REAL VS. NOMINAL STOCK RETURN SEASONALITIES: EMPIRICAL EVIDENCE

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ABSTRACT

In Israel, where the average inflation rate has been relatively high, calendar stock market anomalies appear different than in most of the other international markets. Adjustment for inflation, however, eliminates the dissimilarities. This suggests that calendar seasonalities are real, and should be measured in real terms.

I. INTRODUCTION

In the most recent two decades much evidence has accumulated on return seasonalities in stock markets. Contrary to earlier beliefs that return distribution should be identical across all days of the week, month and year (except possibly days that follow weekends and holidays), it was found that returns depend on day of the week, day of the month, day of the year, and even intraday time, that is, time elapsed since the opening of trade on a certain day. The return patterns detected were shown to recur regularly over a wide range of international equity markets and over long time periods.

An exception to the general return behavior patterns was recently identified by Lauterbach and Ungar (1992) and Plaut (1992). In Israel, the average stock return on the first trading day of the week (Sunday in Israel) is highest of the week and not lowest of the week as in other international markets. This finding suggests that there may exist a

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fundamental compensation for the illiquidity and greater risk of investing during market closures.

The purpose of this paper is twofold. First, to extend the empirical analysis of the Israeli market by examining a larger data set (15 years of daily data on two stock indices) and a wider range of anomalies. Second and more importantly, to test the sensitivity of the Israeli aberration to inflation. During the sample period, the inflation rate in Israel was both relatively high and variable, hence the effects of inflation may be nontrivial.

The empirical work shows that adjustments for inflation matter. The unique nominal anomalies documented in the Israeli market disappear after netting out the effect of inflation. When the anomalies are measured in real (inflation adjusted) terms, the Israeli stock market anomalies are almost indistinguishable from those in other equity markets. These findings highlight the importance of inflation adjustments in capital market research. Real anomalies can be measured only in real terms.

II. PREVIOUS RESEARCH

A. *An Overview of the Main Calendar Anomalies*

The earliest and most widely researched anomaly relates to the day of the week. The so-called weekend effect consists of the observation that the mean return between the closing of week t - 1 and the closing of the first trading day of week t is negative and lowest of the week (Cross, 1973 and French, 1980). There is evidence that the negative mean return accumulates primarily over the non-trading hours of the weekend (between the close of previous week and the open of current week--see Harris, 1986, and Smirlock & Starks, 1986); and that turn of the week effects exist also in bond and futures markets (Gibbons & Hess, 1981, and Dyl & Maberly, 1986).

Jaffe, Westerfield and Ma (1989) document some interesting variations in the weekend effect. Weekend returns are relatively low only following weeks of stock market decline. In weekends that follow stock market advances, stock returns do not appear different from the rest of the week returns.

A second set of calendar anomalies is commonly termed the holiday effect. Stock returns behave differently both before and after holidays. The mean stock returns on the first trading day after a holiday is relatively low (French, 1980; Lakonishok & Smidt, 1988). In contrast, the mean return on the last trading day before a holiday tends to be unusually high (Ariel, 1990). In the U.S., 35 percent of the market advances in the years 1963-1982 occurred on the last trading days before holidays (Jacobs & Levy, 1988).

The holiday effect seems closely related to the weekend effect. The similarity is not only in the low return after a weekend or holiday. Trading days before holidays and weekends also behave qualitatively the same. Keim and Stambaugh (1984) report that in the 1953-82 period the average return of U.S. stocks on Fridays was 0.092 percent, which is large relative to the average daily stock return of 0.025 percent during that period.

A third set of anomalies is associated with the day of the month. The original work of Ariel (1987) demonstrates that in the 1963-1981 period, all stock return accumulated during the first half of the month. The cumulative 1963-1981 return of an equally-weighted

index of U.S. common stocks on the first half of the month (which according to Ariel (1987) includes also the last day of the month) was 2,552.40 percent, while the cumulative return on the rest of the days was -0.25 percent. Ariel termed these findings "the half-month effect."

Later research revealed however that the monthly seasonal concentrates on the turn of the month days, that is, on the first and last trading days of the month, where average returns are abnormally high (Lakonishok & Smidt, 1988). Thus, monthly phenomena seemingly emerge in two layers, on turn of the month days and on the first half of the month.

Given the evidence on turn-of-the-month and turn-of-the-week (weekend) effects, the existence of a turn-of-the-year effect is hardly surprising. Average returns on January were shown to be higher than in any other month of the year, and the turn of the month phenomenon is particularly strong on January (the turn of the year). Cadsby and Ratner (1992, Table 1, p. 501) report that during the years 1962-1987 the average return on an equally-weighted index of U.S. stocks on turn of the year days was 0.8% higher than on other turn of the month days.

