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Are Seasonal Anomalies Real? A Ninety-Year Perspective

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This study uses 90 years of daily data on the Dow Jones Industrial Average to test for the existence of persistent seasonal patterns in the rates of return. Methodological issues regarding seasonality tests are considered. We find evidence of persistently anomalous returns around the turn of the week, around the turn of the month, around the turn of the year, and around holidays.

In recent years there has been a proliferation of empirical studies documenting unexpected or anomalous regularities in security rates of return. In addition to the widely studied relation between firm size and rate of return,[1] these include seasonal regularities related to the time of the day [Harris (1986)], the day of the week [see Ball and Bowers (1986), Cross (1973), French (1980), Gibbons and Hess (1981), Jaffe and Westerfield (1985), Keim and Stambaugh (1984), and Lakonishok and Levi (1982)], the time of the month [Ariel (1987)], and the turn of the year [see Haugen and Lakonishok (1988), Jones, Pearce, and Wilson (1987), Lakonishok

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[1] Early work on the size effect was done by Banz (1981) and Reinganum (1981). Schwert (1983) provides a survey.

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and Smidt (1984), and Schultz (1985)]. The findings present a potentially serious challenge to classical models of market equilibrium and have stimulated the development of new theories that can account for them [see Rock (1989), Admati and Pfleiderer (1988a, 1988b), and Foster and Viswanathan (1987)].

However, it is at least possible that these new facts are really chimeras, the product of sampling error and data mining. For this reason it is important to test for the existence of these regularities in data samples that are different from those in which they were originally discovered. In this article we provide evidence on several seasonal return anomalies over a long period of time using a uniform data base and methodology. The study is based on the daily closing prices of the Dow Jones Industrial Average from 1897 to 1986, practically the whole time that a U.S. security market index has existed.

We examine monthly, semimonthly, weekend, holiday, end-of-December, and turn-of-the-month seasonalities. In several cases our sample period is considerably longer than that used in earlier studies. The holiday and the semimonthly effects were recently investigated using post-1962 data [see Ariel (1985, 1987)]; we add 65 years of new data. Studies of the weekend effect have used data going back to 1928 [see Ball and Bowers (1986), Cross (1973), French (1980), Gibbons and Hess (1981), Jaffe and Westerfield (1985), Keim and Stambaugh (1984), and Lakonishok and Levi (1982)]; we add 30 years of additional data. The end-of-December effect and the turn-of-the-month effect have not been thoroughly explored previously. We add little new data for the monthly seasonals and present results mainly for completeness.

The remainder of this article is organized as follows. The first section discusses the quality of the existing evidence of anomalies. The second section describes the Dow Jones Industrial Average, which is the basis for our analyses. Sections 3 through 7 consider particular anomalies. Section 8 discusses the sensitivity of the results to the pattern of dividend payments. The final section presents our conclusions.

1. Quality of the Evidence

Anomalies in securities returns have been reported by many investigators using a variety of research procedures, so that skepticism about their existence must be based on characteristics that are common to essentially all the studies or to our interpretations of them. Three generic considerations provide support for a skeptical attitude. We call them boredom, noise, and data snooping.

Merton (1985) emphasized the danger of attaching undue importance to studies that report anomalies because of a selection bias, which we call the boredom factor. Even if studies that fail to reject established doctrines are more numerous, they are less likely to be published because they support beliefs that are already widely held and hence do not add much new knowledge. A reader who noted that many published studies report anomalous findings might overestimate the evidence supporting their existence. A similar form of selection bias was studied by Ross (1986).

Fischer Black's (1986) presidential address stressed the importance of noise in security returns. Anomalous changes in average rates of return are difficult to detect if there is a high level of nonstationarity in the return-generating process. On the other hand, if we underestimate the noise level, which Black believes is common, we are likely to report anomalies when we have actually encountered only noise.

A third consideration, the attempt to both discover and test hypotheses using the same data, is called data snooping. The statistical tests routinely used in financial economics are usually interpreted as if they were being applied to new data. But the data available in finance are seldom new. Low-cost computing and reliable data bases such as the Center for Research in Security Prices (CRSP) and COMPUSTAT have led to a huge supply of empirical research on stock prices. Most of this research is based on relatively few data bases. In this situation, the dangers of data snooping are substantial.

As a defense against data snooping, the finance profession has developed a strong preference for empirical studies based on hypotheses derived from theory. This may provide temporary protection, but the degree of security provided is quite subtle when theories are refined and revised based on past studies and the revised theories are then tested using essentially the same data. Moreover, the empirical studies that reported seasonality in rates of return were not based on previously defined theories.

Data snooping is sometimes thought of as an individual sin. One researcher tests many different hypotheses on the same data (perhaps reporting only the most exciting results). However, it is also a collective sin. A hundred researchers using the same data test a hundred different hypotheses. The 101st derives a theory after studying the previous results and tests and theory using more or less the same data.

The best remedy for data snooping is new data. When new data are not available, significance levels on tests of individual hypotheses must be adjusted if multiple tests are performed on the same data. Conventional significance levels may be grossly inadequate in the presence of data snooping. But if significance levels are corrected, it is not necessarily inappro-

[2] In studying seasonal patterns for a five-day trading week, there are 30 ($2^5 - 2$) possible hypotheses. If the 30 hypotheses are tested on the same data (by one or more researchers), each using a conventional 5 percent significance level for each hypothesis, and if the tests are statistically independent, the significance level of the so-called induced test implied by the search for the largest possible *t* values would not be 5 percent, but only 0.79 [$1 - (1 - 0.05)^{30}$]. This result, based on the Bonferroni inequality [see, e.g., Feller (1968, p. 110)], is described in detail in Savin (1984, pp. 834–835). There is a 0.21 probability that one or more of the tests will be significant, even if none of the patterns truly exists. To achieve a joint significance level of 0.05, the significance levels of the individual hypotheses must be reduced to 0.17 percent (0.0017) because $0.05 = 1 - (1 - 0.0017)^{30}$. This requires at least 10 observations ($0.5^9 > 0.0017 > 0.5^{10}$). In the case of monthly seasonals, there are 4094 ($2^{12} - 2$) possible hypotheses. If we want a joint test to be significant at the 0.05 level, the individual tests must be significant at the 0.00001253 level, which requires at least 17 years of data ($0.5^{16} > 0.0000125 > 0.5^{17}$).

priate to test many hypotheses with the same data.[2] Our study can be thought of as an effort to test many hypotheses about seasonal patterns on the same data, not all of which are new. In interpreting our results, we assign considerable importance to evidence that a particular seasonal pattern persists through most or all of the several nonoverlapping subperiods. We report the standard test statistics and their conventional significance but do not interpret the significance levels literally, in part because of the issues raised above.[3]

2. The Dow Jones Industrial Average

On October 7, 1896, the *Wall Street Journal* published two sets of daily stock price averages for the previous 30 days: an average of 20 railroad stock prices and an average of 12 industrial stock prices. Stock price averages for both classes of securities have been published regularly ever since. Thus, a Dow Jones Industrial Average (DJIA) is available on a daily basis back to September 8, 1896. Before this date, Charles H. Dow, editor of the *Wall Street Journal,* had occasionally published stock averages of various kinds, but not on a regular basis. No other American stock average has been available continuously for so long. Our study includes data from the first trading day in 1897 (January 4) through June 11, 1986, approximately 90 years.

