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Is the Weekend Effect Exploitable?

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Abstract

Researchers have long been intrigued by the anomaly of positive Friday/negative Monday returns called the weekend effect. Strategies exploiting weekend trading provide evidence through 2000 of the effect for portfolios of small and mid-sized firms but not for large firms. Mondays following negative Fridays display the strongest effect, refining the traditional definition. Selectively choosing weekends to trade considerably increases returns over the buy and hold strategy without increasing risk. Direct tests indicate that the strategies possess tactical market-timing ability. Money managers who follow simple weekend trading strategies create value for their investors. While transaction costs reduce trading gains, College Retirement Equity Fund portfolios permit individual investors to profit from no-cost weekend portfolio switching.

Introduction

Two enduring features of the theory of finance are that stock returns compensate investors for taking risk and that stock prices change immediately as new information arrives. The quest by risk-averse investors to maximize the expected utility of wealth leads them to the financial markets, assumed to be perfectly competitive, where investors' collective behavior generates a price for risk and their search for wealth-enhancing opportunities leads to the efficient use of information. Investors continuously receive information that is crucial to the valuation of common stock, yet trading in common stock is mostly limited to arbitrary times called trading days. If new information, good or bad, arrives randomly over time, then average stock returns for the different trading days of the week should be indistinguishable from each other.

An anomalous pattern called the weekend effect has been long observed. The pattern of positive Friday and negative Monday returns is not predicted by the traditional theory (Gibbons and Hess, 1981) and appears as long ago as 1885 (Bessembinder and Hertzel, 1993). Its persistence is impressive, but why this anomaly has not been "arbitraged away" is difficult to understand given its well-known history. Noting that institutional traders have lower information and transaction costs than individuals, Kamara (1997) argues that the Monday regularity is likely to be eliminated by institutional traders for large stocks like those in the S&P 500 stock index. Since transaction costs have declined since the early weekend effect studies were conducted, perhaps the weekend effect has weakened as barriers to arbitrage have fallen.

This paper uses recent data (1988 to 2000) to determine whether the weekend effect has deteriorated over time and employs various weekend trading strategies to evaluate whether the weekend effect has economic significance. Our statistical analysis indicates that the weekend effect still persists, even when the analysis is restricted to the even more recent 1994-2000 period. The effect is most obvious in the returns of mid-size stocks and on Mondays following "negative" Fridays. Some of the trading strategies generate considerable increases in ending wealth that are not due to the strategies taking risk greater than that of the benchmark Buy & Hold Strategy. The results of the tests of Henriksson and Merton (1981) indicate that the successful weekend trading strategies possess tactical market-timing ability. Furthermore, money managers who follow simple weekend trading strategies create value for their investors.

Transaction costs can be barriers to arbitrage that allow statistical evidence of the weekend effect to accumulate while limiting realizable gains. The College Retirement Equity Fund (CREF) permits free switching between its portfolios over the telephone or the Internet, enabling individuals enrolled in CREF programs to engage in weekend trading and pay zero transaction

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costs. CREF data are available for the stock and money market portfolios from April 1988 and for the growth portfolio from April 1994, so we restrict our analysis to the post-1988 period.

Regularities in individual investor behavior might explain at least part of the weekend effect. Miller (1988) contends that individuals, confronted mainly with buy recommendations during the workweek (see Lewellen, Lease, and Schlarbaum, 1977), make sell decisions as they review their portfolios over the weekend. Monday selling by individuals increases the supply of shares and depresses share price. Also, individuals own a greater percentage of small company shares for which institutional discretionary liquidity traders have limited ability to arbitrage away price differentials. Our findings for small and mid-size firms are consistent with Miller's view.

Sias and Starks (1995) maintain that informed traders have the greatest advantage on Mondays since information can accumulate over the weekend, and for this reason discretionary liquidity traders refrain from trading on Mondays. They contend that if day-of-the-week patterns are a "manifestation of autocorrelation in portfolio returns" and if institutional traders use trading strategies that induce large autocorrelations more than individuals do, Monday returns might depend on the direction of Friday returns. Bessembinder and Hertzel (1993) find that the Friday-Monday return correlation is the highest of all pairs of weekdays, and we show that trading strategies that use information on the direction of Friday returns perform very well.

A review of the prior work is presented in the next section. Then, the design of our study and the empirical findings are discussed. The last section provides concluding comments.

I. Previous Research on the Weekend Effect

A. Attributes of Stock Returns on Mondays

Cross (1973) first documents the "non-random movements" that French (1980) terms the weekend effect. For the S&P composite index over the 1953-1970 period, Cross tabulates declines on 60.5% of all Mondays and 76.0% of those following a Friday decline. For the S&P 500 index from 1953 to 1977, French (1980) finds Monday average returns to be significantly negative, not attributable to calendar-time or trading-time effects, and different from returns for other days following a closed market (i.e., holidays). Possibly reflecting market inefficiency, French notes that transactions costs would swamp any gains obtained from weekend trading.

Keim and Stambaugh (1984), Rogalski (1984), Smirlock and Starks (1986), and Harris (1986) also report the positive-Friday, negative-Monday pattern that Cross and French observe. Keim and Stambaugh (1984) show that for the 1953-1982 period the correlation between Fridays and Mondays for the stocks in the Dow Jones Industrial Average is higher than for other adjacent days and reinforce French's conclusion that the anomaly occurs because of the weekend. Rogalski (1984) finds that the weekend effect is really a Friday-close-to-Monday-open effect. Smirlock and Starks (1986) show that the effect is limited to Monday mornings because Monday returns turn positive by the afternoon, as Harris (1986) also finds in NYSE transactions data.

B. Investor Behavior and the Weekend Effect

Miller (1988) provides a cohesive explanation for stock price behavior on Mondays based on the idea that negative returns from Friday's close to Monday's close indicate that sell orders exceed buy orders on Mondays. Since many things in everyday life exhibit day-of-the-week effects (e.g., working, golfing, dating, riding the subway), Miller considers it plausible that personal business like reviewing one's portfolio is performed mostly on the weekend. Brokerage houses predominately make buy recommendations, so he reasons that individual investors originate sell decisions that are executed Monday morning when the exchanges open. Because individuals across the U.S. all behave in this manner, the weekend effect will be observed on Monday morning as the day rolls through the different time zones from east coast to west. As funds from Monday sales are channeled back into stocks, purchase volume and stock prices will increase over the rest of the week, so over a typical week aggregate buying and selling should be equal. Miller suggests that the weekend effect should be more pronounced in small-capitalization stocks for which bid-ask spreads are widest and less information is available.

Other research is consistent with Miller's view. Lakonishok and Maberly (1990), echoing Osborne (1962), note that institutional investors are less active on Mondays because they often hold strategic planning sessions on Monday mornings. They show that NYSE trading volume and the block-trade percentage volume are lowest while the percentage of odd-lot sales, attributed to individuals, is the highest on Mondays. Abraham and Ikenberry (1994) suggest that lower liquidity on Mondays due to lower institutional activity will intensify the downward pressure on stock prices exerted by the imbalance of individuals' sell orders. They find out that Monday returns are consistently negative but those following negative Fridays are more negative by a factor of 5.0 on average and that the effect is strongest at 11:00 a.m. Monday morning.

Kamara (1997) points out that the institutional fraction of U.S. equity has increased dramatically from 1962 to 1992 and that the "prudent man" rule leads institutions to accumulate large holdings in large-cap stocks. If institutions are better informed than individuals, the weekend effect is likely to disappear for large-cap stocks, especially after 1982 when the advent of trading in S&P 500 index futures contracts gave traders a low-cost way of shorting the market. Kamara's results support this assertion. Noting that individuals are net sellers on Mondays and institutional investors have higher transaction costs in small-cap stocks relative to large-cap stocks, he shows the weekend effect on small-cap stocks has not diminished over time.