B. *International Evidence*

All return seasonalities reviewed above were originally detected using U.S. data. This led researchers to worry that the anomalies are artifacts of extensive U.S. "data mining." To guard against this false-positive alternative, other stock markets besides the U.S. were examined. Studying equity markets outside the U.S. seems prudent also because an international comparison might aid in formulating hypotheses about the origin of the seasonal effects. For example, if it is found that a particular seasonal is missing in some market, the source of this anomaly should relate to the unique features of that market.

Studies of international stock markets such as Jaffe and Westerfield (1985) generally confirm the U.S. findings. However, occasionally international markets exhibit different behavior than the United States. For example, Cadsby and Ratner (1992) do not find pre-holiday effects in any of the European countries; Lee, Pettit and Swankoski (1990) do not find lower post-holiday stock returns in Japan and Taiwan; and Kato (1990) and Ziemba (1991) find higher returns on the last five to seven days of the month in Japan.

The present study investigates a specific divergent market - the Israeli stock market. The Israeli market exhibits turn of the month and turn of the year phenomena similar to the U.S. [*see* Lauterbach and Ungar (1992)]. However, in Israel, the weekend and post holiday returns are significantly positive and high relative to other (regular) trading days.

The main purpose of the study is to examine whether the idiosyncrasies exhibited by the Israeli market can be explained by the relatively high and variable inflation rate present in Israel over most of the recent two decades. The hypothesis is that real (inflation adjusted) returns would yield an anomaly structure that is more similar to international evidence. If this "real anomaly" thesis can be supported then this study offers somewhat unique evidence that financial phenomena are better described in real, rather than in nominal, terms.

III. DATA AND METHODOLOGY

Daily data on the General (all stocks) Price Index and the Industrial Stock Price Index were collected from the Official Daily Quote Sheet published by the Tel-Aviv Stock Exchange. The price indices used are value-weighted and corrected for distributions such as cash and stock dividends. The sample period is January 2, 1977 to January 2, 1992, and the number of price observations for each index is 3,615. Two index-series are analyzed because the first (the General Index) is more representative while the second (the Industrial-stock Index) is more sensitive.

Daily rates of return, R_t's, are calculated as the continuously compounded rates of change of the appropriate stock price index, that is:

$$R_t = Ln(I_t/I_{t-1}) \tag{1}$$

where I_t is the level of the relevant stock index at the close of day t, and Ln is the natural logarithm. We compute continuously compounded returns (rather than arithmetic returns) because continuously compounded returns are additive and because their distribution "follows" the Normal distribution more closely than arithmetic returns.

One of the major tasks of this study is to document anomalies in real (inflation adjusted) units. In order to convert nominal returns (R_t's) into real returns (r_t's), we subtract from the nominal return an estimate of the inflation that had occurred since the previous trading day, that is:

$$r_t = R_t - (\Pi_t/DAYSM_t)NDAYS_{t-1,\,t}, \tag{2}$$

where Π_t is the inflation (continuously compounded rate of change of the Consumer Price Index) during the month in which trading date t occurs, $DAYSM_t$ is the number of calendar days in that month, and $NDAYS_{t-1,\,t}$ is the number of calendar days between trading dates t-1 and t. The inflation adjustment term in equation (2) is best viewed as built in two steps. First, $\Pi_t/DAYSM_t$—the daily inflation rate in the measurement month—is calculated. Then, this daily inflation figure is multiplied by the number of calendar days elapsed since the previous trading date ($NDAYS_{t-1,\,t}$) in order to obtain an estimate of the inflation that has accumulated between trading dates t-1 and t.

To investigate seasonal patterns, each return observation is coded according to its day of the week, day relative to a holiday, day relative to the turn of the month, and day relative to the turn of the year. Then, each of the recognized seasonal effects is tested individually, using simple t-tests and analysis of variance methods.

IV. EMPIRICAL RESULTS: THE NOMINAL ACCOUNT

A. Day-of-the-Week Effects

Panel A of Table 1 presents the means and standard deviations of nominal stock returns by day of the week. Average returns exhibit a U-shape pattern. The mean returns on the first and last trading days of the week (Sunday and Thursday, respectively in Israel) are highest of the week, while Monday's mean return is lowest of the week. The U-shape pat-

Table 1. The Day-of-the-Week Effect in the Israeli Stock Market (1977-1991)

	Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*
Panel A: Means and Standard Deviations of Returns by Day-of-the-Week					
	The General Stock Index Returns[a]				
Mean return (in %)	0.307	0.203	0.272	0.261	0.316
Standard deviation	1.480	1.417	1.229	1.176	1.076
Observations	716	725	722	724	727
	The Industrial Stock Index Returns[b]				
Mean return (in %)	0.351	0.102	0.148	0.196	0.437
Standard deviation	2.368	2.160	2.141	2.152	1.861
Observations	716	725	722	724	727
Panel B: The Effect of Previous-Week Performance					
	The General Stock Index Returns[c]				
Mean return (in %) when the previous-week return is negative	−0.121	0.065	0.245	0.124	0.267
Observations	208	219	218	212	211
Mean return (in %) when the previous-week return is positive	0.494	0.246	0.290	0.294	0.335
Observations	494	494	496	500	499
t of mean returns difference	−4.65	−1.32	−0.41	−1.83	−0.72
p-value	0.001	0.189	0.686	0.068	0.472
	The Industrial Stock Index Returns[d]				
Mean return (in %) when the previous-week return is negative	−0.268	−0.011	0.148	0.122	0.442
Observations	282	288	289	284	281
Mean return (in %) when the previous-week return is positive	0.740	0.153	0.161	0.176	0.430
Observations	420	425	425	428	429
t of mean returns difference	−5.59	−0.94	−0.08	−0.35	0.09
p-value	0.001	0.346	0.938	0.724	0.931

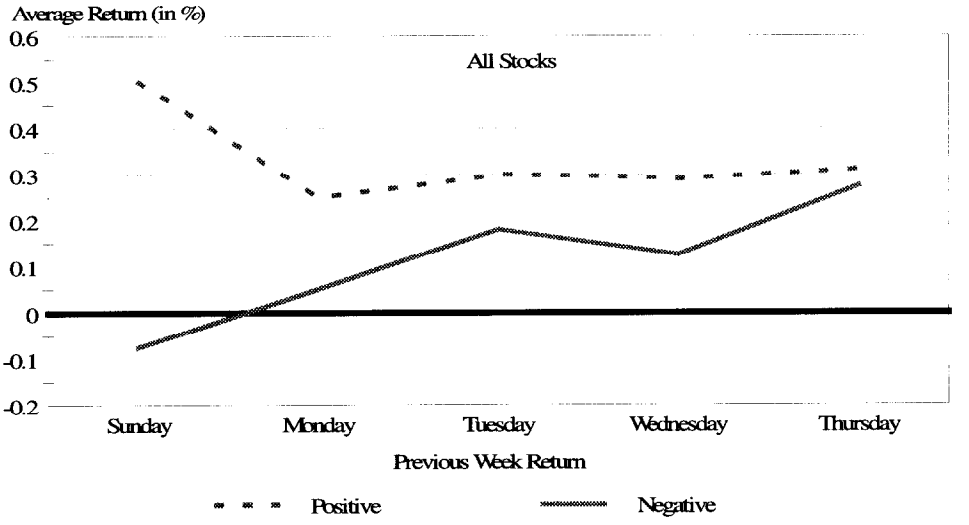
Notes: [a]The *F*-test statistic for the equality of mean returns across weekdays is 0.89 (*p*-value of 0.468).
[b]The *F*-test statistic for the equality of mean returns across weekdays is 3.17 (*p*-value of 0.013).
[c]In a two-way analysis of variance, the *F*-test statistics for day-of-the-week effect, previous-week effect, and interaction between day-of-the-week and previous-week are 1.22, 21.65 and 4.91, respectively (*p*-values of 0.302, 0.001 and 0.001).
[d]In a two-way analysis of variance, the *F*-test statistics for day-of-the-week effect, previous-week effect, and interaction between day-of-the-week and previous-week are 3.43, 11.65 and 7.15, respectively (*p*-values of 0.008, 0.001 and 0.001).

tern is, however, relatively shallow. *F*-tests of the equality of mean return across weekdays (calculated using a one-way analysis of variance procedure, and reported in the table) cannot reject the hypothesis that the General Stock Index mean returns are equal throughout the week. Only for the Industrial Stock Index, the equality of mean returns across weekdays can be rejected at the five percent level.

The findings in Table 1 confirm previous evidence by Lauterbach and Ungar (1992) and Plaut (1992). In Israel the mean return on the first trading day of the week (Sunday) is not lower than on other trading days. Thus, there does not seem to exist any weekend weakness

in Israeli stocks. Curiously, a Monday weakness similar to that present in international markets does appear. This suggests that international interdependencies spill over return anomalies onto Israel.