The industrial averages were based on 12 stocks until October 3, 1916, when the list was expanded to 20 stocks. On October 1, 1928, the list was expanded to 30 stocks. Since then, the number of stocks has not changed.

The particular stocks included in the DJIA have changed from time to time. Changes were more frequent in the early days than they have been recently. The stated objective is to choose companies that are "representative of the broad market and of American industry . . . major factors in their industries . . . and widely held by individuals and institutional investors" [Dow Jones (1986)]. From the beginning, the list was composed of large, well-known, actively traded industrial stocks.

The DJIA is available for every day the market has been open. The stock market closed from August 1, 1914, until December 12, 1914, because of World War I. Beginning on June 1, 1952, Saturday trading sessions were eliminated. For a few years before that, Saturday trading was suspended at certain times, mainly during the summer months. During the last six months of 1968, the exchange closed on Wednesdays so that brokers' back-office operations could catch up with the volume of trading.

The permanent elimination of Saturday trading sessions in 1952 provides a convenient point for partitioning the data. The pre-1952 period was

[3] The "percent of positive returns" statistic is reported in most tables as a measure of central tendency. Conventional significance levels are reported as an additional descriptive statistic. But Brown and Warner (1980) showed that this test is not correctly specified when the distribution of returns is asymmetric, so that these significance levels cannot be taken literally.

partitioned into four subperiods, each approximately 14 years long; the second major period was similarly partitioned into three subperiods, each approximately 12 years long. To facilitate making judgments about the persistence of characteristics of the data, we report in most cases the findings for each of 10 separate periods: the entire 90 years, two major periods, and seven nonoverlapping subperiods.

The DJIA is a reasonable proxy for the large capitalization industrial company component of the market portfolio. The 30 stocks in the index represent about 25 percent of the market value of all NYSE stocks. Concentrating on large, actively traded firms minimizes problems associated with nonsynchronous trading and makes the DJIA an extremely useful index for representing short-term market movements [see Rudd (1979)]. Therefore, the DJIA is particularly suited for our study. The DJIA does not include dividends. Our results do not seem to be affected by the omission of dividends. Evidence on the effect of dividends is provided in Section 8. Our data cannot be used to evaluate seasonal anomalies, such as the January effect, that are characteristic of small companies.

3. Monthly Regularities

The evidence relating to monthly seasonals is presented in the Appendix. From prior research we know that there is a very high January return for small companies but no such pattern for large U.S. companies.[4] Our results are consistent with the previous findings for large companies.

Turning to within-month regularities, Ariel (1987) reported an intriguing result based on 19 years of data from 1963 through 1981—positive rates of return occur in the stock market only during the first half of each month. For example, he reports an average rate of return of 0.826 percent for the value-weighted CRSP Index during the first part of the month and a negative average rate of return, −0.182 percent, during the second part of the month. There have been some recent attempts to explain the higher rates of returns of small firms in January by considering the possibility that risk is not constant across the year [see, e.g., Rogalski and Tinic (1986)]. It is very unlikely that changes in risk within a month would produce such a pattern of rates of return for a value-weighted index.

Ariel's definition of the first part of the month includes the last trading day of the previous month. His justification for this is that the average rate of return on the last trading day of a month is high. Such a justification is

[4] Previous researchers utilized long time series in exploring monthly returns. Rozeff and Kinney (1976) used data for 1909 to 1974. Schultz (1985) utilized data from 1900 to 1929 and Jones, Pearce, and Wilson (1987) used monthly data from as early as 1871 (their period was 1871 to 1929). In the Rozeff and Kinney study, the high January return was obtained for equally weighted portfolios of NYSE or NYSE and AMEX stocks. They obtained their long time series by splicing together several indices. Some of these were value-weighted and others were equal-weighted. At the time they did their study, the importance of the difference between these types of series was not well understood.

[5] In Section 7 we examine rates of return for days around the turn of the month.

Table 1
Differences in rates of return of the Dow Jones Industrial Average between first and last half of the month by periods, in percent

Period	Mean[1]	Standard deviation	Median	Percent[2] positive differences	No. of months
1897–5/86	0.237	5.438	0.546	55.4**	1068
1897–5/52	0.153	6.235	0.486	54.2**	660
6/52–5/86	0.313	3.815	0.562	57.3**	408
1897–1910	−0.517	5.906	0.079	50.2	167
1911–1924	−0.455	5.631	0.202	52.9	164
1925–1938	1.143	8.508	0.832	56.5	168
1939–5/52	0.229	3.764	0.706	57.5	161
6/52–1963	0.299	3.160	0.278	56.7	139
1964–1975	0.582	3.925	1.023	61.8**	144
1976–5/86	0.029	4.327	0.336	52.8	125

[1] The significance levels are based on a t-test of the null hypothesis that the mean is zero.

[2] The significance levels are based on a sign test of the null hypothesis that the probability of a positive return is 50 percent and will not be correct if the return distribution is asymmetric.

* Significant at 5 percent level.

** Significant at 1 percent level.

questionable because it relies on an examination of the data.[5] We define the first half of the month as the first through the fifteenth calendar day of the month, if it is a trading day, or if not, through the next trading day. The last half of the month consists of the remaining days.