Sias and Starks (1995) argue that institutional investors actually cause the weekend effect because stocks with high proportions of institutional holdings exhibit stronger day-of-the-week effects in trading volume and average returns. If informed trading occurs more on Mondays due to information produced over the weekend, discretionary institutional traders might avoid Mondays, reducing total turnover. They point out that institutions also receive recommendations from advisors during the week that are tilted toward "buy" and so face an informational asymmetry similar to that which individuals face. If institutions are more likely than individuals to employ positive-feedback investment strategies, then the propensity for returns to be negative for Mondays following negative Fridays could result from the behavior of institutional investors but serve to reinforce the effect of regularities in the behavior of individual investors[1].

II. Empirical Design

A. The Data

Daily returns for the Center for Research in Security Prices (CRSP) equal-weighted portfolio and the 3:00 and closing values for the S&P 500 index were obtained for the period from January 1, 1988 to December 29, 2000 (678 weeks)[2]. Daily returns for the CREF stock, growth, and money market accounts were downloaded from the TIAA-CREF website for the period from April 1, 1988 to December 29, 2000 (669 weeks), and for the growth account from April 29, 1994 to December 29, 2000 (332 weeks). For use in the risk measures, yields on three-month Treasury bills were downloaded from the Federal Reserve website.

Daily returns for nine size-based portfolios are also analyzed. We begin with all stocks that have data in the CRSP daily file and use price and shares outstanding to compute each firm's market value in the beginning of each year. Then, the firms are sorted in ascending order according to market value and split into deciles, with decile 1 containing the smallest 10.0% of the firms and decile 10 containing the largest 10.0%. This procedure generates ten equal-weighted size-based portfolios (649.3 stocks on average) whose compositions are rebalanced annually.

To mitigate the effects of bid-ask bounce and positively skewed outliers, we exclude stocks with prices less than $3.00 per share from the analysis, as Abraham and Ikenberry (1994)

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[1] Negative Monday returns could result from the disclosure of bad news over the weekend. Penman (1987) finds that firms tend to release bad news on weekends, but Damodaran (1989) shows this explains a small amount of the effect.

[2] The return through 3:00 on Friday proxies for the direction of Friday's return so that a position can be taken, given the appropriate signal, at Friday's close in one of our trading strategies. The data are from S & P's Market Insight.

do. The smallest firms are affected the most, so we have merged decile 1 (154.7 stocks on average) and decile 2 (349.2 stocks on average) into what we label decile 1&2 (503.9 stocks on average)[1].

Given the effect of firm size as characterized by Miller (1988) and Kamara (1997), an inverse relationship is expected between the magnitude of the weekend effect and firm size. We partition the data by the direction of the preceding Friday's return. Cross (1973), Bessembinder and Hertzel (1993), Abraham and Ikenberry (1994), Sias and Starks (1995), and Chow, Hsiao, and Solt (1997) find that the weekend effect is most evident on Mondays following negative Fridays.

B. Economic Significance

Statistical significance alone is not meaningful to investors, and investors will be interested if the weekend effect can serve as a basis for trading strategies that produce returns that exceed transactions costs. When free switching between stock and money market accounts is permitted by plan sponsors like CREF, individuals can trade on the weekend effect without cost. For the CREF portfolios, weekend trading involves switching funds from either the stock or growth account into the money market account at Friday's close and switching back at Monday's close[2].

For the other portfolios, weekend trading involves four transactions: liquidating the long position and taking a short position at Friday's close, and covering the short position and reopening a long position at Monday's close. To determine the level of returns that investors might expect, we apply the following strategies based on different trading rules to each portfolio:

1. Buy and hold. This is the benchmark strategy. No weekend trading is involved: the portfolio is bought at the beginning of the sample period and held until the end of the period; this strategy generates zero trades over the sample period.
2. Weekly. French (1980) proposes a simple trading strategy: weekend trading occurs every weekend. This rule generates the maximum number of trades.
3. Negative Friday. Chow, Hsiao, and Solt (1997) use the Bessembinder and Hertzel (1991) finding about Friday-Monday return correlations and develop a simple positive-feedback trading strategy: weekend trading occurs only if the Friday return is negative (i.e., a 0.0% cut-off). The return on the S&P 500 index from the market opening on Friday to 3:00 pm is the proxy for Friday's return[3]. Not all weekends are picked for trading, so this strategy generates fewer trades than the Weekly Strategy.
4. Fourth Monday. This strategy uses Wang, Li, and Erickson's (1997) finding: weekend trading occurs on the fourth Monday (and fifth Monday if it occurs) of each month. This strategy generates either one or two trades per month.
5. Both. Weekend trading occurs before the fourth and fifth (if available) Monday of the month only if previous Friday's return is negative. This strategy is more selective in trading than either the Negative Friday or the Fourth Monday strategies.
6. Either. Weekend trading occurs either if previous Friday's return is negative or before the fourth or fifth (if available) Monday of the month.

Return on investment is important for maximizing wealth, but risk is another relevant consideration. We present the following performance measures for the trading strategies: alphas and betas from the market model (the S&P 500 is the market portfolio), the Sharpe ratio (portfolio excess returns divided by the portfolio standard deviation), and the Treynor ratio (portfolio excess returns divided by the portfolio beta).

C. Market Timing Tests

The approach just outlined focuses on the sign and magnitude of Monday returns. While significantly negative Monday returns define the classic weekend effect, this is only one way to

[1] Roughly ¾ of decile 1and ½ of decile 2 firms were eliminated, so merging these deciles creates a portfolio closer in number of firms to the other deciles while still providing a wide range of portfolios across the size dimension.
[2] Switching decisions must be made prior to the market close or they will be fulfilled at the next trading day's close.
[3] Often the last hour of trading produces large stock price movements that could change positive Fridays into negative Fridays, and vice versa. While we are limited in the intraday data we have at our disposal, a "real time" trader could use a cut-off time that is nearer to the market close.

examine its significance. An alternative way to evaluate the trading strategies is to treat the selection of position-switching weekends as a tactical asset reallocation designed to exploit the occurrence of negative Mondays. Over any weekend, a strategy can be considered successful either because: 1) it indicates switching into a short position (or the money account) on Friday and the portfolio return on Monday is negative (or less than that of the money account) or 2) it signals no trade and the portfolio return on Monday is positive. In other words, the success of a strategy is measured by the extent to which it captures profitable, and avoids unprofitable, weekend trading.

We employ two sets of tests developed by Henriksson and Merton (1981) to gauge the extent and value of the strategies' predictive ability. In a non-parametric test, we define P_1 as the conditional probability of a correct switching prediction given that ex post return on Monday is negative and P_2 as the conditional probability of a correct no-switching prediction given that the ex post return on Monday is positive. It follows that the value of a strategy can be evaluated by the sum of P_1 and P_2. If $P_1(t) + P_2(t) = 1$, then an investor could not modify his or her prior belief about the distribution of ex post returns on Monday from the ex ante prediction, and the strategy has no value. Two examples of valueless strategies are the Buy-and-Hold and Weekly strategies. The former always indicates no trading, so P_1=0 and P_2=1, while the later always indicates a weekend trade, so P_1=1 and P_2=0. In both cases, P_1+P_2=1 and the strategies contain no predictive value. Conversely, a perfect strategy is characterized by making the right call each weekend (i.e., P_1= 1, P_2= 1, so P_1+ P_2 = 2).

