# The Monday effect on the Johannesburg Stock Exchange

N. Bhana

Graduate School of Business, University of Durban-Westville, Durban

The efficient market hypothesis submits that the expected returns on shares and other financial assets are identical for all the days of the week. Studies of share returns on the New York Stock Exchange have revealed that the expected returns are not identical for the various days of the week. This article examines two hypotheses that have attempted to explain the distribution of returns over different days of the week. The calendar-time hypothesis states that the expected return for Monday is three times the expected return for the other days of the week. The trading-time hypothesis states that the expected return is the same for each day of the week. During the period 1978 – 1983, the daily returns on shares traded on the JSE were inconsistent with both hypotheses. The average return for Monday was significantly negative while the average return for the other trading days was positive with Wednesday showing the highest return. Evidence is presented to show that Treasury Bills have the same weekend effect as share transactions. An investment strategy based on the observed pattern of share returns over different days of the week is suggested. The implications of the effect of day of the week for tests of market efficiency are examined.

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Die effektiewemark-hipotese stel voor dat die verwagte opbrengs op aandele en ander finansiële bates, identies is op alle dae van die week. Studies van aandele-opbrengste op die New Yorkse Effektebeurs het aangetoon dat die verwagte opbrengste nie identies is vir alle dae van die week nie. Hierdie artikel ondersoek twee hipoteses wat poog om die verspreiding van opbrengste oor verskillende dae van die week te verklaar. Die kalendertyd-hipotese stel voor dat die verwagte opbrengs vir Maandag driekeer die verwagte opbrengs vir ander dae van die week sal wees. Die handelstyd-hipotese stel voor dat die verwagte opbrengs dieselfde sal wees vir elke dag van die week. Die daaglikse opbrengste teenoor aandele verhandel op die Johannesburgse Effektebeurs gedurende die periode 1978 – 1983, was teenstrydig met beide hipoteses. Die gemiddelde opbrengs vir Maandag was betekenisvol negatief terwyl die gemiddelde opbrengs ten opsigte van die ander handelsdae positief was, waar Woensdag die hoogste opbrengs toon. Daar word aangedui dat Staatseffekte dieselfde naweek-effek het as aandeletransaksies. 'n Investeringstrategie gebaseer op die waargenome patroon van aandele-opbrengste oor verskillende dae van die week word voorgestel. Die implikasie van die dag-van-die-week-effek as 'n toets van markeffektiwiteit word ondersoek.

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**N. Bhana**
Graduate School of Business, University of Durban-Westville, Private Bag X54001, Durban, 4000 Republic of South Africa

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## Introduction

The returns on shares traded on stock exchanges is one of the most popular topics of research in finance. A knowledge of expected returns will facilitate planning an investment strategy. Several studies of shares traded on the New York Stock Exchange (NYSE) have revealed that Monday's returns are typically negative in comparison with the positive returns generated by the other trading days. The purpose of this paper is to determine whether or not the weekend effect is applicable to shares traded on the Johannesburg Stock Exchange (JSE), i.e. to determine if the day of the week has an influence on share returns.

## The efficient market hypothesis (EMH)

During the past 10 years much academic research has been devoted to efficient capital markets. The subject is important because it has significant implications for investors and portfolio managers. Much of early research on efficient markets was done by testing the random-walk hypothesis. Kendall (1953:13) has shown that share prices could be generated by a series of random numbers and that the present share prices are independent of past results.

A formal theory based on the numerous empirical studies was formulated by Fama (1970:383 – 417). Fama separated the efficient market hypothesis (EMH) and empirical tests into three sub-hypotheses; weak, semi-strong, and strong. The weak form of the EMH assumes that the current share price reflects all historical information of a company and any other historical information generated by the market itself. The semi-strong form of the EMH asserts that share prices adjust rapidly to the release of all new publicly available information. The strong form of the hypothesis contends that the share prices fully reflect all information including insider information. There is substantial empirical evidence to support the weak and semi-strong forms of the EMH. However, there is no conclusive evidence supporting the strong form of the EMH. Niederhoffer and Osborne (1966:897 – 916) have pointed out that specialists on the NYSE apparently use their monopolistic access to information concerning unfilled limit orders to generate monopoly profits. Jaffe (1974:410 – 418) summarized the various studies on insider trading; most of the studies reported support the hypothesis that corporate insiders are able to outperform the market.