Table 1 shows differences in the average rates of return between the first and last half of the month for each of the 10 periods. The average difference for the entire period is 0.237 percent, which is much less than the 1 percent difference reported by Ariel. Furthermore, the average rate of return is positive for both halves of the month. The average difference between the two halves is positive for the two major periods. It is negative in two of the seven subperiods and practically zero in the last subperiod. The second largest difference in any of the seven nonoverlapping subperiods, 0.582 percent, occurs during the 12-year period from 1964 through 1975, which is wholly contained in Ariel's 19-year observation period. Based on a t-test (5 percent significance level), we could not reject the null hypothesis that the two halves of the month have the same rate of return for any of the 10 periods.[6]

We used the parametric test to examine the difference between the first and last halves of months on a month-by-month basis. For the total period and the two major subperiods, significant differences between the first and

[6] Table 1 also shows the percentage of months in which returns are higher in the first half than in the second half. For the whole sample, 55.4 percent of the months have higher returns in the first half than in the second half. The null hypothesis that the two halves of the month are the same can be rejected at the 1 percent level. The results are similar for both the pre- and post-1952 periods and for the one subperiod, 1964–1975, that was wholly included in Ariel's observation period. To summarize, the parametric test does not detect significant differences between the two halves of the month, whereas the nonparametric test finds a superior performance during the first half of the month. The difference between the results of the parametric and nonparametric tests may be attributable to skewness in the distribution of returns, in which case the nonparametric test is not correctly specified.

second halves of the month are observed, in general, only for April and December. In April, the first half of the month performs exceptionally well, and in December the second half has an exceptional performance. For the seven nonoverlapping subperiods, we find only two differences significant at the 5 percent level of 84 (12 × 7) possible, which is less than would be expected by chance. Looking at the signs of the differences we find 49 positive differences (58 percent) and 35 negative differences. This result is in the direction of Ariel's findings. But a two-tailed sign test does not reject the null hypothesis that positive and negative changes are equally likely, even at the 10 percent level.[7]

The evidence described so far provides only mild support for the idea that rates of return are larger in the first half of the month than in the last half. Ariel's evidence of a higher average rate of return during the first half of the month appears to be partly the result of idiosyncratic characteristics of the period he studied and partly the result of including the last trading day of the previous month as part of the first half of a month.[8]

For the total period of 90 years the average rate of return during the second half of December is 1.54 percent. This is the highest rate of return of any of the 24 half-months. In each of the seven subperiods the average rate of return of the DJIA during the last half of December exceeded 1 percent. In 75 percent of the years the rate of return in the second half of December was positive, compared with 56 percent positive for a typical half-month. Such a relatively consistent high rate of return for the largest companies over such a short period of time deserves further investigation. It is consistent with the widely held opinions on Wall Street about window dressing.[9]

If the importance of an anomalous rate of return is evaluated in terms of its impact on a dollar-weighted portfolio, then the high average end-of-December rate of return for large companies is far more important than the high average rate of return for small companies in January. This very high rate of return in the second half of December may reflect high returns before holidays. Lakonishok and Smidt (1984, pp. 446–447) report high rates of return for large companies on the last trading day of the year (0.61 percent) and around Christmas. The end-of-December period is investigated further in Section 6.

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[7] To conserve space, detailed results on rates of return for the first and second halves of the month by calendar month are not reported but are summarized in the text. Detailed data are available from the authors.

[8] Of course, some differences may exist that are not detected because of the large semimonthly standard deviation. In fact, even for the total period which includes 1068 months, a difference of 0.33 percent would be necessary to make the results significant at the 5 percent level.

[9] For example: "Before retailers take down their Christmas window displays, big investors are likely to do some window dressing of their own this week. That should keep blue chip stocks dancing along, while smaller stocks lag behind," *U.S.A. Today,* December 29, 1986. See also, "Heard on the Street," *Wall Street Journal,* May 18, 1988; "Abreast of the Market," *Wall Street Journal,* June 27, 1988, which discusses quarterly window dressing; and Solveig Jansson, "The Fine Art of Window Dressing," *Institutional Investor,* December 1983. The topic of window dressing also has been considered by academic writers as a partial explanation for some seasonal patterns. See Ritter and Chopra (1989) and Haugen and Lakonishok (1989).

4. The Weekend Effect

One of the most puzzling empirical findings is that mean stock rates of return vary according to the day of the week. Rates of return on Monday tend to be significantly negative, and rates of return on the last trading day of the week tend to be high. The weekend effect is documented in many papers.[10]

The customary trading days have changed during the period of our study. Before June 1, 1952, the New York Stock Exchange was usually open for trading six days a week. On Saturdays, however, the exchange was open only until noon. From 1945 until 1952, when Saturday trading was permanently eliminated, there were times, usually during the summer months, in which the exchange was closed on Saturday.

Therefore, in presenting our results for periods before June 1, 1952, we report rates of return for two groups of Fridays: those followed by Saturday trading and those followed by a long weekend. To test for differences in mean rates of return across the days of the week, we use an F-test for the joint significance of the coefficients in the regression

$$r_t = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \alpha_5^1 D_{5t}^1 + \alpha_5^2 D_{5t}^2 + \alpha_6 D_{6t} + \epsilon_t$$
$$t = 1, 2, \ldots, T$$

where r_t is the rate of return of the DJIA on day t and D_{1t}, D_{2t}, D_{3t}, D_{4t}, and D_{6t} are dummy variables that equal 1 if trading day t is a Monday, Tuesday, Wednesday, Thursday, or Saturday, respectively, and 0 otherwise; D_{5t}^1 equals 1 if day t is a Friday followed by Saturday trading, and D_{5t}^2 equals 1 if day t is a Friday followed by a nontrading Saturday; otherwise, D_{5t}^1 and D_{5t}^2 equal 0.

The results are presented in Table 2.[11] The null hypothesis that all days of the week have the same rate of return is rejected for all 10 periods at the 1 percent significance level. The most noticeable pattern is the negative rate of return on Mondays for each of the 10 periods. The negative Monday rates of return are significantly different from zero at the 1 percent level for the total sample, the pre- and post-1952 periods, and in three of the subperiods.[12] In two additional subperiods, Monday rates of return are significantly different from zero at the 5 percent level.

We have two subperiods, 1897–1910 and 1911–1924, that were not con-

[10] See Cross (1973), French (1980), Gibbons and Hess (1981), Lakonishok and Levi (1982), Keim and Stambaugh (1984), Jaffe and Westerfield (1985), Harris (1986), and Ball and Bowers (1986). Many of the previous studies use the CRSP Daily Returns File, which began in 1962. The study by Keim and Stambaugh (1984) analyzed 55 years of data on the Standard and Poors Composite Index, 1928–1982. The data before 1928 have not been examined in any recent study but were considered by Fields (1931, 1934).