Henriksson and Merton (1981) show that a necessary and sufficient condition for a strategy to have information value is for $P_1 + P_2 > 1$. To test whether a strategy has any predictive ability, they develop a one-tailed nonparametric test based on the approximated normal distribution of P_1+P_2, with expected value and variance as follows:

$$E(n_1) = \frac{nN_1}{N} \text{ and } \sigma^2(n_1) = \frac{\left[n_1 N_1 (N - N_1)(N - n)\right]}{\left[N^2 (N-1)\right]}, \tag{1}$$

where N = the total number of Mondays, N_1 = the number of Mondays where trading is ex post profitable, n = the number of weekend trades the strategy suggests, and n_1 = the strategy's number of profitable weekend trades. A test score (z^*) is computed as the difference between the actual and expected number of successful weekend trades standardized by the standard error. To test the null hypothesis that the strategy has no predictive value when applied to a particular equity portfolio/index, the (z*) score and its significance level are reported in Table 2.

We also conduct a parametric test to examine the strategies' market timing ability and to estimate their application value. Following Merton (1981), we define a perfect timer as someone who has the ability to ex ante predict the ex post trading profit on an equity portfolio over the weekend. Accordingly, he or she shifts all funds into a short or long equity position, whichever is predicted to perform better. The pattern of returns to the perfect timer is equivalent to holding the equity portfolio in combination with double "put" options[1]. When the equity return is positive, the puts expire worthless and the long equity position realizes a positive return. When the equity return is negative, the puts are "in-the-money", and one offsets the loss on the equity position while the other produces a gain equal to the negative of the equity return. The following illustrates the pay-offs to an equity position with double put options and to perfect timing:

Pay-off	If equity return (R) is positive	If equity return (R) is negative
Equity	R	R (< 0)
Puts	0	-2*R
Equity + 2 Puts	R	-R
Perfect Timer	R	-R

[1] For the CREF accounts, the perfect timer can ex ante forecast if the ex post return on the stock/growth account outperforms that on the money account. Accordingly, he or she shifts all funds into the stock/growth or money account over weekend, whichever is predicted to do better. The pattern of returns is equivalent to holding the equity account with a single "put" option to swap the ex post return on the equity account into that on the money account.

Assuming a money manager possesses perfect timing ability, then how much is the fair percentage management fee that clients could be charged for this service? Following Merton (1981), the value of perfect timing ability increases with the riskiness (volatility) of the equity position and the length of the forecast period (i.e., until the ex post Monday equity return is revealed). He shows that the value of a single put option (half of the value of perfect timing ability) is characterized as $m(t) = 2\Phi\left[\frac{1}{2}\sigma(t)\sqrt{\tau}\right] - 1$, where $\Phi[\ ]$ is the cumulative normal density function, $\sigma^2(t)$ is the constant-over-the-forecast-interval variance rate and τ is the length of the forecast period. In Table 2, we present $m(t)$ as a single put value for each equity portfolio.

Since all strategies possess partial, but not perfect, market timing ability, we estimate the fraction of the perfect market timing ability captured by each strategy using the following regression from Henriksson and Merton (1981):

$$R_{i,j}(t) = \beta_{i,j}x_j(t) + \gamma_{i,j}y(t) + \varepsilon(t), \tag{2}$$

where $R_{i.j}(t)$ is the return for the i^{th} strategy on the j^{th} portfolio; $x_j(t)$ is the return for buying and holding the j^{th} portfolio; $y_j(t)$ is the return from a put option written on the j^{th} portfolio, i.e., $y(t) = \max[0, -x(t)]$; and $\varepsilon(t)$ is the zero-mean, constant variance error term. Sample observations are restricted to Mondays since tactical asset reallocation decisions are made only to capture negative Mondays.

In Equation (2), $\beta_{i,j}$ is the expected beta of strategy i given that ex post equity return is positive, and $\gamma_{i,j}$ is an estimate of the number of "free" puts resulting from applying the i^{th} strategy on the j^{th} portfolio. The value of $\gamma_{i,j}$, ranging from 0 (no value) to 2 (perfect timing), is reported in Table 2 along with its standard error. To reject the null hypothesis that a strategy has no predictive value when applied to a particular equity index/account, the value of $\gamma_{i,j}$ must be significantly different from 0. The fair information value charged to the customers of the money manager is the amount of the free puts obtained, $\gamma_{i,j}$, times the value of a single put, m(t). We then annualize the information value and report it as the Strategy Value in Table 2.

III. Empirical Results

A. Mean Daily Returns

Part A of Table 1 presents unconditional average returns for each day of the week for the nine size-based portfolios, the CRSP equal-weighted portfolio, the S&P 500 index, and the CREF portfolios. The findings provide evidence that the weekend effect continues to exist[1]. While our most negative Monday average returns (deciles 4, 5, and 6) are roughly of the same magnitude as those reported by Wang, Li, and Erickson (1997), they are only about half the magnitude reported in the early weekend effect studies (See Cross, 1973 and French, 1980).

Part A of Table 1 displays the classic positive Friday/negative Monday weekend effect that is often accompanied by significant t-statistics. Small and mid-size firms exhibit a stronger effect than the largest firms do, and the effect appears weakly at best in the CRSP equal-weighted and CREF growth portfolio returns. Mean Monday returns are positive for the largest decile port-

[1] Table A-1 in Appendix A show that the results for 1994-2000 are very similar to Table 1. Our results do not appear to be driven by the peaking of the stock markets during 2000 since Table A-2 in Appendix A shows similar results for the 1994-1999 period. The trading strategies also show similar results when run through 1999. Although not reported, these results are available upon request.

folio and for the S&P 500, as Kamara (1997) finds for 1982-1993, and for the CREF stock portfolio. This is consistent with the view that the weekend effect no longer exists for the largest stocks.

F-tests reveal day-of-the-week effects in both tables. The smaller deciles exhibit the largest F-statistic across the days of the week. The F-statistics decline in significance after (roughly) decile 7 with the largest decile having no statistical significance. This is consistent with the impact of reduced obstacles to arbitrage being related to firm size (Kamara, 1997).

The F-statistics in Table 1 indicate that Thursday and Friday exhibit a significant difference in means across the deciles. Monday, Tuesday, and Wednesday mean returns show no significant differences across the deciles. The decile portfolio returns tend to be negative on Monday, to increase from Tuesday to Thursday, and to be positive on Friday with a magnitude at least twice that of Thursday. This pattern is consistent with Miller's (1988) contention that funds from Monday sales are channeled back into the market over the remainder of the week.

Figure 1 graphs the unconditional average Monday returns for the decile portfolios from Table 1 and those from Rogalski (1984) and Harris (1986) which are representative of the range covered by Monday returns in previous research. Figure 1 shows that the unconditional weekend effect is weaker in our study than in earlier research, especially for the larger deciles. The effect of firm size does not increase monotonically but has a more U-shaped pattern. Still, the pattern for deciles 1 though 6 is roughly similar to those for Rogalski (1984) and Harris (1986).