Further analyses of the day-of-the-week effect focus on its relation to the previous week return. Panel B of Table 1 reports the results. Similarly to Jaffe, Westerfield and Ma (1989) it is found that the mean weekend (Sunday) return is much lower following weeks of stock price decline. For example, the average return of the General Stock Index on Sundays following negative-return weeks is -0.12 percent, while the average return on Sundays



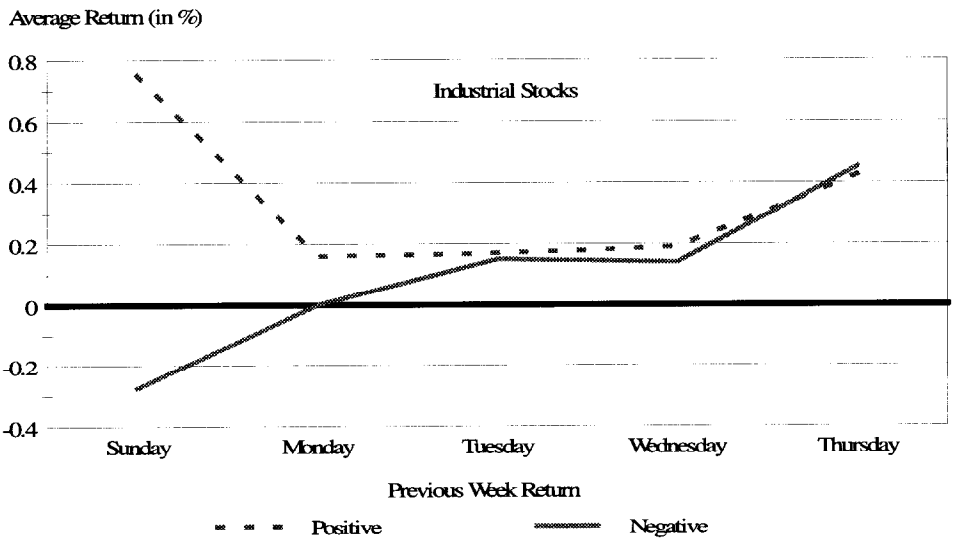


Figure 1. The Effect of Previous-Week Return on Daily Returns in Israel; 1977-1991

following positive-return weeks is 0.49 percent. The difference between these mean returns is statistically significant at the one percent level, indicating strong dependence of weekend returns on the previous-week performance. The effect of previous week performance extends to other days of the week as well. However, similarly to Jaffe, Westerfield and Ma (1989), the previous week effect is strongest on the first trading day of the week and it weakens as the week progresses (see Figure 1).

B. Holiday Effects

Table 2 presents summary statistics for nominal returns around holidays. Consistent with most international evidence, the pre-holiday mean return in Israel appears large relative to non-holiday returns. As usual, this pattern shows up most clearly in the more sensitive Industrial Stock Index, where the average pre-holiday return is more than thrice the average non-holiday return. The *t*-of-difference between pre-holiday and non-holiday average daily returns on the Industrial Stock Index is 3.12.

More interesting are the post-holiday returns. Contrary to U.S. evidence, post-holiday returns in Israel are high relative to non-holiday returns. The mean return of the General Stock Index on the day following a holiday is 0.59 percent, compared to a 0.25 percent mean return on non-holiday days (the *t*-of-difference is 2.3).

The finding of a high post-holiday mean return in Israel complements the finding of a strong Sunday (post-weekend) mean return. During the sample period, a break in trading in Israel was followed by higher, not lower, nominal returns. A-priori, this Israeli behavior appears more consistent with common sense than international evidence. The weekend return is a three calendar days return (from Thursday's close to Sunday's close, in Israel), and even for simple reasons such as "time value of money" considerations, it should be higher than regular trading days (one calendar day) returns.

Table 2. The Holiday Effect in the Israeli Stock Market (1977-1991)

	The trading day before holidays	*The trading day after holidays*	*Other trading days*
	The General Stock Index returns[a]		
Mean return (in %)	0.424	0.590	0.248
Standard deviation	0.872	1.825	1.266
Observations[b]	156	157	3,289
	The Industrial Stock Index returns[c]		
Mean return (in %)	0.644	0.651	0.207
Standard deviation	1.687	3.226	2.098
Observations[b]	156	157	3,289

Notes: [a]The t-statistic for the difference between pre-holiday and non-holiday mean returns is 2.40 (p-value of 0.017). The t-statistic for the difference between the post-holiday and non-holiday mean return is 2.32 (p-value of 0.222).
[b]Twelve days that are both pre-holiday and post-holiday trading days are excluded.
[c]The t-statistic for the difference between pre-holiday and non-holiday mean returns is 3.12 (p-value of 0.002). The t-statistic for the difference between the post-holiday and non-holiday mean return is 1.70 (p-value of 0.090).

C. *Monthly Effects*

The strong monthly seasonal is on turn of the month days. Panel A of Table 3 presents average nominal returns on the first, last, and "other" trading days of the month. The results are consistent with international evidence. The mean returns on the first (last) day of the month are larger than the mean returns on non-turn-of-the-month days by a factor of 2.6 and 4.4 (1.5 and 1.7) for the General Stock Index and the Industrial Stock Index, respectively. The difference between the mean returns on turn of the month (the first and last trading days of the month) and non-turn-of-the-month days is statistically significant at the one percent level.