[11] There is some evidence that returns before holidays tend to be high. It is also possible that the average rate of return on the day after a holiday could tend to be different from that on a regular day. In examining the day of the week, the last trading day before a holiday and the first trading day after a holiday were excluded to avoid confounding day-of-the-week and holiday effects.

[12] The magnitude of the negative Monday return is worthy of note. The total period rate of return of −0.144 percent per day would result in an annual compounded decrease of more than 30 percent per year on a 250-trading-day basis, or a cumulative decrease on Mondays of around 7.5 percent per year.

sidered in any recent study. In these periods the regulatory environment, the institutional setting, the mechanics of trading, the availability of information, and many other details were different from the setting more recently, but the negative Monday return has a remarkable tendency to persist. Combining these two subperiods, the average Monday return is −0.076 percent, and it is significantly different from zero at the 1 percent level.

In general, there are somewhat larger and statistically significant positive rates of return on the last trading day of the week. In most studies, Friday was the last trading day.[13] We find that there is a tendency for a higher rate of return on the last trading day of the week, whether the last day is Friday or Saturday. Even when Friday is not the last trading day of the week, it still has a relatively high rate of return (see the period 1897–1952), possibly because Saturday was a short trading day. (The exchange was, in general, open for two hours—until noon.)

The nonparametric results shown in Table 2 support the daily seasonal. The only negative median rates of return for the total period or the two major subperiods are on Monday. In general, the percentage of positive rates of return is significantly below 50 percent for Monday and significantly above 50 percent for Friday and Saturday.[14]

5. Holiday Returns

The consistency of the pattern around the weekend closing suggests that it may apply to any gap in trading. High rates of return before holidays have been documented in previous studies.[15] Table 3 shows average rates of return around holidays. Days are classified as preholiday, postholiday, or regular (neither) without regard to the day of the week.[16] The average preholiday rate of return is 0.220 percent for the total sample, compared with the regular daily rate of return of 0.0094 percent per day. Therefore, the preholiday rate of return is 23 times larger than the regular daily rate of return, and holidays account for about 50 percent of the price increase in the DJIA. The percentage of positive rates of return before holidays is 63.9. The results for the subperiods are, in general, consistent with the total-period results.

Although it is possible that the preholiday and preweekend returns have

[13] Keim and Stambaugh's (1984) paper is an exception.

[14] Something like a weekend effect has also been detected in an experimental market [Coursey and Dyl (1986)].

[15] For example, Roll (1983) observed high rates of return on the last trading day of December and Lakonishok and Smidt (1984) reported high rates of return around Christmas. Ariel (1985) found preholiday daily rates of return of 0.53 percent and 0.36 percent for the CRSP equal-weighted index and value-weighted index, respectively, for the period 1963 to 1982. He reported that for the value-weighted index, the eight holidays per year account for 38 percent of the total annual rate of return.

[16] For this purpose a holiday was defined as a day when trading would normally have occurred but did not. For the post-1952 period, a Friday was counted as a day before a holiday if there was no trading on the following Monday. The special Wednesday closings in 1968 were not counted as holidays.

Table 2
Daily rates of return of the Dow Jones Industrial Average by day of the week, in percent

Period	Monday	Tuesday	Wednesday
1897–1986			
Mean[1]	−0.144**	0.029	0.045**
Standard deviation	1.139	1.040	1.083
Median	−0.079	0.035	0.056
Percent of positive days[2]	45.4**	51.9*	52.6**
Number of days	3700	3962	3977
1897–5/30/52			
Mean[1]	−0.145**	0.035	0.032
Standard deviation	1.269	1.155	1.222
Median	−0.050	0.056	0.050
Percent of positive days[2]	47.0**	50.3	52.2*
Number of days	2205	2440	2394
6/1/52–1988			
Mean[1]	−0.142**	0.020	0.064**
Standard deviation	0.915	0.822	0.829
Median	−0.113	0.009	0.064
Percent of positive days[2]	43.0**	50.5	53.2*
Number of days	1495	1522	1583
1897–1910			
Mean[1]	−0.045	0.023	0.007
Standard deviation	1.234	1.062	1.025
Percent of positive days[2]	49.6	49.6	52.9
Number of days	599	629	630
1911–1924			
Mean[1]	−0.110*	0.048	0.001
Standard deviation	1.020	0.918	0.985
Percent of positive days[2]	47.3	53.9	49.2
Number of days	558	586	571
1925–1938			
Mean[1]	−0.331**	0.073	0.047
Standard deviation	1.744	1.583	1.822
Percent of positive days[2]	43.2**	55.5**	52.3
Number of days	578	623	608
1939–5/30/52			
Mean[1]	−0.084*	−0.004	0.072*
Standard deviation	0.771	0.904	0.766
Percent of positive days[2]	47.9	52.2	54.2*
Number of days	470	602	585
6/1/52–1963			
Mean[1]	−0.194**	0.015	0.084
Standard deviation	0.802	0.678	0.691
Percent of positive days[2]	41.3**	52.9	55.0*
Number of days	509	522	533
1964–1975			
Mean[1]	−0.164**	−0.011	0.081*
Standard deviation	0.897	0.803	0.891
Percent of positive days[2]	40.6**	49.0	54.3*
Number of days	527	526	547
1976–1985			
Mean[1]	−0.060	0.060	0.025
Standard deviation	1.040	0.974	0.891
Percent of positive days[2]	47.7	49.6	50.3
Number of days	459	474	503

Excludes days preceded or followed by holidays.

[1] The significance levels are based on a *t*-test of the null hypothesis that the mean is zero.

[2] The significance levels are based on a sign test of the null hypothesis that the probability of a positive return is 50 percent and will not be correct if the return distribution is asymmetric.