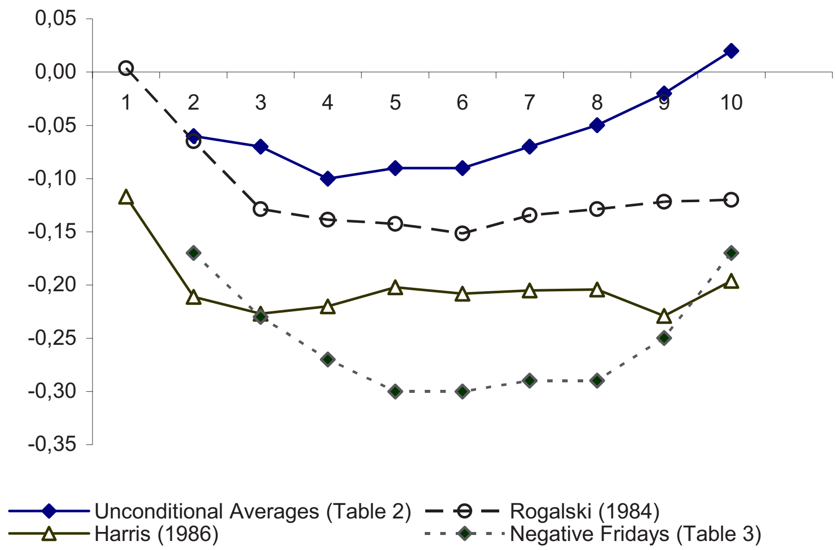

Fig. 1. Average Monday Close-to-Close Returns for Size-Based Portfolios (1 = smallest and 10 = largest)

Table 1

Analysis of the Daily Returns of Various Portfolios, 1988-2000

Day of the Week	Number of Observations	Deciles									All Deciles	F-Statistic for Differences Across Deciles	Average Daily Returns		
		1 & 2	3	4	5	6	7	8	9	10			CRSP Eq.-Weighted Portfolio	S&P 500 Index	CREF Stock Portfolio
A. Unconditional Average Returns															
Monday	623	-.06%	-.07%	-.10%	-.09%	-.09%	-.07%	-.05%	-.02%	.02%	-.06%	1.51	-.04%	.11%	.05%
t-Statistic		-2.40	-2.88	-3.77	-3.27	-2.94	-2.21	-1.53	-.66	.48	-5.77	.15	-1.48	2.91	1.38
Tuesday	673	.07%	.04%	.03%	.03%	.02%	.02%	.03%	.04%	.05%	.04%	.41	.05%	.08%	.06%
t-Statistic		3.30	1.97	1.36	1.23	.71	.61	1.01	1.31	1.27	3.99	.92	1.88	2.12	1.98
Wednesday	672	.12%	.12%	.10%	.09%	.09%	.09%	.10%	.09%	.06%	.10%	.53	.14%	.04%	.05%
t-Statistic		5.74	5.66	4.64	4.33	3.93	3.60	3.77	3.40	1.76	11.62	.83	5.98	1.40	1.59
Thursday	661	.15%	.13%	.11%	.10%	.09%	.08%	.06%	.05%	.03%	.09%	2.12	.15%	-.02%	.02%
t-Statistic		7.83	5.79	5.15	4.24	3.61	2.80	2.17	1.54	.68	9.81	.03	6.10	-.45	.51
Friday	656	.27%	.26%	.22%	.19%	.16%	.13%	.11%	.10%	.10%	.17%	5.92	.26%	.06%	.04%
t-Statistic		11.83	11.92	9.98	8.77	6.73	4.85	3.70	2.90	2.44	1.19	.00	10.11	1.52	1.29
All Days	3285	.11%	.10%	.07%	.07%	.06%	.05%	.05%	.05%	.05%	.07%	3.47	.11%	.06%	.04%
t-Statistic		11.61	9.59	7.25	6.29	4.97	4.08	3.90	3.68	3.00	16.57	.00	9.79	3.36	3.00
F-Statistic for Differences															
Monday through Friday		30.87	29.26	26.22	19.82	13.76	7.88	4.70	2.29	.74	84.80		19.93	1.67	.27
Level of Significance		.00	.00	.00	.00	.00	.00	.00	.06	.56	.00		.00	.15	.90
B. Average Monday Returns Conditional on Previous Friday's S&P 500 Return															
Positive Friday	355	.03%	.05%	.03%	.07%	.08%	.10%	.14%	.15%	.16%	.09%	2.15	.10%	.20%	.17%
t-Statistic		1.18	1.75	1.22	2.47	2.34	2.92	3.66	3.77	3.31	7.84	.03	3.25	4.34	4.08
F-Statistic for Differences															
Monday through Friday		17.34	15.36	15.36	7.47	4.61	2.58	1.85	1.56	1.36	30.34		9.99	3.15	2.14
Level of Significance		.00	.00	.00	.00	.00	.04	.12	.18	.24	.00		.00	.01	.07
Negative Friday	268	-.17%	-.23%	-.27%	-.31%	-.30%	-.29%	-.30%	-.26%	-.17%	-.26%	1.13	-.23%	.00%	-.10%
t-Statistic		-4.27	-5.14	-5.99	-6.34	-6.03	-5.64	-5.57	-4.58	-2.62	-15.02	0.34	-4.83	-.06	-1.72
F-Statistic for Differences															
Monday through Friday		33.16	36.80	36.30	35.18	27.23	19.76	16.60	10.64	3.70	166.99		29.85	1.07	2.38
Level of Significance		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00		.00	.37	.05

Part B of Table shows that the strongest weekend effect is not a positive Friday followed by a negative Monday (i.e., not the traditional effect) but a negative Friday followed by a negative Monday. Since Part B shows a positive Friday/positive Monday pattern, Friday and Monday returns are positively correlated, as Bessembinder and Hertzel (1993) report. Figure 1 also graphs Monday returns following negative Fridays. The effect is stronger than for the unconditional means (ranging from -.17% to -.31%) but weaker than the conditional means reported by Cross (1973; -.48%) and Abraham and Ikenberry (1994; -.61%). This provides support for using positive feedback trading strategies like the Negative Friday Strategy. The largest deciles exhibit a weekend effect when Fridays are negative, indicating that not all of the effect has been arbitraged away as Kamara (1997) suggests or as it appears to be for our results for the S&P 500 index. Indeed, we find little evidence of the weekend effect for the S&P 500 in any part of our analysis.

B. Assessing Market Timing Ability

Table 2 presents the results of the market timing tests on the trading strategies. Since the Buy & Hold Strategy involves no trading strategy decisions and the Weekly Strategy trades each weekend, these two strategies possess no predictive value and are not processed in Table 2. In both the parametric[1] and non-parametric tests, the four remaining trading strategies exhibit market-timing attributes, with significantly positive gammas and z^* scores that often reject the null hypothesis. The Both Strategy appears to have a slight edge over the other strategies with gammas that are mostly larger than those for the other strategies.

Table 2

Tests of Market Timing Predictability for Various Monday Strategies

	1988-2000						1994-2000
	Deciles						
Trading Strategy	1 & 2	5	10	CRSP Equal-Weighted Index	S&P 500 Index	CREF Stock Portfolio	CREF Growth Portfolio
1	2	3	4	5	6	7	8
Single Put Value, m(t)	11.16%	13.32%	16.35%	13.53%	18.25%	16.09%	23.32%
A. The Negative Friday Strategy							
Parametric Test							
Gamma	.85	1.04	.62	.89	.73	.61	.36
Standard Error	(.08)	(.08)	(.08)	(.08)	(.07)	(.05)	(.07)
Strategy Value (annualized)	9.4%	13.9%	10.1%	12.1%	13.4%	9.9%	8.3%
Non-parametric Test							
z*	(3.77)***	(5.73)***	(2.37)***	(6.20)***	1.02	(2.11)**	(1.82)**
B. The Fourth Monday Strategy							
Parametric Test							
Gamma	.49	.56	.56	.65	.70	.44	.60
Standard Error	(.09)	(.09)	(.08)	(.08)	(.07)	(.05)	(.07)
Strategy Value (annualized)	5.5%	7.4%	9.2%	8.8%	12.8%	7.1%	13.9%
Non-parametric Test							
z*	(2.86)***	(4.69)***	(4.22)***	(4.07)***	(3.65)***	(3.82)***	(1.26)*
C. The Both Strategy							
Parametric Test							
Gamma	.77	.98	.74	.96	.92	.67	.70
Standard Error	(.08)	(.08)	(.07)	(.07)	(.07)	(.05)	(.07)
Strategy Value (annualized)	8.6%	13.1%	12.0%	13.0%	16.8%	10.8%	16.4%

[1] Because our main concern is about market-timing ability, only the gammas are presented for the parametric tests. The results for only deciles 1&2, 5 and 10 are presented to conserve space.

