

Weekend Effects on Stock Returns: A Note

JOSEF LAKONISHOK and MAURICE LEVI*

SOME RESEARCHERS HAVE APPARENTLY been surprised to discover that the distribution of stock returns depends on the day of the week.¹ Kenneth French [3], for example, in testing whether daily stock returns are generated by a trading time or calendar time hypothesis, provided convincing evidence of a negative market return on Mondays. As French carefully notes, this finding runs counter to both hypotheses, since a trading time view would have expected stock returns equal on different days, and a calendar time view would have higher expected returns on Monday to compensate for the longer holding period.

In this paper we offer a partial explanation for the apparently puzzling discovery of different daily returns. We argue that the expected stock returns as measured, for example, from closing to closing prices, should depend on the day of the week. In general, we argue that the expected returns on Mondays should be lower than would be implied simply by a trading time or calendar time model, and the returns on Fridays should be higher. In addition, we anticipate that holidays will have complex effects on stock returns on other days of the week. Our argument is based on the delay between trading and settlements in stocks and in clearing checks. The explanation that we offer for different measured daily returns does not contradict the efficient market hypothesis, as correctly adjusted expected returns should not differ according to the day of the week.

I. Effect of Settlement and Clearing Delays

Since 1968 it has been the established practice in the United States for the settlement on stocks to take place five business days after trading. In an ordinary week that does not contain any holidays, this means that payment is due on the same day of the week as the trade, but in the following week.

Checks that clear via the United States Federal Reserve System take one business day from the time they are delivered to the commercial banks to the time that usable funds are debited and credited. On the same day a check is deposited in a bank, the funds which are credited are known as clearing house funds, no interest is earned on them, and they cannot be used for settlement until

* Josef Lakonishok is Associate Professor, Faculty of Management, Tel-Aviv University, and Visiting Associate Professor, Faculty of Commerce, University of British Columbia. Maurice Levi is Associate Professor, Faculty of Commerce, University of British Columbia. We have received computational help from Gordon McOrmond and advice from Allen Felix, Director of Education, the New York Stock Exchange. Financial assistance was received from the Canadian Ministry of Industry, Trade and Commerce. The paper has benefited considerably from the valuable comments of Michael Brennan and Jerold Warner but the authors are solely responsible for any errors that may remain.

¹ See, for example, Cross [1], Fama [2], French [3], and Gibbons and Hess [4] for observations on daily returns.

the next business day when they become federal funds.² The clearing delay means that in weeks without a holiday, stocks purchased on business days other than Friday give the buyer eight calendar days before losing funds for stock purchases. These eight days are the five business days for settlement, the two weekend days, and the check clearing day. However, payment for stock purchased on a Friday will not occur until the second following Monday, ten calendar days after the trade. These ten days are the five business days for settlement, the two weekends, and the check clearing day. Buyers should therefore be prepared to pay more on a Friday than on other days by the amount of two days interest. The sellers of stock should also require a higher price for stocks sold on a Friday because of the two days extra delay before being paid. Hence, the equilibrium expected rate of return on Fridays should be higher than on other days. Similarly, the equilibrium expected rate of return on Mondays should be lower by two days of interest than the return expected from either a trading time or calendar time view.

The five-day settlement period came into effect on 9 February 1968 after a period of hectic trading activity in which volumes were so large that the New York Stock Exchange closed on some Wednesdays. Before this time, a four-day settlement period had been in effect. With 4-day settlement and an extra day for debiting by banks, the delay from trading to final settlement is five business days. This means that no distortions should occur in expected daily returns as a result of weekends. If a stock is purchased on a Monday, payment will be completed the next Monday. If a stock is purchased Friday, payment is completed the next Friday. Holidays will make payment delays very much like the normal five-day settlement we have described as will the closures on Wednesdays during the early weeks of 1968. Because normal weeks before 1968 require no adjustment for interest savings etc. and there are only minor effects on holidays, we shall later give results for unadjusted returns before 1968 and adjusted returns after this date.

The presence of holidays will affect the equilibrium expected returns in a complex fashion. The returns start to be affected about a week in advance. As many as four daily returns may be affected. Given that about a fifth of the weeks contain a business holiday, the complication they introduce is not negligible. We shall illustrate the effect of holidays with the current five-day settlement period.

Let us consider a holiday on the 15th of a month when this day falls on a Wednesday. If a stock is purchased on the previous Friday 10th, settlement in the form of a check will occur five business days later which, because of the Wednesday holiday, is Monday 20th. The settlement is in clearing house funds which become federal funds on the next business day, which is the 21st. There are, therefore, eleven calendar days between the trade and the final settlement, which is three days longer than for days other than Fridays in normal weeks. With the Wednesday 15th holiday, if the stock had traded on Thursday the 9th, settlement would have been made after five business days—Friday 10th, Monday 13th, Tuesday 14th, Thursday 15th—and hence on Friday 17th. These are clearing house funds, and “good” or federal funds are not settled until Monday 20th. This

² Until 1 October 1981, the distinction between clearing house funds and federal funds had important implications for exchange rates. This is shown in Levi [5].

is again eleven days, just like the purchase on Friday 10th, so there is no advantage of the Friday trade over the Thursday trade. Indeed, if the holiday had fallen on any weekday, the same would have been true. This can be seen by working down a calendar for holidays on Monday 13th, Tuesday 14th, etc. We discover that the higher expected return on Fridays should disappear whenever there is a holiday in the following week. When there is a holiday, it is on the previous Thursday that the stock price should close higher with a consequently higher daily return.