In recent years the EMH has received strong support from academic scholars. The vast pool of evidence supporting the weak and semi-strong forms of the hypothesis has made EMH a settled issue on university campuses. However, there has also been a proliferation of criticism of the EMH. Seligman

(1983:88 – 90) reports that several large investment advisory services have consistently outperformed the market. In particular the 'Value Line Investment Survey' in the United States has provided information to clients that consistently earned abnormal returns during the period 1956 – 1983. Another contradiction of the EMH is the seasonality of monthly returns on the NYSE. Rozeff and Kinney (1976) found that investors earned above-average returns in the month of January compared to the other months of the year. The effect of day of the week is further evidence against the EMH and is the subject of discussion in this article.

## The effect of day of the week on share returns

Several researchers have examined the distribution of share prices over the various trading days of the week. In the past researchers have generally assumed that the distribution of share returns is identical for all trading days of the week. Nevertheless, there are reasons to suspect that Monday's returns are different from those of other days. Since no trading takes place on Saturday and Sunday, Monday's return is calculated over three days instead of one calendar day. Therefore, the mean and variance of Monday's returns can be expected to be higher than those of the other trading days.

Fama (1965:34 – 105) reports that Monday's variance is about 20% higher than the variance for the other days of the week. This conclusion is supported by the findings of Godfrey, Granger, and Morgenstern (1964:1 – 30). Cross (1973:67 – 69) measured the behaviour of share prices on Fridays and Mondays on the NYSE. There was a persistent tendency for Monday's returns to be negative and Friday's returns to be positive. Gibbons and Hess (1981:579 – 596) examined the returns of the 30 companies comprising the Dow Jones Industrial Average. For the period 1962 – 1978 all 30 shares yielded a negative mean return on Monday and a positive return on the other days. French (1980:55 – 69) studied the daily returns to the Standard and Poor's composite portfolio for the period 1953 – 1977; the average return for Monday was significantly negative, although the average return for the other days of the week was positive. These research findings suggest the existence of a 'weekend effect' phenomenon which yields a negative return on Mondays.

## Research methodology

The purpose of this study is to determine whether or not the day of the week has an influence on share returns of companies listed on the JSE. There are two models which could explain the distribution of returns over a period of time. The calendar-time hypothesis states that share returns are generated in calendar time. Monday's returns represent an investment of three calender days, i.e. from the close of trading Friday to the close of trading Monday. The returns for the other trading days represent an investment for one day. The calendar-time hypothesis states that the expected return is a linear function of the period of investment. Therefore, the mean return for Monday will be three times the mean return for the other trading days. The trading-time hypothesis states that the expected return is a linear function of the trading period which is the same for each day of the week, i.e. one calendar day. Therefore, the trading-time hypothesis assumes that the mean returns will be the same for each day of the week.

According to the calendar-time hypothesis the expected returns are higher for Mondays as well as for trading days following holidays. Therefore, the expected returns for a period which includes a holiday are excluded from the analysis. For example, if Wednesday is a public holiday, the returns for the following day, i.e. Thursday, are not included in the analysis. To determine the 'closed market' hypothesis the returns for the days following holidays should be compared with the 'non holiday' returns. However, there are insufficient public holidays during the study period for the results to be statistically significant. French (1980:63) observed that there was no evidence of the 'closed market' hypothesis on the NYSE during the period 1953 – 77. French concludes that the negative returns for Monday are due to some weekend effect, rather than to the closed-market effect.

The daily returns associated with the Rand Daily Mail 100 Industrial Index (RDM 100 Index) and the JSE Overall Actuaries Index (JSE OAI) are used to analyze whether returns are generated in calendar time or trading time. The JSE OAI reflects the price changes of all shares traded on the JSE, and therefore is the most appropriate measure of share returns. However, the Actuaries Index was only brought into use in November 1978. Prior to this date the RDM 100 Index was the index most widely used to reflect general share price changes on the JSE. The RDM 100 Index monitors the daily price changes of the leading 100 industrial shares on the JSE. The JSE OAI gained general acceptance and began to be regularly published from April 1980. Therefore, the RDM 100 Index is used for the period 1 January 1978 – 30 March 1980, and the JSE Overall Actuaries Index is used for the period 1 April 1980 – 31 December 1983.