Table 2 (continuous)

1	2	3	4	5	6	7	8
Non-parametric Test							
z*	(3.81)***	(5.83)***	(3.87)***	(5.39)***	(3.01)***	(3.74)***	(2.01)**
D. The Either Strategy							
Parametric Test							
Gamma	0.56	0.61	0.45	0.58	0.52	0.38	.25
Standard Error	(.07)	(.07)	(.07)	(.07)	(.07)	(.05)	(.07)
Strategy Value (annualized)	6.3%	8.1%	7.3%	7.8%	9.4%	6.2%	5.8%
Non-parametric Test							
z*	(3.74)***	(6.02)***	(3.64)***	(6.23)***	(2.34)***	(3.05)***	(1.50)*

*, **, *** indicates significance at 10%, 5%, and 1% level, respectively.

For the non-parametric tests, all four strategies have significant prediction value for all the portfolios, except that the Negative Friday Strategy applied to the S&P 500 index is not significant. For the parametric tests, all of the gammas are significantly positive, again indicating that each strategy has predictive value. The largest gamma is the Negative Friday Strategy applied to decile 5, implying that decile 5 possesses the most obvious negative Monday after a negative Friday (see Figure 1). The Fourth Monday Strategy has greater predictive ability in the large cap portfolios (like the S&P 500) while the Negative Friday Strategy has greater predictive ability in the small- and mid- cap portfolios.

The value of perfect timing is higher for portfolios with higher market value and for market value based indexes (such as S&P 500), indicating that these portfolios possess higher volatility in returns over the weekends. Therefore it is most valuable to accurately forecast the returns on these portfolios or possess a put option on the returns of these portfolios. The Both strategy tends to perform very well for these portfolios because it combines the advantages of the Negative Friday and the Fourth Monday Strategies. All in all, the maximum management (information) value seems to result from applying the Both Strategy to high market value portfolios.

C. Trading Strategy Returns

Table 3 presents the results from applying the six trading strategies over the 1988-2000 period (3,285 daily returns). Each portfolio begins with $1,000. Table 3 assumes trading involves zero transaction costs, but only the CREF portfolios actually offer costless trading, so the results for the non-CREF portfolios are suggestive of the maximum potential of weekend trading. To conserve space, only the results for deciles 1&2, 5, and 10 are presented.

The results for the Buy & Hold Strategy show a strong size effect in both periods: decile 1&2 and the CRSP equal-weighted portfolio have much larger ending wealth than the decile 10, the S&P 500 index, and so does the CREF stock portfolio. Compared to the Buy & Hold Strategy, the Weekly Strategy applied to decile 1&2, decile 5, and the CRSP equal-weighted portfolio leads to increased ending wealth but for decile 10 and the S&P index, it decreases wealth. The Negative Friday Strategy produces impressive ending wealth: $109,308 for decile 1&2 and $130,624 for the CRSP equal-weighted portfolio, although the Either Strategy produces similar ending wealth.

The Weekly Strategy's implementation would entail significant transaction costs. But even in the zero-cost CREF environment, the Weekly Strategy is not useful, performing worse than the Buy & Hold Strategy for either CREF portfolio. The other strategies applied to the CREF portfolios increase ending wealth relative to the Buy & Hold Strategy by 38.0% to 128.0%[1].

[1] The CREF portfolios cannot be shorted, only switched into cash and back, and this explains in part why the ending wealth for the CREF portfolios is generally much lower than for the non-CREF portfolios for each strategy.

Table 3

Returns for Different Weekend Trading Strategies Assuming Zero Transaction Costs and $1,000 Initial Wealth

	1988-2000							1994-2000	
		Deciles							
Trading Strategy	No. of Weekends	1 & 2	5	10	CRSP Equal-Weighted Index	S&P 500 Index	CREF Stock Portfolio	No. of Weekends	CREF Growth Portfolio
1	2	3	4	5	6	7	8	9	10
A. The Buy & Hold Strategy									
Ave. Monday	623	-.055%	-.090%	.019%	-.041%	.114%	.057%	318	.019%
tandard Error		(.023%)	(.028%)	(.040%)	(.028%)	(.039%)	(.034%)		(.072%)
Average Daily Return		.113%	.066%	.053%	.111%	.056%	.054%		.069%
Ending Wealth		$40,395	$8,843	$5,608	$37,807	$6,197	$5,631		$3,178
B. The Weekly Strategy									
Ave. Monday, Weekends Switched	623	-.055%	-.090%	.019%	-.041%	.114%	.057%	318	.019%
Standard Error		(.023%)	(.028%)	(.040%)	(.028%)	(.039%)	(.034%)		(.072%)
Average Daily Return		.134%	.101%	.045%	.126%	.012%	.032%		.061%
Ending Wealth		$80,165	$27,240	$4,419	$63,388	$1,503	$2,804		$2,815
C. The Negative Friday Strategy									
Ave. Monday, Weekends Switched	281	-.177%	-.286%	-.154%	-.221%	-.002%	-.115%	135	-.195%
Standard Error		(.037%)	(.047%)	(.063%)	(.047%)	(.066%)	(.057%)		(.137%)
Ave. Monday, Not Switched	342	.045%	.070%	.161%	.106%	.209%	.199%	183	.177%
Standard Error		(.027%)	(.030%)	(.051%)	(.032%)	(.046%)	(.039%)		(.073%)
Average Daily Return		.143%	.115%	.079%	.148%	.056%	.068%		.088%
Ending Wealth		$109,306	$44,076	$13,330	$130,634	$6,284	$8,790		$4,389
D. The Fourth Monday Strategy									
Ave. Monday, Weekends Switched	267	-.129%	-.195%	-.154%	-.164%	-.038%	-.097%	136	-.164%
Standard Error		(.036%)	(.047%)	(.065%)	(.047%)	(.068%)	(.059%)		(.124%)
Ave. Monday, Not Switched	356	.001%	-.012%	.149%	.050%	.227%	.173%	182	.156%
Standard Error		(.029%)	(.032%)	(.050%)	(.033%)	(.045%)	(.039%)		(.085%)
Average Daily Return		.134%	.098%	.078%	.137%	.062%	.065%		.085%
Ending Wealth		$80,608	$25,018	$12,736	$90,754	$7,589	$8,211		$4,220
E. The Both Strategy									
Ave. Monday, Weekends Switched	128	-.291%	-.440%	-.392%	-.398%	-.237%	-.327%	64	-.483%
Standard Error		(.059%)	(.081%)	(.104%)	(.081%)	(.112%)	(.097%)		(.231%)

Table 3 (continuous)