Table 2
Extended

Thursday	Trading Saturday	Friday before no-trading Saturday	Saturday
0.024	0.050*	0.070**	0.052**
1.042	1.227	0.721	0.837
0.021	0.094	0.079	0.074
51.0	54.4**	54.6**	56.5**
4111	2316	1645	2308
0.012	0.050*	0.115	0.052**
1.173	1.227	0.626	0.837
0.012	0.094	0.052	0.074
50.3	54.4**	53.6	56.5**
2507	2316	110	2308
0.040*	—	0.067**	
0.795	—	0.727	
0.037	—	0.090	
51.9	—	54.7**	
1604	—	1535	
−0.031	0.082*	—	−0.013
1.084	1.032	—	0.845
50.3	55.6**	—	51.8
648	620	—	623
−0.013	0.075	—	0.090**
1.083	0.931	—	0.668
47.8	53.9	—	56.3**
603	586	—	588
0.082	0.044	—	0.032
1.582	1.804	—	1.161
53.5	56.0**	—	56.0**
637	612	—	600
0.011	0.012	0.067**	0.112**
0.789	0.810	0.727	0.441
49.6	51.2	54.7	63.4**
619	498	1535	497
0.039	—	0.119**	
0.620	—	0.579	
54.0	—	60.7**	
550	—	527	
0.048	—	0.028	
0.835	—	0.786	
49.5	—	53.0	
549	—	540	
0.033	—	0.054	
0.911	—	0.800	
52.3	—	50.1	
505	—	468	

* Significant at 5 percent level for two-tailed test.
** Significant at 1 percent level for two-tailed test.

Table 3
Daily rates of return of the Dow Jones Industrial Average before and after holidays and on regular days, in percent

Period	Before-holiday days	After-holiday days	Regular days
1897–1986 (No. of holidays = 915/22,019)[1]			
Mean[2]	0.220**	−0.017	0.009
Standard deviation	1.061	1.314	1.050
Median	0.196	0.054	0.035
Percent of positive days[3]	63.9**	50.1	51.7
1897–1951 (No. of holidays = 543/14,280)[1]			
Mean[2]	0.241**	−0.101	0.008
Standard deviation	1.143	1.490	1.154
Median	0.196	0.000	0.045
Percent of positive days[3]	64.3**	50.0	52.2
1952–1986 (No. of holidays = 372/7739)[1]			
Mean[2]	0.181**	0.106*	0.011
Standard deviation	0.897	0.987	0.822
Median	0.196	0.103	0.017
Percent of positive days[3]	63.2**	55.9*	50.8
1897–1910 (No. of holidays = 123/3749)[1]			
Mean[2]	0.285**	−0.020	0.004
Standard deviation	1.011	1.320	1.052
Percent of positive days[3]	70.1**	48.3	51.6
1911–1924 (No. of holidays = 139/3492)[1]			
Mean[2]	0.083	0.001	0.016
Standard deviation	1.040	1.206	0.945
Percent of positive days[3]	55.7	51.3	51.4
1925–1938 (No. of holidays = 138/3658)[1]			
Mean[2]	0.449**	−0.268	0.000
Standard deviation	1.601	2.089	1.636
Percent of positive days[3]	66.3**	47.6	52.9
1939–5/1952 (No. of holidays = 143/3381)[1]			
Mean[2]	0.130**	−0.097	0.021
Standard deviation	0.593	1.138	0.764
Percent of positive days[3]	65.4**	48.9	53.0
6/1952–1963 (No. of holidays = 123/2641)[1]			
Mean[2]	0.323**	0.216**	0.014
Standard deviation	0.717	0.799	0.685
Percent of positive days[3]	72.2**	65.8**	52.9
1964–1975 (No. of holidays = 146/2689)[1]			
Mean[2]	0.178*	−0.045	−0.001
Standard deviation	0.868	0.836	0.847
Percent of positive days[3]	61.3*	50.7	49.3
1976–6/1986 (No. of holidays = 103/2409)[1]			
Mean[2]	0.011	0.189	0.023
Standard deviation	1.089	1.317	0.926
Percent of positive days[3]	54.4	51.5	50.0

[1] The numbers shown are the number of holidays and the total number of trading days. The number of days before and after holidays equals the number of holidays. All other trading days are regular days.

[2] The significance levels are based on a t-test of the null hypothesis that the mean is zero.

[3] The significance levels are based on a sign test of the null hypothesis that the probability of a positive return is 50 percent and will not be correct if the return distribution is asymmetric.

* Significant at 5 percent level for two-tailed test.

** Significant at 1 percent level for two-tailed test.

a common origin in the closing of the exchange the following day, the preholiday rates of return are generally two to five times larger than preweekend rates of return. Therefore, there appears to be an additional factor at work.

The average rate of return after holidays is negative for the total period, −0.017 percent. However, this rate of return is not significantly different from zero or from the average rate of return on regular days and is much less negative than the rate of return on Mondays.

6. End-of-December Returns

We have already mentioned that the last half of December has exceptionally high returns. Possibly, this is because the period includes the trading days before two major holidays, Christmas and New Year's Day. The results in the previous section document high preholiday rates of return. Table 4 focuses on the last half of December. This period was partitioned into three intervals as follows: (1) from mid-December up to, but not including, the last trading day before Christmas (the pre-Christmas period); (2) from the first trading day after Christmas up to, but not including, the last trading day before New Year's Day (the interholiday period); and (3) the last trading day before Christmas and the last trading day before New Year's Day (the preholiday days). The average number of trading days per year in each of the three intervals is 3.5, 3.3, and 2 for the pre-Christmas period, interholiday period, and preholiday days, respectively.

The average daily rate of return for the pre-Christmas period is slightly negative but not significantly different from the typical daily rate of return. The increase in the DJIA index during the last half of December is concentrated in the period beginning on the last pre-Christmas trading day. The average rates of increase during this brief time are very large: 0.248 percent per day during the interholiday period and 0.386 percent per day on the two preholiday days. Overall, the average rate of increase in the DJIA index during this week is on the order of 1.6 percent ($3.3 \times 0.248 + 2 \times 0.386$). These high rates of increase are persistent across all the subperiods; for the pre-1952 period the average rate of increase is 1.8 percent, and for the post-1952 period it is 1.2 percent.[17]

7. The Turn-of-the-Month Returns

Ariel (1987) analyzed the 1963–1981 period and provided some evidence that days around the turn of the month exhibit high rates of return. We examine this issue in depth.

[17] The nonparametric statistics confirm the previous results with respect to the total period and the subperiods. The frequency of positive rates of return is high during the interholiday period and especially on the preholiday days. On the two preholiday days the rate of return is positive on 71 percent of the days compared with 51 percent on a typical day.