## Empirical results

Table 1 lists the sample means, standard deviations, and the number of observations of shares traded on the JSE during the period 1978 – 1983. An inspection of the means for the six-year period indicates that the expected returns were not constant for the various days of the week. These results clearly contradict the trading-time hypothesis. Furthermore, the

**Table 1** Mean, standard deviation, and *t*-statistics of the percentage return associated with the close of the previous trading day to the close of the day indicated[a]

| Period 1978 – 1983 | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Mean | −0,1192 | 0,0865 | 0,2299 | 0,1705 | 0,1446 |
| Standard deviation | 1,2429 | 0,9905 | 1,0931 | 1,2983 | 0,9804 |
| *t*-statistic | −2,0151[b] | 0,1106 | 1,4230 | 0,8355 | 0,5831 |
| observations | 286 | 290 | 298 | 302 | 295 |

[a]Returns for periods including holidays are excluded. These returns are defined as:

$$R_t = \frac{R_t - R_{t-1}}{R_{t-1}} \times 100$$

[b]2% significance level.

return for Monday was not three times the return for the other days of the week. A surprising finding was that the return for Monday is the lowest, and Monday is the only day yielding a negative return during the period 1978 – 1983 and is inconsistent with the calendar-time hypothesis. Furthermore, the hypothesis that Monday's expected return is positive can be rejected during the study period. The mean return of −0,1192% for Monday rejects this hypothesis at a 2% significance level. Monday is the most unusual day of the week, because of its negative rate of return. Wednesday's returns are the highest for the five trading days, followed by Thursday, Friday and Tuesday. Thursday's returns have the highest standard deviation, closely followed by the standard deviation for Monday's return.

The annual mean returns for the different days of the week during the period 1978 – 1983 are shown in Table 2. During four of the six years studied, the mean return for Monday was negative. Tuesday had the next largest number of negative returns having two out of six annual returns which are negative. Friday had one negative return, whereas Wednesday and Thursday showed no negative returns during the study period. Furthermore, Monday's mean return was lower than the mean return for any other day of the week during five of the six years studied. These results serve to confirm the contradiction of both the trading-time hypothesis and the calendar-time hypothesis. The persistent negative returns for Monday confirm the similar trend observed on the NYSE by Gibbons & Hess (1981) and French (1980).

### Tests of trading-time and calendar-time hypothesis

The negative returns for Monday relative to the positive returns for the other days of the week implies that neither the trading-time hypothesis nor the calendar-time hypothesis offer an adequate explanation of the returns generated by shares listed on the JSE. Formal statistical analysis is necessary to accept or reject both the hypotheses which predict the behaviour of returns over different trading days. The regression-analysis technique using dummy variables is used to measure the expected returns for the various days of the week. To test the trading-time hypothesis the following regression model is used:

$$Y' = A + B_2D_2 + B_3D_3 + B_4D_4 + B_5D_5 + E \ldots (1)$$

where $Y'$ = return of the JSE Overall Actuaries Index; $D_2$ = dummy variable for Tuesday, i.e. $D_2 = 1$ if observation falls on Tuesday and 0 otherwise; $D_3$ = dummy variable for Wednesday, i.e. $D_3 = 1$ if observation falls on Wednesday and 0 otherwise. Similarly, $D_4$ and $D_5$ represent the observation of Thursday and Friday respectively; $A$ = expected return for Monday; $B_2$, $B_3$, $B_4$, $B_5$ = difference between the expected return for Monday and the expected return for each of the other days of the week; and $E$ = disturbance factor.

If the trading-time hypothesis is correct the expected return would be the same for each day of the week. Therefore, the estimates of $B_2$, $B_3$, $B_4$, and $B_5$ will be close to zero, i.e. the standard errors of the coefficients provided by the regression analysis should be very small. The $F$-statistic tests the hypothesis that $B_2$ through $B_5$ equal zero and that the joint significance of the dummy variables should be insignificant. The estimate of equation (1) provided by the regression analysis is presented in Part A of Table 3. The regression analysis indicates that the observed returns are inconsistent with the trading-time hypothesis during the period 1978 – 1983. The $F$-statistic is significant at 0,5% level.

The statistical test of the calendar-time hypothesis is similar to the test of the trading-time hypothesis. The calendar-time hypothesis assumes that Monday's return is three times the expected return for the other days of the week. Therefore, the following regression model is used:

$$Y' = A(1 + 2D_1) + B_2D_2 + B_3D_3 + B_4D_4 + B_5D_5 + E \ldots (2)$$

where $D_1$ = dummy variable for Monday, i.e. $D_1 = 1$ if observation falls on Monday and 0 otherwise; $A$ = one-third of the expected return for Monday; $B_2$, $B_3$, $B_4$, $B_5$ = difference between one-third of Monday's return and the expected return for each of the other days of the week; and all other variables the same as used in equation (1).