1	2	3	4	5	6	7	8	9	10
Ave. Monday, Not Switched	495	.006%	.000%	.125%	.051%	.204%	.157%	254	.146%
Standard Error		(.024%)	(.027%)	(.042%)	(.027%)	(.039%)	(.033%)		(.067%)
Average Daily Return		.135%	.101%	.083%	.142%	.074%	.068%		.089%
Ending Wealth		$84,993	$27,255	$15,279	$104,795	$11,365	$9,022		$4,454
F. The Either Strategy									
Ave. Monday, Weekends Switched	420	-.112%	-.181%	-.081%	-.130%	.046%	-.039%	207	-.086%
Standard Error		(.029%)	(.035%)	(.049%)	(.035%)	(.051%)	(.044%)		(.096%)
Ave. Monday, Not Switched	203	.063%	.097%	.227%	.143%	.253%	.256%	111	.215%
Standard Error		(.037%)	(.041%)	(.069%)	(.044%)	(.057%)	(.049%)		(.100%)
Average Daily Return		.141%	.113%	.073%	.144%	.044%	.065%		.085%
Ending Wealth		$103,667	$40,460	$11,112	$113,130	$4,196	$8,001		$4,159

CREF transaction costs are shared by all participants and by CREF policy a participant's marginal cost of switching often has been zero. Since this is not fair to those who do not switch, CREF currently permits only three free switches into any account other than the money account per month. (There is no restriction on the number of times switching into the money account within a month). Table 4 presents the effect of this limitation by restricting trading to the first three trading signals each month and, for comparison purposes, to the first trading signal only.

Interestingly, either restriction improves ending wealth for the Weekly Strategy compared to that in Table 3. Given that the Fourth Monday and Both Strategies trade at most twice per month, the current CREF restriction has no effect on these strategies, and it affects the ending wealth of the Negative Friday and Either Strategies for the CREF stock portfolio minimally and for the CREF growth portfolio moderately. For these four strategies, weekend trading still outperforms the Buy & Hold Strategy. Compared to Table 3, limiting trading to only the first signal each month reduces ending wealth for these four strategies to ranging from 66.7% (Negative Friday Strategy) to roughly 90.0% (Both Strategy). Table 4 suggests that selectivity when trading is beneficial (consider the Weekly Strategy results), that the results in Table 3 have a certain amount of robustness, and that weekend trading has practical economic value for CREF participants.

Table 5 presents portfolio performance measures and shows that the higher average daily returns and ending wealth displayed in Table 3 are not due to the strategies taking greater risk. Each strategy's alpha is higher, beta is lower, and reward-to-risk ratios are larger than those for the Buy & Hold Strategy. The Negative Friday Strategy seems to have the best performance compared to the other strategies, but its superiority over the Both Strategy depends on the size of the firms in the portfolio. Table 5's findings enhance the practical value of weekend trading.

Table 4

Returns for Different Weekend Trading Strategies with Limited Free Switching per month Between CREF Accounts and $1,000 Initial Wealth

	1988-2000	1994-2000	
Trading Strategy	CREF Stock Portfolio	CREF Stock Portfolio	CREF Growth Portfolio
A. The Buy & Hold Strategy			
Average Monday Return	.057%	.057%	.019%
Ending Wealth	$5,631	$2,744	$3,178
B. The Weekly Strategy			
Average Monday Return (3 Free Switches)	.015%	-.004%	-.025%
Ending Wealth	$4,360	$2,261	$2,763
% of Unrestricted Switching	155.5%	118.5%	98.2%
Average Monday Return (1 Free Switch)	.021%	-.003%	-.025%
Ending Wealth	$4,505	$2,264	$2,767
% of Unrestricted Switching	160.7%	118.6%	98.3%
C. The Negative Friday Strategy			
Average Monday Return (3 Free Switches)	.124%	.134%	.097%
Ending Wealth	$8,459	$3,503	$4,076
% of Unrestricted Switching	96.2%	96.3%	92.9%
Average Monday Return (1 Free Switch)	.064%	.076%	.039%
Ending Wealth	$5,863	$2,910	$3,388
% of Unrestricted Switching	66.7%	80.0%	77.2%
D. The Fourth Monday Strategy			
Average Monday Return (3 Free Switches)	.119%	.119%	.108%
Ending Wealth	$8,211	$3,342	$4,220
% of Unrestricted Switching	100.0%	100.0%	100.0%
Average Monday Return (1 Free Switch)	.115%	.077%	.041%
Ending Wealth	$8,008	$2,926	$3,404
% of Unrestricted Switching	97.5%	87.6%	80.7%
E. The Both Strategy			
Average Monday Return (3 Free Switches)	.134%	.145%	.125%
Ending Wealth	$9,022	$3,630	$4,454
% of Unrestricted Switching	100.0%	100.0%	100.0%
Average Monday Return (1 Free Switch)	.119%	.116%	.087%
Ending Wealth	$8,203	$3,314	$3,939
% of Unrestricted Switching	90.9%	91.3%	88.4%
F. The Either Strategy			
Average Monday Return (3 Free Switches)	.117%	.110%	.074%
Ending Wealth	$8,099	$3,249	$3,779
% of Unrestricted Switching	101.2%	97.0%	90.9%
Average Monday Return (1 Free Switch)	.061%	.067%	.022%
Ending Wealth	$5,759	$2,834	$3,205
% of Unrestricted Switching	72.0%	84.6%	77.1%

Table 5

Performance Measures for Different Weekend Trading Strategies

	1988-2000						1994-2000
	Deciles						
Trading Strategy	1 & 2	5	10	CRSP Equal-Weighted Index	S&P 500 Index	CREF Stock Portfolio	CREF Growth Portfolio
A. The Buy & Hold Strategy							
Alpha	.07%	.02%	-.02%	.05%	.00%	.00%	-.01%
Beta	.30	.40	.97	.51	1.00	.84	1.12
Sharpe Ratio	.12	.05	.02	.10	.04	.04	.03
Treynor Ratio	.003	.001	.000	.001	.000	.000	.000
B. The Weekly Strategy							
Alpha	.11%	.07%	.01%	.10%	-.03%	.01%	.01%
Beta	.16	.22	.58	.29	.60	.67	.91
Sharpe Ratio	.20	.13	.02	.16	-.01	.04	.04
Treynor Ratio	.007	.004	.000	.004	.000	.000	.001
C. The Negative Friday Strategy							
Alpha	.11%	.08%	.03%	.11%	.01%	.02%	.02%
Beta	.19	.29	.72	.36	.77	.74	.98
Sharpe Ratio	.22	.15	.05	.19	.03	.06	.05
Treynor Ratio	.007	.004	.000	.004	.000	.000	.001
D. The Fourth Monday Strategy							
Alpha	.10%	.06%	.03%	.10%	.01%	.02%	.02%
Beta	.18	.28	.73	.36	.78	.74	1.00
Sharpe Ratio	.20	.12	.05	.17	.04	.05	.05
Treynor Ratio	.006	.003	.001	.003	.000	.001	.001
E. The Both Strategy							
Alpha	.10%	.07%	.03%	.10%	.02%	.02%	.02%
Beta	.19	.30	.79	.39	.86	.77	1.02
Sharpe Ratio	.20	.12	.06	.18	.05	.05	.05
Treynor Ratio	.006	.002	.001	.003	.001	.001	.001
F. The Either Strategy							
Alpha	.11%	.08%	.03%	.11%	.00%	.02%	.02%
Beta	.18	.26	.66	.33	.70	.71	.96
Sharpe Ratio	.21	.15	.05	.19	.02	.05	.05
Treynor Ratio	.007	.003	.001	.004	.000	.001	.001

D. Further Thoughts on Transaction Costs

Table 6 gauges the effect of transaction costs on the trading strategies for the non-CREF portfolios and allows for transaction costs in two ways: 1) with an initial wealth of $1,000, a cost of .05% per transaction is applied, and 2) at $30.00 per transaction, the level of initial wealth needed for each strategy to break even is computed, given that strategy's average trading return[1]. For the .05% transaction cost's ending wealth, Table 6 also shows the percentage of the comparable Table 3 no-transaction-cost ending wealth.