Table 3. Day-of-the-Month Effects in the Israeli Stock Market (1977-1991)

	Trading Day of the Month		
	Last	*First*	*Other*
Panel A: The Turn-of-the-Month Effect			
	The General Stock Index Returns[a]		
Mean return (in %)	0.368	0.636	0.246
Standard deviation	1.277	1.616	1.260
Observations	180	180	3,254
	The Industrial Stock Index Returns[b]		
Mean return (in %)	0.345	0.905	0.205
Standard deviation	1.806	2.992	2.100
Observations	180	180	3,254

	Half of the Month		
	First (1-15 of the Month)		*Second (16 - end of the Month)*
Panel B: The Half-Month Effect			
	The General Stock Index Returns		
Mean return (in %)	0.305		0.239
Standard deviation	1.240		1.324
Observations	1,775		1,839
t of mean returns difference		1.56	
p-value		0.120	
	The Industrial Stock Index Returns		
Mean return (in %)	0.364		0.134
Standard deviation	2.190		2.094
Observations	1,775		1,839
t of mean returns difference		3.22	
p-value		0.001	

Notes: [a]The t-statistic for the difference in mean returns between turn-of-the-month days (the last and first trading days of the month) and other trading days is 3.19 (p-value of 0.002).

[b]The t-statistic for the difference in mean returns between turn-of-the-month days (the last and first trading days of the month) and other trading days is 3.09 (p-value of 0.002).

Another monthly seasonal examined is the half-month effect. We compare the average return on the first half (1st through 15th) of the month with the average return on the second half (16th through end) of the month. Ariel's (1987) original work included the last trading day of the month in the first half-month return. However, later work such as Lakonishok and Smidt (1988) and Milonas (1991) add the last trading day to the second half of the month.

The results of the half-month effect analysis are shown in panel B of Table 3. The mean returns on the first half of the month are higher than on the second half. However, the difference is statistically significant only for the Industrial Stock Index. Therefore, the evidence shows only mild support for the half-month phenomenon.

D. The Turn-of-the-Year Effect

Summary statistics for the turn of the year are presented in Table 4. The evidence is consistent with international findings. The last and first trading days of the year exhibit remarkably high returns. The mean daily return of the General (all stocks) Index on the turn of the year period (including the first and last trading days of the year) is 0.82 percent, while the mean daily return on the remainder of the year is 0.27 percent (1.22% and 0.24% respectively for the Industrial Stock Index). The hypothesis that the mean return at the turn of the year is equal to the mean return on other days can be marginally rejected for the General Stock Index (t-of-difference of 2.0; p-value of 0.05), and more strongly rejected for the Industrial Stock Index (t-of-difference of 2.5; p-value of 0.02).

It is interesting that when the turn of the Jewish year is examined no special returns are found. The Jewish New Year is a holiday in Israel and its returns seem to behave accordingly. The mean daily returns of the General and Industrial stock indices on the turn of the

Table 4. The Turn-of-the-Year Effect in the Israeli Stock Market (1977-1991)

	Trading Day of the Year		
	Last	*First*	*Other*
	The General Stock Index Returns[a]		
Mean return (in %)	0.632	1.011	0.267
Standard deviation	0.972	1.910	1.281
Observations	15	15	3,254
	Trading Day of the Month		
	Last	*First*	*Other*
	The Industrial Stock Index Returns[b]		
Mean return (in %)	0.690	1.756	0.239
Standard deviation	1.193	2.792	2.142
Observations	15	15	3,254

Notes: The t-statistic for the difference in mean returns between turn-of-the-year days (the last and first trading days of the year) and other trading days is 2.02 (p-value of 0.053).
The t-statistic for the difference in mean returns between turn-of-the-year days (the last and first trading days of the year) and other trading days is 2.47 (p-value of 0.020).

Jewish year period (0.49% and 0.61% respectively) are almost indistinguishable from regular holiday mean returns (see Table 2).

V. REAL ANOMALIES: THE EFFECT OF ADJUSTING FOR INFLATION

During the sample period, the average return on the General (all stocks) Index in Israel was 65.4 percent per year, while the average annual inflation rate was 57.9 percent. This suggests that most of the accumulated nominal return served to compensate investors for the reduction in the purchasing power of their money. In this section we will neutralize the inflation component of nominal returns in order to uncover the real behavior of returns.

Some general information about inflation rates in Israel might be in order first. During the sample period, the average inflation rate in Israel was 4.8 percent per month with a standard deviation of 4.6 percent. The median monthly inflation was 3.0 percent and the range of inflation rates was -1.3-24.3 percent per month. Two main subperiods can be observed. Prior to the drastic anti inflation plan of 1985 (described in Bruno, 1986) inflation rates in Israel were in excess of 100 percent per year. Since 1985, annual inflation rates are in the range of 10-20 percent. It is noteworthy that the overall-period real return patterns documented below recur in both the low and high inflation subperiods.