As in the case of the trading-time hypothesis, the $F$-statistic tests the hypothesis that $B_2$ through $B_5$ equal zero should not be significant. The estimates of equation (2) provided by the

**Table 2** Average percentage returns for different days of the week during the years 1978 – 1983[a]

| Year | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| 1978 | −0,0433 | 0,1655 | 0,1399 | 0,1184 | 0,0696 |
| 1979 | 0,0996 | 0,1726 | 0,2825 | 0,1856 | 0,2962 |
| 1980 | 0,0792 | −0,1814 | 0,4238 | 0,4371 | 0,2337 |
| 1981 | −0,3750 | −0,1447 | 0,2917 | 0,0331 | 0,0846 |
| 1982 | −0,2606 | 0,1185 | 0,1985 | 0,1621 | 0,2140 |
| 1983 | −0,2151 | 0,3888 | 0,0428 | 0,0869 | −0,0306 |

[a]Returns for periods including holidays are excluded. These returns are defined as:

$$R_t = \frac{R_t - R_{t-1}}{R_{t-1}} \times 100$$

**Table 3** Tests of the trading-time and calendar-time hypothesis[a] for shares traded on the JSE during the period 1978 – 1983

| | $A$ | $B_2$ | $B_3$ | $B_4$ | $B_5$ | $R^2$ | $F$-statistic[b] | Degrees of freedom |
|---|---|---|---|---|---|---|---|---|
| Part A: Trading time | −0,119 | 0,087 | 0,230 | 0,171 | 0,145 | 0,023 | 16,255 | (4,1466) |
| $Y' = A + B_2D_2 + B_3D_3 + B_4D_4 + B_5D_5 + E$ | (0,027) | (0,039) | (0,039) | (0,039) | (0,039) | | | |
| Part B: Calendar time | −0,040 | 0,127 | 0,270 | 0,211 | 0,185 | 0,023 | 16,250 | (4,1466) |
| $Y' = A(1 + 2D_1) + B_2D_2 + B_3D_3 + B_4D_4 + B_5D_5 + E$ | (0,009) | (0,029) | (0,029) | (0,029) | (0,029) | | | |

[a]The dependent variable, $Y'$ is measured as a percentage.

[b]The $F$-statistic tests the hypothesis that $B_2$ through $B_5$ are zero. $F4{,}1000\ (99{,}5\%) = 3{,}72$. Returns for periods including holidays are excluded. The standard errors of the coefficients are in parenthesis.

regression analysis is presented in Part B of Table 3. The regression analysis indicates that the observed returns are inconsistent with the calendar-time hypothesis during the period 1978 – 1983. The *F*-statistic is significant at 0,5% level.

### Day of the week effect on other financial assets

Empirical evidence has shown that the return on shares display a pronounced weekend effect of a strong negative return for Monday. This raises the interesting question as to whether the weekend effect is restricted to shares or whether the phenomenon is widespread across other types of financial assets. Several investigators have studied the pattern of return on Treasury Bills. Jaffe & Mandelker (1976:447 – 458) and Fama & Schwert (1977:115 – 146) have shown that when Treasury Bills are actively traded their price changes have a similar pattern to shares, i.e. price fluctuations are random in behaviour. The returns on Treasury Bills are strongly influenced by the prevailing interest rates. Fama (1976) has demonstrated that nominal interest rates resembles a random walk. Therefore, in an efficient market we would not expect differences in returns on Treasury Bills for different days of the week. Gibbons and Hess (1981:588) have shown that Treasury Bill returns reveal a pattern similar to share returns. Mondays's return were on average substantially lower than the other days of the week. They conclude that the Treasury Bill returns have the same weekend effect as the returns on shares.

### Implications for market efficiency

The empirical evidence presented in this paper rejects both the trading-time and calendar-time hypotheses as explanations for the distribution of share returns over various days of the week. In particular it can be concluded that the return on shares from Friday to Monday was negative during the period 1978 – 1983. The empirical results indicate strong evidence that equilibrium returns vary across the days of the week. The persistent negative returns for Monday suggest that the market pricing mechanism is inefficient. While there is no justification to reject the EMH, the effect of day of the week must be considered as anomalous evidence which remains unanswered. The evidence presented in this article and similar findings on the NYSE cannot be reconciled with efficient pricing mechanism. All tests of market efficiency rely on a necessary condition of market equilibrium. Brown and Warner (1980: 205 – 258) have demonstrated that market equilbrium rests on the assumption that equilibrium returns are constant and the mean-adjusted return is calculated relative to the announcement dates. The foundations of the market equilibrium model are inconsistent with the findings of this empirical study.