Table 4
Daily rates of return of Dow Jones Industrial Average during last half of December by period, in percent

Period	Pre-Christmas period[1]	Interholiday period[2]	Preholiday days[3]
1897–1986			
Mean[4]	−0.039	0.248**	0.386**
Standard deviation	1.100	1.011	0.714
Median	0.003	0.134	0.256
Percent of positive days[5]	49.7	57.3*	70.9**
Number of days	314	293	172
1897–1951			
Mean[4]	−0.042	0.288**	0.423**
Standard deviation	1.266	1.156	0.811
Median	0.023	1.644	0.299
Percent of positive days[5]	52.1	57.4*	72.1**
Number of days	209	190	104
1952–1985			
Mean[4]	−0.034	0.175**	0.329**
Standard deviation	0.661	0.663	0.532
Median	−0.105	0.083	0.184
Percent of positive days[5]	44.8	57.3	69.1**
Number of days	105	103	68
1897–1910			
Mean[4]	0.055	0.504**	0.359*
Standard deviation	1.109	1.139	0.901
Percent of positive days[5]	53.8	61.7	65.4
Number of days	52	47	26
1911–1924			
Mean[4]	0.033	0.185	0.685**
Standard deviation	1.523	0.992	0.959
Percent of positive days[5]	52.9	53.1	84.6**
Number of days	51	49	26
1925–1938			
Mean[4]	−0.218	0.217	0.508**
Standard deviation	1.569	1.548	0.826
Percent of positive days[5]	52.5	51.0	71.4*
Number of days	59	49	28
1939–1951			
Mean[4]	−0.009	0.252*	0.111*
Standard deviation	0.447	0.790	0.259
Percent of positive days[5]	48.9	64.4	66.7
Number of days	47	45	24
1952–1963			
Mean[4]	−0.104	0.216*	0.295**
Standard deviation	0.508	0.509	0.344
Percent of positive days[5]	37.8	64.7	79.2**
Number of days	37	34	24
1964–1975			
Mean[4]	−0.151	0.190	0.392**
Standard deviation	0.651	0.753	0.673
Percent of positive days[5]	45.9	56.8	62.5
Number of days	37	37	24
1976–1985			
Mean[4]	0.189	0.115	0.293*
Standard deviation	0.790	0.713	0.549
Percent of positive days[5]	51.6	50.0	65.0
Number of days	31	32	20

[1] From mid-December up to, but not including, the last trading day before Christmas.

[2] From the first trading day after Christmas up to, but not including, the last trading day before New Year's Day. (Table notes continued, p. 417.)

Table 5 shows statistics on rates of return for eight days around the turn of the month. Days −1 and 1 are the last and the first trading days of a month, respectively. The results reveal a strong turn-of-the-month effect. Focusing on the total sample, the average rates of return are especially high for days −1 to 3. The cumulative rate of increase over the four days around the turn of the month is 0.473 percent, whereas for an average four-day period the rate of increase is 0.0612 percent. This difference is statistically significant at the 0.1 percent level. The frequency of positive rates of return around the turn of the month is more than 56 percent compared to less than 52 percent for a regular day.

The average price increase during the four-day period around the turn of the month exceeds the average monthly price increase, which is 0.349 percent. Therefore, the DJIA goes down during the non-turn-of-the-month period. We found an average daily rate of return of −0.001 percent for days 5 to 9 and −0.032 percent per day for the interval −5 to −9.

The results are, in general, consistent across the major subperiods. For example, the four-day rate of return is 0.492 percent and 0.443 percent for the first and second major subperiods, respectively. The results remained essentially the same when the last trading day of December and the first three trading days of January were excluded.[18]

8. Dividend Effects

The DJIA is not adjusted for dividends. Seasonalities in dividend payments could induce seasonal patterns in the reported rates of return on the DJIA even though there was no seasonal pattern in the dividend-adjusted rates of return. To investigate this issue we collected dividend data for the stocks in the DJIA during five calendar years—1941, 1951, 1961, 1971 and 1981—and computed the dividend return to the DJIA on each day that any Dow stock went ex dividend. The total dividend return (a simple sum of the daily dividend returns) for these years was 6.2, 5.8, 3.0, 3.5, and 6.0 percent, respectively.[19] Data on the seasonal pattern for the first and last of these years and the average of the five years are shown in Table 6.

[18] This turn-of-the-month pattern may partly be due to pension fund managers concentrating their buying at the end of the month to avoid a downward bias in estimated rates of return (Stewart, 1987).

[19] We acknowledge the help of Mr. Steven Wheeler, assistant archivist of the New York Stock Exchange, who provided information on New York Stock Exchange ex-dividend period regulations for the 1875–1933 period, and of Professor Michael Barclay of the University of Rochester, who kindly shared with us some data on ex-dividend days around the turn of the century that were collected for his article (1987).

←

[3] The last trading day before Christmas and the last trading day before New Year's Day.

[4] The significance levels are based on a t-test of the null hypothesis that the mean is zero.

[5] The significance levels are based on a sign test of the null hypothesis that the probability of a positive return is 50 percent and will not be correct if the return distribution is asymmetric.

* Significant at 5 percent level for two-tailed test.

** Significant at 1 percent level for two-tailed test.

Table 5
Daily rates of return of the Dow Jones Industrial Average around the turn of the month, in percent

	−4	−3	−2
1897–1986			
Mean[1] (1052 obs.)	0.002	−0.023	0.061
Standard deviation	1.093	1.104	1.049
Median	0.051	0.000	0.087
Percent of positive days[2]	52.3	49.8	54.1**
1897–1952			
Mean[1] (643 obs.)	−0.001	−0.061	0.090*
Standard deviation	1.256	1.217	1.100
Median	0.028	0.000	0.107
Percent of positive days[2]	51.5	49.1	56.0**
1952–1986			
Mean[1] (409 obs.)	0.017	0.035	0.014
Standard deviation	0.772	0.897	0.847
Median	0.082	0.018	0.032
Percent of positive days[2]	53.5	50.9	51.1
1897–1910			
Mean[1] (163 obs.)	0.173*	−0.026	0.133
Standard deviation	1.126	1.046	0.987
Percent of positive days[2]	60.1*	51.5	52.1
1911–1924			
Mean[1] (156 obs.)	−0.001	−0.037	0.045
Standard deviation	0.962	0.928	0.900
Percent of positive days[2]	48.1	42.3	56.4
1925–1938			
Mean[1] (164 obs.)	−0.237	−0.209	0.090
Standard deviation	1.853	1.853	1.546
Percent of positive days[2]	43.9	53.1	57.3
1939–5/1952			
Mean[1] (160 obs.)	0.043	0.032	0.092
Standard deviation	0.750	0.690	0.805
Percent of positive days[2]	53.8	49.4	58.1*
6/1952–1963			
Mean[1] (139 obs.)	0.029	0.082	0.149*
Standard deviation	0.682	0.909	0.802
Percent of positive days[2]	54.7	56.1	58.3
1964–1975			
Mean[1] (144 obs.)	−0.063	0.028	−0.033
Standard deviation	0.828	0.949	0.829
Percent of positive days[2]	51.4	47.2	43.8
1976–5/1986			
Mean[1] (126 obs.)	0.094	0.000	−0.082
Standard deviation	0.796	0.825	0.900
Percent of positive days[2]	54.8	49.2	51.6

[1] The significance levels are based on a t-test of the null hypothesis that the mean is zero.