Holidays can affect returns for over a week in advance. For example, with our Wednesday 15th holiday, if a stock had been purchased on Wednesday 8th, settlement is due on Thursday 16th, which means federal funds move on the 17th. This is nine days versus the normal Wednesday delay of eight days. Trades on Tuesday 7th will require a settlement on the 14th, but federal funds will move on the 16th because of the business day lag in clearing checks, which is two calendar days in this case. This is again nine days. We find that a holiday on the 15th has distorted the normal schedule for settlement and the expected daily returns as far forward as the 7th.

The complete effect of delays in payments on expected measured rates of return because of holidays and normal weekends is presented in Table I. We denote by x the average equilibrium daily return on investment in stocks; y refers to the daily interest rate; and H -day signifies a holiday. The table is presented under the assumption that expected returns are proportional to calendar time. The top row shows the effect of normal weekends where the two-day saving of interest by buying on Friday makes prices rise on that day by $2y$. This is corrected the following Monday with $-2y$ and is accompanied by the extra two days return because of two extra calendar days. Table I also allows us to observe the effect of holidays on equilibrium expected returns. For example, a holiday on a Wednesday, as shown in the second row, will increase the expected return on the Tuesday and Thursday in the week preceding the holiday. The increase on Tuesday will be by one day's interest and on Thursday, by two days' interest. In addition, the return on Friday will decrease relative to a non-holiday by two days' interest and the return on Thursday following the holiday will decrease by one day's interest. If the holiday is not on Wednesday, returns on other days of the week will be affected. However, regardless of the day on which the holiday falls, the Friday effect observed on nonholiday weeks will be picked up on Thursday preceding the holiday.

II. Data Adjustments

The data employed are those for the daily stock market returns for closing-to-closing prices from the Center for Research in Security Prices (CRSP) of the University of Chicago and cover the period from July 1962 to December 1979. If they had been available, it would have been preferable to use closing-to-opening prices. This is because the gain or loss from waiting until the next day will occur from the very outset of trading. This follows because interest is paid overnight and because settlement delays involve "clear" days.

The daily returns are adjusted for the interest rate. The adjustment procedure

Table I
The effect of weekends and holidays on equilibrium daily returns^a

	F	M	T	W	Th	F	M	T	W	Th	F	M
No holiday	$x + 2y$	$3x - 2y$	x	x	x	$x + 2y$	$3x - 2y$	x	x	x	$x + 2y$	$3x - 2y$
Wednesday Holiday	$x + 2y$	$3x - 2y$	$x + y$	x	$x + 2y$	x	$3x - 2y$	x	H-Day	$2x - y$	$x + 2y$	$3x - 2y$
Thursday Holiday	$x + 2y$	$3x - 2y$	x	$x + y$	$x + 2y$	x	$3x - 2y$	x	x	H-Day	$2x + y$	$3x - 2y$
Friday Holiday	$x + 2y$	$3x - 2y$	x	x	$x + 3y$	x	$3x - 2y$	x	x	$x + 2y$	H-Day	$4x - 3y$
Monday Holiday	$x + 3y$	$3x - 2y$	x	x	$x + 2y$	x	H-Day	$4x - 3y$	x	x	$x + 2y$	$3x - 2y$
Tuesday Holiday	$x + 2y$	$3x - y$	x	x	$x + 2y$	x	$3x - 2y$	H-Day	$2x - y$	x	$x + 2y$	$3x - 2y$

^a x —average daily equilibrium expected return on stocks.
 y —daily rate of interest.

is based on Table I. For example, from nonholiday Friday returns we subtracted two days of interest (measured as the prime rate) and to Monday returns we added two days of interest. The returns around the holidays were adjusted accordingly. No adjustment is made for the 1962–67 subperiod because the 4-day settlement means that each day is alike. The adjusted average returns for the entire period is formed from the average of the unadjusted returns for 1962–67 and the adjusted returns for the later subperiods. Two different market indices were used in the study—the CRSP equally weighted and the CRSP value weighted indices. The results are very similar and we therefore report only the results using the value weighted index.