No plausible explanation for the weekend effect has yet been offered. French (1980) suggests that unfavourable information is more likely to be released over the weekend. It is further suggested that delaying the announcement over the weekend allows more time for the unfavourable information to be digested. This explanation is only valid in inefficient markets. In efficient markets investors would anticipate the release of unfavourable information on weekends and its impact would be fully reflected in Friday's closing prices.

The trading pattern on the JSE is heavily influenced by the overall international investment trends. The trading on the JSE invariably follows the observed trends in overseas markets such as Hong Kong, London, and New York. There is a time lag of several hours before an overseas trend can be implemented on the JSE. The closure of the markets on weekends will create uncertainty and hesitancy on the JSE for share transactions on Monday. On Mondays the JSE investors can be expected to wait for overseas market reaction and subsequent confirmation of the trend in other markets. For instance, the market position in Hong Kong will require several hours for confirmation in London and several additional hours for the New York reaction to be observed. As a result of this hesitancy, minimal share transactions are expected to take place on Monday. There will be less hesitancy on subsequent trading days because overseas trends of the previous days will serve as guidelines.

Accounts for share transactions on the JSE are settled on a Tuesday. On Mondays the staff of the institutional investors are involved in administration relating to the balancing of books for settlement on Tuesday. The uncertainty in the market on Monday coupled with the involvement in administration is likely to delay the execution of share transactions. Orders may be held back for later processing, depending on the outcome of the overall international investment trend.

The pattern of share returns on the JSE during the period 1978 – 1983 revealed a negative return for Monday and the highest return for Wednesday. A possible investment strategy based on this observation would be to alter the timing of trading on share transactions. Purchases should be delayed until Monday and sales should be made on Wednesday. The evidence presented in this article strongly suggest that investors could increase their expected return by following this strategy for transactions which would have to be made anyway.

### Conclusions

In an efficient market no differences in expected returns over the different trading days are expected. The existence of the effect of day of the week on share prices and returns on Treasury Bills has been observed by several researchers. Two theories have attempted to explain the distribution of shares and other financial assets over different days of the week. The calendar-time hypothesis states that the expected returns is a linear function of the period of investment. Therefore, the mean return for Monday is expected to be three times the mean return for the other trading days. The trading-time hypothesis states that the expected return is a linear function of the trading period. Therefore, the expected return will be the same for each day of the week.

An empirical study of the daily returns to the RDM 100 Index and the JSE OAI during the period 1978 – 1983 was undertaken. Neither the calendar-time nor the trading-time hypothesis offer an explanation of the distribution of returns over the different days of the week. The average return for Monday was significantly negative while the average return for the other trading days was positive with Wednesday showing the highest return. A similar pattern of returns has been observed for returns on Treasury Bills. It would seem that the weekend-effect phenomenon is widespread across other types of financial assets.

Tests of market efficiency have generally assumed that the distribution of share returns is identical for all days of the week. The findings of this article supports previous studies which have demonstrated that the distribution of returns may vary according to the day of the week. This finding could lead to biases in empirical tests which rely on analyzing daily share prices. Future tests of share market efficiency, especially event type of studies (share splits, dividend announcements, new share issues, etc.) should allow for effect of day of the week in market returns. The persistent negative returns for Monday suggests that the market pricing mechanism is

inefficient. The findings of this study are inconsistent with the basic assumptions of the market equilibrium model. Therefore, the assumptions about the nature of market equilibrium needs to be further investigated.

A limitation of this empirical study is the relatively short duration of the investigation. The longer the period of study the greater the reliability of the research findings. Studies of the effect of day of the week on share returns in the United States have covered periods of 25 years and more. In the United States the various indices relating to share prices on the NYSE and other large stock exchanges are available on computer records. This has facilitated event-type empirical studies to test market efficiency. Computer-based information on share-price indices on the JSE has only been available for the past few years. Much of the data used in this study was obtained manually. It is recommended that follow-up studies on the effect of day of the week on the JSE should be undertaken as more computer-based information becomes available.

The pattern of share returns over different days of the week on the JSE indicates evidence of market inefficiency. The evidence presented in this article suggests that investors could benefit from this inefficiency utilizing the following investment strategy: Purchases should be delayed until Monday and sales should be made on Wednesday. An active trading strategy based on the observed pattern of share returns may not be profitable because of transaction costs incurred. However, investors might increase their expected returns by utilizing this strategy for transactions which are to take place anyway.

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