[2] The significance levels are based on a sign test of the null hypothesis that the probability of a positive return is 50 percent and will not be correct if the return distribution is asymmetric.

The top panel in Table 6 shows the monthly dividend returns for 1941 and 1981. Most companies pay their regular dividends on a quarterly basis. Two seasonal patterns are noteworthy. The first is a tendency for the dividend return during the middle month of each calendar quarter to be higher

Table 5
Extended

−1	1	2	3	4
0.122**	0.084*	0.127**	0.140**	0.016
0.980	1.119	1.014	1.068	1.071
0.123	0.137	0.147	0.132	0.079
56.5**	56.9**	57.8**	56.8**	53.1*
0.123**	0.114*	0.113**	0.142**	0.019
1.100	1.181	1.103	1.195	1.221
0.123	0.170	0.123	0.133	0.071
56.3**	59.3**	56.6**	56.5**	52.6
0.120**	0.036	0.149**	0.138**	0.013
0.754	1.015	0.857	0.833	0.782
0.123	0.079	0.188	0.129	0.083
56.7**	53.3	59.7**	57.2**	54.0
0.103	0.181*	0.060	0.024	−0.062
1.035	1.113	0.870	0.990	1.007
55.9	60.7**	51.5	52.8	49.7
0.072	0.077	0.110	0.069	0.016
1.072	1.109	1.084	0.928	0.998
51.3	59.0*	57.7	55.1	51.9
0.215	0.086	0.074	0.273*	0.161
1.471	1.594	1.557	1.744	1.840
59.8*	56.1	54.3	59.8*	57.9*
0.098	0.111	0.212**	0.198**	−0.043
0.669	0.747	0.703	0.876	0.721
58.1*	61.3**	63.1**	58.1*	50.6
0.188**	0.122*	0.277**	0.141*	0.010
0.670	0.668	0.639	0.673	0.640
66.2**	63.3**	69.1**	59.7*	50.4
0.142*	0.000	0.045	0.186*	0.074
0.822	0.924	0.851	0.875	0.732
53.5	49.7	56.9	60.4*	58.3*
0.018	0.000	0.128	0.078	−0.054
0.755	1.371	1.042	0.938	0.960
50.0	48.4	52.4	50.8	53.1

* Significant at 5 percent level for two-tailed test.
** Significant at 1 percent level for two-tailed test.

than the dividend return during either the first or last month of the quarter. This tendency has intensified over time. In 1941, 48 percent of the dividend return for the year occurred in the middle months of the quarter; by 1981 this had risen to 68 percent. The second pattern is a tendency for firms to

Table 6
Dividend yields for the Dow Jones Industrial Average

	1941	1981	Average[1]
By month (percent per month)			
January	0.17	0.31	0.18
February	0.64	0.99	0.71
March	0.50	0.10	0.24
April	0.24	0.22	0.16
May	0.72	1.04	0.78
June	0.54	0.11	0.22
July	0.17	0.31	0.16
August	0.65	1.10	0.79
September	0.47	0.07	0.19
October	0.18	0.63	0.28
November	0.95	0.93	0.86
December	1.00	0.15	0.33
By day of the week (percent per day)			
Monday	0.0126	0.0480	0.0240
Tuesday	0.0082	0.0226	0.0225
Wednesday	0.0134	0.0129	0.0117
Thursday	0.0453	0.0131	0.0134
Friday	0.0404	0.0179	0.0229
Around the turn of the month (percent per day)			
−4	0.0016	0.0469	0.0133
−3	0.0071	0.0103	0.0144
−2	0.0149	0.0062	0.0120
−1	0.0037	0.0381	0.0148
1	0.0053	0.0809	0.0342
2	0.0090	0.0210	0.0215
3	0.0355	0.0237	0.0185
4	0.0375	0.0348	0.0257

[1] Average across the years 1941, 1951, 1961, 1971, and 1981.

pay an extra dividend during December. This tendency has weakened. Four Dow companies paid an extra dividend in December 1941. None did during December 1981.

The monthly pattern of dividend returns does not change any of our conclusions regarding monthly returns on the Dow. The dividend rate of return in January is below average, but, as we have seen, without dividends there is not a statistically significant difference between the January DJIA rate of return and the rate of return of the other months. The dividend pattern indicates that adjusting for dividends would not lead to any changes in our conclusions about monthly rate-of-return seasonality.

The middle panel in Table 6 shows dividend returns by day of the week. The high dividend return on Mondays is a recent phenomenon. In 1981, 42 percent of the dividends were paid on Mondays. However, the daily dividend returns are much too small to explain the weekly seasonal. The largest daily dividend return in the table is 0.048 percent, whereas the average rate of return on Mondays is −0.144 percent.

The bottom panel in Table 6 shows dividend returns around the end of the month. Again, there does not seem to be any pattern, certainly not any that is large enough to explain the turn-of-the-month effect.

9. Conclusions

In summary, DJIA returns are persistently anomalous over a 90-year period around the turn of the week, around the turn of the month, around the turn of the year, and around holidays. Specifically, the rate of return on Monday is substantially negative (−0.14 percent), the price increase around the turn of the month exceeds the total monthly price increase, the price increase from the last trading day before Christmas to the end of the year is over 1.5 percent, and the rate of return before holidays is more than 20 times the normal rate of return. The possibility that these particular anomalies could have occurred by chance cannot be excluded, but this is very unlikely. We do not find either a consistent monthly pattern in the returns or any consistent tendency for returns in the first part of the month to be higher.

It is useful to relate the magnitude of the anomalies with the size of a tick (the smallest price change), which is 12.5 cents. Because the average price per share on the NYSE is about $40, a movement of one tick corresponds to a price change of 0.313 percent or more, which is much larger than most seasonal anomalies discussed in this paper. For example, the average Monday price decrease of −0.144 percent is well within one tick.