Real stock returns are calculated using equation (2), and the analysis of Tables 1-4 is replicated with real returns. The most interesting findings concern the weekend and post-holiday mean real returns (see Tables 5 and 6). The real adjustment made the weekend mean return negative and lowest of the week (see Figure 2). Similarly, the average real return on the day after a holiday became negative and low relative to regular trading days. These dramatic changes in behavior relative to the nominal patterns narrow the differences between Israel and other international markets because in international markets weak weekend and post-holiday returns are customary.

Real analyses of the turn-of-the-month phenomenon support the nominal evidence. Real returns on turn-of-the-month days seem much higher than on non-turn-of-the-month days. For the General Stock Index the mean turn-of-the-month return is 0.195 percent and the mean return on non-turn-of-the-month days is 0.015 percent. (For the Industrial Stock Index the comparable numbers are 0.318 percent and -0.026 percent respectively.) It appears that most of the real return of Israeli stocks accumulated during turn-of-the-month days.

Adjustments for inflation do not mitigate the turn-of-the-year phenomenon either. The mean real return on turn-of-the-year days is relatively high; 0.509 percent for the General Stock Index and 0.911 percent for the Industrial Stock Index.

Overall, the patterns of real returns in Israel are almost indistinguishable from those in other international markets. Thus, the real adjustment transformed a market where nominal returns diverge significantly from international patterns into an ordinary market. This achievement is due primarily to the ability of the inflation adjustment to suppress the weekend and post-holiday returns. The key element is the deduction of three days of inflation from the weekend return, x-days of inflation from the post-holiday return (where x is the

number of calendar days between the pre- and post-holiday trading dates), and only one day of inflation from other trading days.

Our method of calculating the daily rate of inflation (dividing the realized inflation in the month by the number of days in the month) may seem too simplistic. For if inflation is not uniformly distributed over calendar time, and if the rate of inflation is much lower on weekends than on weekdays, our conclusions about the behavior of real returns may be flawed.