[1] From the Datek web page, commission rates per trade are: $7.00 (Scotttrade), $9.99 (Datek), $14.94 (TD Waterhouse), $22.99 (E*Trade), $25.00 (Fidelity), and $29.95 (Scwab). Table 6's $30.00 cost per trade covers the high end. $7.00 cost per trade equals .05% of $14,000.00, so perhaps Table 6 should be based on an initial wealth of at least $14,000.00, but to compare to Table 4, initial wealth is kept at $1,000 for even the .05% cost per transaction.

Table 6

Returns for Different Weekend Trading Strategies with Transaction Costs and $1,000 Initial Wealth

Trading Strategy	Deciles 1 & 2	Deciles 5	Deciles 10	CRSP Equal-Weighted Index	S&P 500 Index
A. The Buy & Hold Strategy					
Average Monday Return	-.055%	-.090%	.019%	-.041%	.114%
Ending Wealth	$40,395	$8,843	$5,608	$37,807	$6,197
B. The Weekly Strategy					
Average Monday Return after Transaction Costs	-.145%	-.110%	-.219%	-.159%	-.314%
Ending Wealth at .05% Cost per Transaction	$23,060	$7,836	$1,271	$18,234	$432
Ending Wealth as a % of No-Transaction Cost Case	28.8%	28.8%	28.8%	28.8%	28.8%
Investment Required to Cover $30 per Transaction	$109,091	$66,667	-$314,136	$146,341	-$52,770
C. The Negative Friday Strategy					
Average Daily Return	.015%	.077%	.068%	.067%	.026%
Ending Wealth at .05% Cost per Transaction	$62,312	$25,126	$7,599	$74,470	$3,582
Ending Wealth as a % of No-Transaction Cost Case	57.0%	57.0%	57.0%	57.0%	57.0%
Investment Required to Cover $30 per Transaction	$33,898	$20,979	$38,961	$27,149	$3,000,000
D. The Fourth Monday Strategy					
Average Daily Return	-.030%	-.009%	.065%	.013%	.061%
Ending Wealth at .05% Cost per Transaction	$47,257	$14,667	$7,467	$53,205	$4,449
Ending Wealth as a % of No-Transaction Cost Case	58.6%	58.6%	58.6%	58.6%	58.6%
Investment Required to Cover $30 per Transaction	$46,512	$30,769	$38,961	$36,585	$157,895
E. The Both Strategy					
Average Daily Return	.023%	.049%	.139%	.081%	.170%
Ending Wealth at .05% Cost per Transaction	$65,797	$21,099	$11,828	$81,127	$8,798
Ending Wealth as a % of No-Transaction Cost Case	77.4%	77.4%	77.4%	77.4%	77.4%
Investment Required to Cover $30 per Transaction	$20,619	$13,636	$15,306	$15,075	$25,316
F. The Either Strategy					
Average Daily Return	-.039%	.019%	-.006%	.000%	-.084%
Ending Wealth at .05% Cost per Transaction	$44,754	$17,467	$4,797	$48,840	$1,812
Ending Wealth as a % of No-Transaction Cost Case	43.2%	43.2%	43.2%	43.2%	43.2%
Investment Required to Cover $30 per Transaction	$53,571	$33,149	$74,074	$46,154	-$129,310

The results for the Weekly Strategy and for the S&P Index are the least encouraging: ending wealth is quite low for the .05% transaction cost and the break-even investment for the $30.00 transaction cost is either prohibitive or negative. (A negative value means the strategy is not feasible and will never break even). For the other strategies, ending wealth with transaction costs is between 43.2% and 77.4% of the no-transaction cost case, and the break-even investment required to cover the $30.00 transaction cost ranges roughly between $15,000.00 and $40,000.00. While transaction costs cannot be ignored, Table 6 suggests that weekend trading still has economic value. However, either transaction costs must be very low or, from an individual investor's viewpoint, the amount invested must be substantial (i.e., more than $40,000) to make trading worthwhile.

Which strategy has the best performance? Table 3 shows that the Negative Friday Strategy and the Both Strategy perform better in a no transaction cost environment: the Negative Friday Strategy generates a lower return per switch than the Both Strategy does (e.g., for decile 1&2, .178% versus .291%) but it has a higher ending wealth because it switches more often (281 versus 128 times).

However, in Table 6, when a cost of .05% per transaction is applied, the Both Strategy clearly has a higher ending wealth for all portfolios (except the decile 5 portfolio). Compared to the Negative Friday Strategy, the Both Strategy preserves a higher percentage of Table 3's maximum ending wealth, has a lower break-even investment requirement, and captures more of Table 3's predictive value for the larger portfolios in the whole period. Furthermore, when applied to the CREF stock or growth accounts, the Both strategy generates the highest ending wealth whether unlimited free trading on CREF accounts is allowed (Table 3) or not (Table 4). When there is a cost associated with each transaction, the Both Strategy performs better since it is more selective about switching and avoids the accumulation of transaction costs.

IV. Concluding Comments

The traditional weekend effect of positive Friday and negative Monday returns is evident in the average daily returns for many of the portfolios in our sample that ends in 2000. This anomaly's long-lasting existence appears to be continuing, although our results are weaker than those in the earliest weekend effect studies. However, we find that size matters. For our largest portfolios, we do not find much support for the traditional weekend effect. Such stocks are widely held by institutional investors who have informational and transaction cost advantages over individual investors, so if markets are efficient, this finding is not surprising. For the small (large trading gains) and mid-size firms (most negative Mondays) for which the weekend effect is most apparent, institutions are limited in the size of the positions they can take, and individual investors can play a more significant role in the transactions in these stocks. The notion that individuals, confronted with buy recommendations during the trading week, develop decisions to sell stocks over the weekend that are executed on Mondays receives support from our results.

We also find that the direction of returns on Friday matters in that, on average, negative Mondays follow negative Fridays and positive Mondays follow positive Fridays. Various trading strategies are used to evaluate the economic significance of negative Mondays, and assuming no transaction costs, the strategy based on positive feedback generates the highest ending wealth – turning $1,000 into over $100,000 for some portfolios. Each of the trading strategies offers a similar risk-return pattern; each possesses lower risk and higher risk-adjusted return performance than the benchmark Buy & Hold Strategy does. Additional testing confirms that the trading strategies exhibit market-timing ability. This implies that investors could use weekend trading strategies to enhance value of their equity portfolios, or money managers could apply these strategies to their managed portfolios and charge clients a higher fee for doing so.

Our best strategy results from a combination of the findings of two previous studies on the weekend effect. The best strategy is selective about which weekends to trade – approximately 20% of the weekends, helping to economize on transaction costs – and has the highest predictive value in the market timing tests.