III. The Results

Table II shows the average measured daily rates of return on the stock market over different subperiods. We find, as did, for example, French [3] that over the earlier periods, unadjusted returns on Mondays are significantly negative, and returns on Fridays are positive. After adjustment for interest gains from Friday trades and the effects of holidays, we find that the daily returns on Fridays are reduced, for example, in the 1968–73 period from 0.090 to 0.060 percent, a reduction of 33 percent. Since the average daily return over the entire survey period is approximately 0.03 percent, the extra return on Fridays after adjustment is extremely small. The abnormally low return on Mondays is reduced during 1968–73 from -0.208 to -0.172 , a reduction of 17 percent. However, the returns are not sufficiently reduced on Friday or increased on Monday to completely eliminate the daily effects. We are left with a puzzling result which is not entirely accounted for by payment and clearing delays. An additional puzzling result is the abnormally high returns on Wednesdays for the entire period and earlier subperiods. We do, however, discover that over the most recent period, part of which has not been included in previous studies, the Monday and Friday returns as well as other daily returns have become insignificant. It would appear that any abnormality which had existed earlier has been eliminated since the mid-1970s.

By comparing the unadjusted returns on Mondays between the two periods, 1962–67 and 1968–73, we find that during the earlier period the decline on Mondays is smaller. This is consistent with the 4-day settlement during the 1962–67 period which would not cause a Friday buying advantage on normal weekends, and hence should not cause a Monday fall in returns.

As an alternative test of the day of the week on daily returns, we also used dummy variables in the regression equation

$$R_t = \gamma_W + \gamma_M D_{Mt} + \gamma_T D_{Tt} + \gamma_{TH} D_{THt} + \gamma_F D_{Ft} + e_t$$

where R_t is the adjusted percentage rate of return and the dummy variables take on a value of one on the respective day of the week and zero otherwise. We obtain results very similar to those given in Table II. Monday returns remain negative and Friday returns remain positive even after interest adjustment. Wednesday returns are positive. The regression results also reveal that the effects of the day of the week have disappeared by 1974.

Table II
Daily percent rates of return before and after adjustment for interest rates

Period	Monday		Tuesday		Wednesday		Thursday		Friday		
	Raw	Adjusted	Raw	Adjusted	Raw	Adjusted	Raw	Adjusted	Raw	Adjusted	
1962-79	Mean	-0.110	-0.082	0.014	0.015	0.100	0.101	0.057	0.051	0.092	0.069
	't'-stat	-3.848	-3.058	0.569	0.559	3.779	3.752	2.452	2.252	4.017	3.158
	observations ^a	818		832		860		849		849	
1962-67	Mean	-0.102		0.061		0.133		0.060		0.112	
	't'-stat	-2.694		1.788		3.843		2.118		4.114	
	observations	259		261		272		275		267	
1968-73	Mean	-0.208	-0.172	0.001	0.000	0.117	0.115	0.039	0.031	0.090	0.060
	't'-stat	-4.058	-3.359	0.017	0.001	2.394	2.358	0.880	0.691	2.327	1.547
	observations	278		286		282		274		287	
1974-79	Mean	-0.020	0.028	-0.015	-0.015	0.056	0.056	0.071	0.062	0.078	0.035
	't'-stat	-0.631	0.515	-0.278	-0.284	1.104	1.088	1.568	1.362	1.590	0.710
	observations	281		285		306		300		295	

^a When the previous day is a holiday, no closing to closing return is included on the succeeding day.

As a final confirmation of our conclusions, we computed the fraction of days on which daily returns were positive and the z -statistics on the null-hypothesis of equal probabilities of positive and negative returns. All of our previous conclusions are confirmed which indicates that the results are not driven by a limited number of extreme observations.

We should note in interpreting the results that our adjustment for interest rates assumes a calendar time hypothesis and therefore to some extent represents an upper bound on the appropriate adjustment. However, we believe that since interest is earned during weekends and holidays, a calendar time view is relevant for interest bearing securities and therefore also for the alternative, i.e. holding stocks.

IV. Conclusions

Many studies of the behavior of stock prices have been based on the belief that returns are uninfluenced by the day of the week. However, we have presented an argument that the measured daily returns *should* depend on the day of the week and that adjustment for interest gains on certain days over adjacent business days should be made. Our results suggest that future examinations of the stock market which use data before 1974, even if adjusted data are used, will have residual daily effects. This could potentially influence conclusions about, for example, market efficiency. Data over more recent years would appear to be free of residual problems, but should in any case use only adjusted data, especially as a result of the high interest rates which have been experienced.

REFERENCES

1. F. Cross. "The Behavior of Stock Prices on Fridays and Mondays." *Financial Analysts Journal* 29 (November–December 1973), 67–69.
2. E. F. Fama. "The Behavior of Stock Market Prices." *Journal of Business* 38 (January 1965), 34–105.
3. K. R. French. "Stock Returns and the Weekend Effect." *Journal of Financial Economics* 7 (March 1980), 55–69.
4. M. R. Gibbons and P. J. Hess. "An Investigation into Day Effects in Asset Returns—A Progress Report." Working paper, University of Chicago.
5. M. Levi. "The Weekend Game: Clearing House vs. Federal Funds." *Canadian Journal of Economics* 11 (November 1978), 750–57.