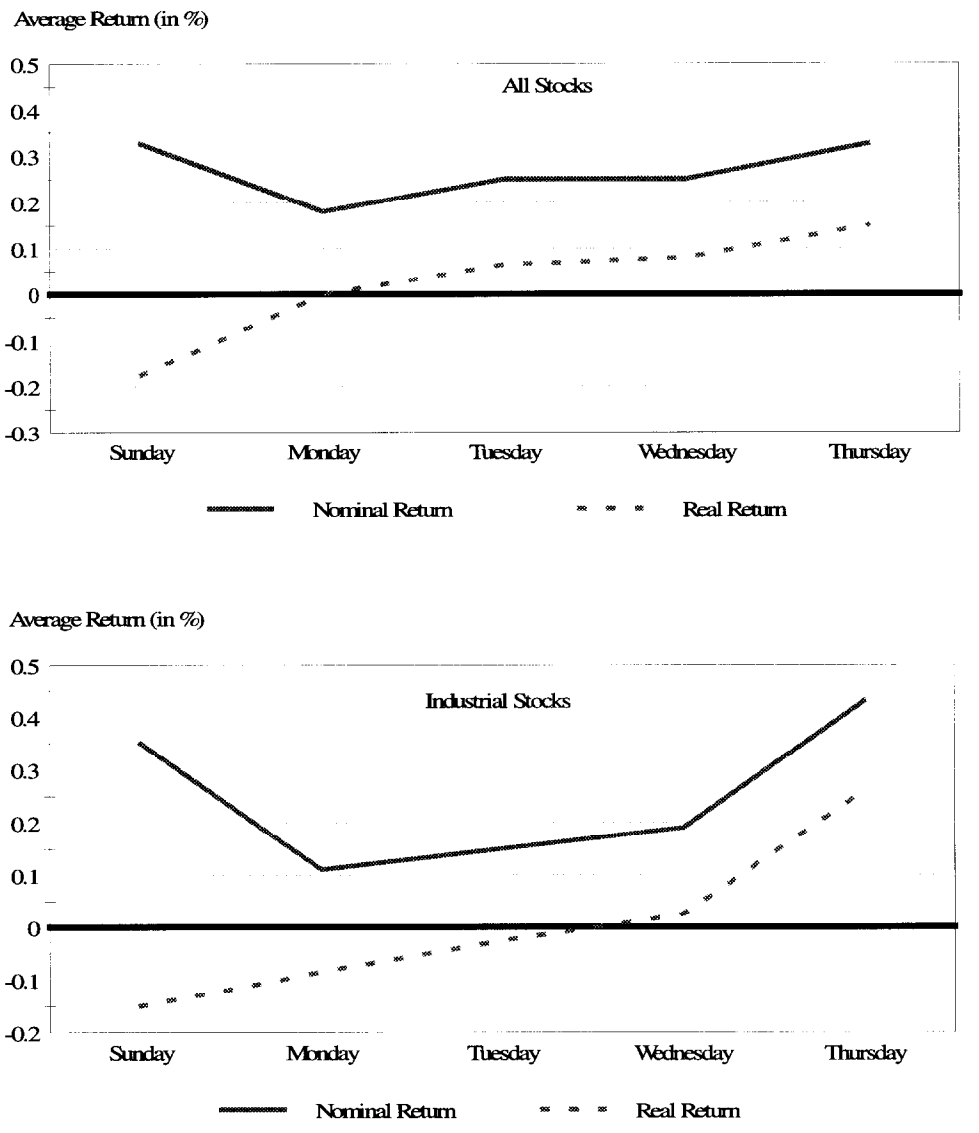


Figure 2. The Effect of Adjusting for Inflation on Daily Stock Returns in Israel; 1977-1991

Table 5. The Day-of-the-Week Effect in the Israeli Stock Market: Real Returns (1977-1991)

	Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*
Panel A: Means and Standard Deviations of Returns by Day-of-the-Week					
			The General Stock Index Returns[a]		
Mean return (in %)	−0.186	0.027	0.095	0.096	0.150
Standard deviation	1.490	1.398	1.221	1.112	1.072
Observations	716	725	722	724	727
			The Industrial Stock Index Returns[b]		
Mean return (in %)	−0.142	−0.074	−0.038	0.021	0.272
Standard deviation	2.397	2.139	2.138	2.090	1.849
Observations	716	725	722	724	727
Panel B: The Effect of Previous-week Performance					
			The General Stock Index Returns[c]		
Mean return (in %) when the previous-week return is negative	−0.502	−0.083	0.057	0.031	0.136
Observations	317	324	322	317	317
Mean return (in %) when the previous-week return is positive	0.092	0.097	0.119	0.118	0.170
Observations	385	389	392	395	393
t of mean returns difference	−5.32	−1.67	−0.67	−1.08	−0.42
p-value	0.001	0.095	0.503	0.280	0.676
			The Industrial Stock Index Returns[d]		
Mean return (in %) when the previous-week return is negative	−0.677	−0.142	−0.025	−0.073	0.247
Observations	331	338	340	333	331
Mean return (in %) when the previous-week return is positive	0.315	−0.040	−0.035	0.046	0.299
Observations	371	375	374	379	379
t of mean returns difference	−5.62	−0.63	0.06	−0.80	−0.38
p-value	0.001	0.532	0.950	0.425	0.703

Notes: [a]The *F*-test statistic for the equality of mean returns across weekdays is 7.52 (*p*-value of 0.001).
[b]The *F*-test statistic for the equality of mean returns across weekdays is 4.06 (*p*-value of 0.003).
[c]In a two-way analysis of variance, the *F*-test statistics for day-of-the-week effect, previous-week effect, and interaction between day-of-the-week and previous-week are 7.25, 20.59 and 5.93, respectively (*p*-values of 0.001, 0.001 and 0.001).
[d]In a two-way analysis of variance, the *F*-test statistics for day-of-the-week effect, previous-week effect, and interaction between day-of-the-week and previous-week are 4.36, 12.67 and 6.94, respectively (*p*-values of 0.002, 0.001 and 0.001).

The closest we could approach daily inflation rate estimates is by examining daily nominal interest rates. The Bank of Israel has daily interest rate data available since September 1986. Using these data we have calculated the excess return of stocks as the realized return on the stock index minus the interest rate that could be earned by investment in a nominal

Table 6. The Holiday Effect in the Israeli Stock Market: Real Returns (1977-1991)

	The trading day before holidays	*The trading day after holidays*	*Other trading days*
	The General Stock Index Returns[a]		
Mean return (in %)	0.205	−0.110	0.032
Standard deviation	0.873	1.671	1.265
Observations[b]	156	157	3,289
	The Industrial Stock Index Returns[c]		
Mean return (in %)	0.425	−0.050	−0.009
Standard deviation	1.672	3.073	2.093
Observations[b]	156	157	3,289

Notes: [a]The *t*-statistic for the difference between pre-holiday and non-holiday mean returns is 2.37 (*p*-value of 0.019). The *t*-statistic for the difference between the post-holiday and non-holiday mean returns is 1.05 (*p*-value of 0.295).

[b]Twelve days that are both pre-holiday and post-holiday trading days are excluded.

