and YOMCUM is the day of and day following the holiday.

	SPRET	DVOL
ROSH	1.83**	-5.30*
YOM	-1.40	-5.19*
ROSHCUM	2.90*	-3.56*
YOMCUM	-2.00*	1.84**

*indicates significance at α=.05 **indicates significance at α=.10

Table 8

Table 8 gives regression results, using SPRET and DVOL as dependent variables for the sample period July 1962-December 2000.   SPRET is the average daily return to the S&P over the sample period July 1962-December 2000, and DVOL is the percent change in dollar volume for NYSE. DWCUM denotes the first day of, the day preceding, and one day following the Hindu festival of Diwali, while GFCUM denotes the Thursday before Good Friday. All coefficients are multiplied by 100. T-statistics are reported in parentheses.

	SPRET	SPRET	DVOL	DVOL
INTERCEPT	.011029	.010536	1.876	1.899
	(0.60)	(0.57)	(3.75)*	(3.80)*
DWCUM	.010307		-0.966	
	(0.10)		(-0.35)	
GFCUM		0.145		-7.588
		(0.99)		(-1.90)**
Adj. R^2	0.0001	0.0002	-0.0002	0.0002

*indicates significance at α=.05 **indicates significance at α=.10

Table 9

Table 9 reports mean values for SPRET and DVOL for the holidays and all trading days (NORMAL) over sample period July 1962-December 2000.   SPRET is the average daily percent return to the S&P over the sample period July 1962-December 2000, and DVOL is the proportional change in dollar volume for NYSE. DWCUM denotes the day of, the one day, and the one day following preceding the Hindu festival of Diwali, while GFCUM denotes the Thursday before Good Friday. THURS denotes all Thursdays in the sample. T-statistics for differences in means relative to normal days are reported in parentheses. T-statistics from testing whether the mean is different from zero are reported in brackets.

	SPRET	DVOL
NORMAL	0.0368 [4.02]*	2.06 [8.25]*
DWCUM	0.0476 (0.06) [0.27]	1.11 (-0.35) [0.41]
GFCUM	0.1810 (1.59) [2.03]*	-5.49 (-3.48)* [-2.58]*
THURS	0.0246 (-0.57) [1.28]	4.26 (-3.73)* [1.19]

*indicates significance at α=.05