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Appendix A

Table A-1

Analysis of the Daily Returns of Various Portfolios, 1994-2000

		Deciles											Average Daily Returns			
Day of the Week	Number of Observations	1 & 2	3	4	5	6	7	8	9	10	All Deciles	F-Statistic for Differences Across Deciles	CRSP Eq.-Weighted Portfolio	S&P 500 Index	CREF Stock Portfolio	CREF Growth Portfolio
A. Unconditional Average Returns																
Monday	318	-.09%	-.07%	-.11%	-.09%	-.07%	-.06%	-.05%	-.04%	-.03%	-.07%	.28	-.05%	.11%	.06%	-.01%
t-Statistic		-2.45	-1.79	-2.86	-2.14	-1.53	-1.21	-1.08	-.78	-.52	-4.36	.97	-1.22	1.77	1.10	-.10
Tuesday	346	.05%	-.01%	-.01%	.00%	.01%	.00%	.01%	.02%	.04%	.01%	.24	.03%	.11%	.09%	.05%
t-Statistic		1.35	-.34	-.22	-.10	.17	-.03	.28	.48	.59	.83	.98	.73	1.90	1.81	.62
Wednesday	346	.08%	.09%	.07%	.07%	.06%	.06%	.06%	.06%	.02%	.06%	.27	.10%	.02%	.04%	.02%
t-Statistic		2.30	2.65	2.11	2.26	1.80	1.56	1.56	1.37	0.33	4.91	.98	2.65	.50	.86	.36
Thursday	338	.15%	.10%	.09%	.08%	.07%	.06%	.05%	.04%	.04%	.08%	.61	.13%	.00%	.01%	.08%
t-Statistic		4.59	2.68	2.53	2.31	1.77	1.30	1.06	.80	.69	5.15	.77	3.14	.04	.22	1.18
Friday	337	.32%	.29%	.25%	.22%	.19%	.18%	.16%	.14%	.18%	.21%	1.76	.30%	.10%	.11%	.05%
t-Statistic		7.98	8.16	7.26	6.48	5.09	4.17	3.29	2.67	2.50	14.04	.08	7.10	1.77	2.10	.72
All Days	1685	.10%	.08%	.06%	.06%	.05%	.05%	.05%	.05%	.05%	.06%	.92	.10%	.07%	.06%	.04%
t-Statistic		6.29	4.95	3.70	3.65	3.07	2.52	2.25	2.02	1.72	9.18	.50	5.49	2.73	2.75	1.25
F-Statistic for Differences:																
Monday through Friday		17.23	14.62	14.15	10.24	5.98	4.21	2.75	1.70	1.41	48.99		10.26	0.85	0.64	0.21
Level of Significance		.00	.00	.00	.00	.00	.00	.03	.15	.23	.00		.00	.49	.63	.93
B. Average Monday Returns Conditional on Previous Friday's S&P 500 Return																
Positive Friday	188	.00%	.06%	.03%	.07%	.09%	.11%	.13%	.14%	.12%	.08%	.79	.10%	.20%	.21%	.17%
t-Statistic		.02	1.56	.82	1.79	1.99	2.26	2.29	2.17	1.52	4.86	.61	2.11	3.20	3.87	2.28
F-Statistic		11.15	10.41	8.19	5.72	3.31	2.69	1.62	1.10	1.01	27.49		6.50	1.55	.61	1.92
Level of Significance		.00	.00	.00	.00	.01	.03	.17	.36	.40	.00		.00	.18	.66	.10
Negative	130	-.22%	-.26%	-.32%	-.32%	-.30%	-.30%	-.32%	-.31%	-	-.29%	1.56	-.28%	-.03%	-.17%	-.20%
t-Statistic		-3.35	-3.53	-4.34	-4.21	-3.78	-3.56	-3.66	-3.27	-2.30	-10.40	.13	-3.41	-.29	-1.77	-1.44
F-Statistic		17.75	18.73	19.59	17.39	12.05	9.33	7.61	5.47	3.03	85.19		14.90	.94	1.74	2.51
Level of Significance		.00	.00	.00	.00	.00	.00	.00	.00	.02	.00		.00	.44	.14	.04

Table A-2

Analysis of the Daily Returns of Various Portfolios, 1994-1999

		Deciles											Average Daily Returns			
Day of the Week	Number of Observations	1 & 2	3	4	5	6	7	8	9	10	All Deciles	F-Statistic for Differences Across Deciles	CRSP Eq.-Weighted Portfolio	S&P 500 Index	CREF Stock Portfolio	CREF Growth Portfolio
A. Unconditional Average Returns																
Monday	271	-0.06%	-0.05%	-0.10%	-0.07%	-0.05%	-0.04%	-0.03%	-0.01%	0.03%	-0.04%	0.61	-0.03%	0.10%	0.06%	0.05%
t-Statistic		-1.98	-1.19	-2.37	-1.60	-1.07	-0.71	-0.57	-0.25	0.55	0.00	0.80	-0.62	1.53	1.16	0.67
Tuesday	295	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.06%	0.02%	0.48	0.04%	0.12%	0.10%	0.11%
t-Statistic		2.60	0.09	0.07	0.06	0.10	0.03	0.35	0.69	1.30	1.64	0.87	1.20	2.03	2.12	1.75
Wednesday	294	0.13%	0.15%	0.11%	0.11%	0.09%	0.10%	0.10%	0.11%	0.13%	0.11%	0.22	0.16%	0.11%	0.12%	0.17%
t-Statistic		4.93	4.57	3.39	3.13	2.54	2.64	2.64	2.78	3.15	9.61	0.99	4.72	2.21	2.92	3.12
Thursday	287	0.14%	0.10%	0.08%	0.08%	0.06%	0.03%	0.01%	0.00%	0.00%	0.06%	1.32	0.11%	-0.04%	-0.02%	0.01%
t-Statistic		4.66	2.68	2.26	2.02	1.35	0.69	0.24	0.00	0.02	3.90	0.23	2.91	-0.61	-0.43	0.08
Friday	286	0.30%	0.28%	0.25%	0.21%	0.19%	0.18%	0.16%	0.14%	0.14%	0.21%	2.52	0.29%	0.15%	0.12%	0.15%
t-Statistic		11.65	9.98	8.55	6.54	5.28	4.44	3.68	3.17	2.86	16.52	0.01	8.78	2.69	2.68	2.71
All Days	1433	0.12%	0.10%	0.07%	0.07%	0.06%	0.06%	0.05%	0.06%	0.07%	0.07%	1.38	0.12%	0.09%	0.08%	0.10%
t-Statistic		9.01	6.37	4.51	4.00	3.29	2.93	2.59	2.60	3.28	11.85	.20	6.93	3.43	3.57	3.51
F-Statistic for Differences:																
Monday through Friday		21.89	14.62	14.07	8.48	5.24	3.99	2.89	2.13	1.45			10.72	1.57	1.53	1.23
Level of Significance		.00	.00	.00	.00	.00	.00	.02	.07	.22			.00	.18	.19	.30
B. Average Monday Returns Conditional on Previous Friday's S&P 500 Return																
Positive	166	.01%	.07%	.04%	.09%	.11%	.13%	.16%	.17%	.17%	0.11%	1.30	.12%	.20%	.21%	.20%
t-Statistic		0.41	1.88	1.09	2.08	2.29	2.63	2.76	2.76	2.80	6.52	0.24	2.66	2.95	3.69	2.79
F-Statistic		14.21	10.59	8.29	4.87	3.37	3.14	2.54	2.25	1.78	30.33		7.13	2.19	2.72	1.48
Level of Significance		0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.06	0.13	0.00		0.00	0.07	0.03	0.21
Negative	105	-.19%	-.24%	-.33%	-.33%	-.32%	-.31%	-.32%	-.31%	-.19%	-0.28%	0.41	-.26%	-.06%	-.17%	-.20%
t-Statistic		-2.97	-2.97	-3.85	-3.66	-3.36	-3.14	-3.25	-2.99	-1.73	-9.15	0.92	-2.92	-0.46	-1.63	-1.37
F-Statistic		22.44	19.40	20.41	15.77	11.62	9.53	8.43	7.02	3.74	95.34		16.68	2.04	3.83	3.04
Level of Significance		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.09	0.00	0.02