Notwithstanding the small magnitude of these regularities, their persistence demands explanation and focuses attention on the processes by which prices in securities markets are set. It is unlikely that there is a single explanation of the various seasonalities. Possible explanations that have been suggested include inventory adjustments of different traders [Rock (1989) and Ritter (1988)], the timing of trades by informed and uninformed traders [Admati and Pfleiderer (1988a)], and specialists' strategies in response to informed traders [Admati and Pfleiderer (1988b)], as well as the timing of corporate news releases [Penman (1987)], seasonal patterns in cash flows to individuals and institutional investors, tax-induced trading [Lakonishok and Smidt (1986)], and the window dressing induced by periodic evaluation of portfolio managers [Haugen and Lakonishok (1988) and Ritter and Chopra (1989)].

Appendix

Descriptive statistics for average rates of return by month for the total sample and the pre- and post-1952 periods are shown in Table A1. The results reveal that none of the months is consistently different than average.[20] August, which had the highest rate of return in the first subperiod, had a relatively low rate of return in the second subperiod. January is

[20] Table A1 also shows the percentage of months with positive rates of return and the results of a sign test in which the null hypothesis is that the percentage of positive rates of return in the given month is equal for all months. The results of this nonparametric test are consistent with the findings presented above.

Table A1
Monthly rates of return of the Dow Jones Industrial Average by period, 1897–1986, in percent

	January	February	March	April	May
1897–5/86					
Mean[1]	0.818	−0.456	0.483	0.647	−0.554
Standard deviation	4.463	4.188	5.597	6.569	6.085
Median	0.952	−0.245	1.035	0.479	−0.113
Number of months	90	90	89	90	90
Percent of positive months	62	48	60	54	49
Sign test (z-statistic)[2]	1.085	−1.680	0.570	−0.404	−1.467
1897–5/52					
Mean[1]	0.776	−0.622	0.307	0.050	−0.306
Standard deviation	4.016	4.701	6.743	7.770	7.236
Median	0.841	−0.518	0.996	−0.461	0.221
Number of months	55	56	56	56	56
Percent of positive months	64	45	55	48	54
Sign test (z-statistic)[2]	0.999	−1.863	−0.244	−1.323	−0.514
6/52–1986					
Mean[1]	0.883	−0.182	0.979	1.631*	−0.961
Standard deviation	5.149	3.214	2.993	3.762	3.513
Median	1.336	0.323	1.444	1.190	−0.753
Number of months	35	34	34	34	34
Percent of positive months	60	53	62	65	41
Sign test (z-statistic)[2]	0.536	−0.300	0.735	1.080	−1.681

[1] The significance levels are based on a t-test of the null hypothesis that the mean is zero.

[2] The significance levels are based on a sign test of the null hypothesis that the probability of a positive return is 50 percent and will not be correct if the return distribution is asymmetric.

definitely not an above-average month. There are quite a number of months with higher rates of return.[21]

Tests of the null hypothesis that all months are the same are reported in Table A2. An F-test of the equality of mean rates of return across months is significant at the 1 percent level for the total period and one short subperiod and at the 5 percent level for one of the main subperiods (not reported). However, months that performed well in one subperiod are not, in general, months that performed well in other subperiods. Therefore, it seems that there is no consistent monthly pattern in the stock market. A chi-square test of the equality of the fraction of positive returns in each month yields similar results.

Monthly data provides a good illustration of Black's (1986) point about the difficulty of testing hypotheses with noisy data. It is quite possible that some month is indeed unique, but even with *90* years of data the standard

[21] Based on the total sample, the strongest candidates for months having exceptional rates of return are the late-summer months July and August, with high positive rates of return (1.29 percent and 1.58 percent, respectively) and September, with high negative rates of return (−1.47 percent). One can see in the pre-1952 period the basis for the widespread belief in the summer market rally among practitioners. If any persistent tendency for prices to rise in the summer once existed, which may be doubted, there is no evidence in recent data for its continued existence; July and August in the post-1952 period have rates of return similar to a typical month.

Table A1
Extended

June	July	August	September	October	November	December	Entire period average
0.430	1.290*	1.578*	−1.470*	−0.092	0.603	0.895	0.349
5.562	5.588	5.676	6.580	5.774	5.948	5.279	
0.030	2.115	1.476	−0.537	0.344	0.819	1.886	
89	89	88	88	88	88	89	
51	62	67	41	55	60	71	
−1.141	0.998	1.985*	−2.961**	−0.380	0.695	2.709**	
0.700	1.603	2.539**	−1.855	−0.414	−0.018	0.566	0.265
6.603	6.439	6.143	7.798	6.635	6.537	6.360	
0.108	2.958	2.294	−0.222	0.755	0.464	2.353	
55	55	54	54	54	54	55	
51	65	76	46	52	56	73	
−0.908	1.271	2.813**	−1.584	−0.760	−0.210	2.360*	
−0.006	0.783	0.052	−0.859	0.420	1.589	1.426**	0.484
3.290	3.872	4.519	3.981	4.094	4.797	2.769	
0.000	0.964	0.479	−1.058	0.269	1.989	1.186	
34	34	34	34	34	34	34	
50	56	53	32	59	68	68	
−0.645	0.045	−0.300	−2.716**	0.390	1.425	1.425	

* Significant at 5 percent level for two-tailed test.

** Significant at 1 percent level for two-tailed test.

deviation of the mean monthly return is very high (around 0.5 percent). Therefore, unless the unique month outperforms other months by more than 1 percent, it would not be identified as a special month.

Another interesting observation is that January had the lowest standard deviation in the first major subperiod and the highest standard deviation

Table A2
Significance tests for monthly rates of return of the Dow Jones Industrial Average

Period	Equality of months: *F*-value (DF)	Equality of months: Chi-square (DF)	January vs. average of other months, *t*-statistic
1897–1986	2.204** (12, 1055)	29.61** (11)	1.0642
1897–5/30/52	1.560 (12, 647)	25.60** (11)	0.890
6/1/52–1986	2.148* (12, 396)	17.01 (11)	0.593

1 The significance levels are based on a *t*-test of the null hypothesis that the mean is zero.

2 The significance levels are based on a sign test of the null hypothesis that the probability of a positive return is 50 percent and will not be correct if the return distribution is asymmetric.

Significant at 5 percent level for two-tailed test.

Significant at 1 percent level for two-tailed test.

in the second major subperiod. Perhaps changes in the timing of information releases can account for this change.

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