[c]The t-statistic for the difference between pre-holiday and non-holiday mean returns is 3.13 (*p*-value of 0.002). The t-statistic for the difference between the post-holiday and non-holiday mean returns is 0.17 (*p*-value of 0.869).

deposit (one-day deposit for regular weekdays, three-days' deposit for weekends, and x-days' deposit for holidays). If these short-term interest rates approximate well expected inflation then the mean excess return should be close to the mean real return. Analyzing the excess returns on the General Stock Index and the Industrial Stock Index during the subperiod September 1986 through December 1991 reveals similar patterns to those obtained using the simple method of dividing monthly inflation by the number of days in the month. In the subperiod examined, the average difference between excess returns and this paper's estimates of real returns is less than 0.01 percent. (The maximum difference is 0.03%.) Both these figures are low relative to the mean effects documented in Tables 5 and 6. Thus, it appears that the deficiencies of our method of calculating real returns do not significantly impact the results.

VI. CONCLUSIONS

The paper demonstrates that the appearance and characteristics of return seasonalities are sensitive to the method of measurement: nominal vs. real. Using 15 years of daily data on two stock indices in Israel, we document nominal return patterns that are substantially different from real return patterns. For example, the mean nominal weekend return is positive and highest of the week, while the mean real (inflation adjusted) weekend return is negative and lowest of the week.

The similarity of the Israeli anomalies (when measured in real terms) to those documented in international markets suggests that return seasonalities are real and should be measured in real terms. The real return similarity may also indicate that financial theories and phenomena are more robust when couched in real terms. This may be the most important general implication of the study. Recent progress in asset pricing such as the tests of

Ferson and Harvey (1992) also employs real data. Hence it appears that adjusting for inflation becomes the standard rather than the exception.

REFERENCES

Ariel, R. A. (1987). A monthly effect in stock returns. *Journal of Financial Economics, 17*, 161-174.

Ariel, R. A. (1990). High stock returns before holidays: Existence and evidence on possible causes. *Journal of Finance, 45*, 1611-1626.

Bruno, M. (1986). Sharp disinflation strategy: Israel 1985. *Economic Policy, 2*, 379-402.

Cadsby, C.B., and Ratner, M. (1992). Turn-of-month and pre-holiday effects on stock returns: Some international evidence. *Journal of Banking and Finance, 16*, 497-509.

Cross, F. (1973). The behavior of stock prices on Fridays and Mondays. *Financial Analysts Journal, 29*, 67-69.

Dyl, E. A., & Maberly, E. D. (1986). The weekly pattern in stock index futures: A further note. *Journal of Finance, 41*, 1149-1152.

Ferson, W., & Harvey, C. (1992). Seasonality and consumption-based asset pricing. *Journal of Finance, 17*, 511-552.

French, K.R. (1980). Stock returns and the weekend effect. *Journal of Financial Economics, 8*, 55-69.

Gibbons, M., and Hess, P. (1981). Day of the week effects and asset returns. *Journal of Business, 54*, 579-596.

Harris, L. (1986). A transaction data study of weekly and intradaily patterns in stock returns. *Journal of Financial Economics, 16*, 99-117.

Jacobs, B. I., & Levy, K. N. (1988). Calendar anomalies: Abnormal returns at calendar turning points. *Financial Analysts Journal, 44*, 28-39.

Jaffe, J., & Westerfield, R. (1985). The week-end returns in common stock prices: The international evidence. *Journal of Finance, 40*, 433-454.

Jaffe, J., Westerfield, R., & Ma, C. (1989). A twist on the Monday effect in stock prices: Evidence from the U.S. and foreign stock markets. *Journal of Banking and Finance, 13*, 641-650.

Kato, K. (1990). Being a winner in the Tokyo stock market. *Journal of Portfolio Management, 16*, 52-56.

Keim, D. B., & Stambaugh, R. (1984). A further investigation of the weekend effect in stock returns. *Journal of Finance, 39*, 819-835.

Lakonishok, J., and Smidt, S. (1988). Are seasonal anomalies real? A ninety year perspective. *Review of Financial Studies, 1*, 403-425.

Lauterbach, B., & Ungar, M. (1992). Calendar anomalies: Some perspectives from the behaviour of the Israeli stock market. *Applied Financial Economics, 2*, 57-60.

Lee, I., Pettit, R. R., & Swankoski, W. V. (1990). Daily return relationships among Asian stock markets. *Journal of Business, Finance and Accounting, 17*, 265-284.

Milonas, N. T. (1991). Measuring seasonalities in commodity markets and the half-month effect. *Journal of Futures Markets, 11*, 331-345.

Plaut, S. (1992). Whose sabbath matters?, or, When does the weekend effect occur? *Economics Letters, 38*, 341-344.

Smirlock, M., & Starks, L. (1986). Day-of-the-week and intraday effects in stock returns. *Journal of Financial Economics, 17*, 197-210.

Ziemba, W.T. (1991). Japanese security market regularities: Monthly, turn-of-the-month and year, holiday and golden week effects. *Japan and the World Economy, 3*, 119-146.