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The Day of the Week Effect on the JSE Securities Exchange since 1994

Stanislav Ioffe

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2008

ABSTRACT

This research examines the day-of-the-week effect on the JSE Securities Exchange for the period from 1995 to 2007. This effect was documented in the 1970s and 1980s. The first democratic election in 1994 left the international isolation of South Africa behind, and the financial markets opened up to foreign investors, bringing the possibility that political and economic changes could impact on market behaviour and anomalies.

Time series of the JSE daily closing prices comprised JSE/Actuaries All Share Index (Code: CI01) for the period 1st of January, 1995 until 21st of June 2002 and FTSE/JSE All Share Index (Code: J203) for the period 24th of June, 2002 until 31st of December, 2007.

The presence of the day of the week pattern was tested by conducting daily return mean variance examinations and formal statistical analysis of trading-time hypothesis. The latter was implemented by means of regression analysis.

The study shows that the day-of-the-week effect is no longer present on the JSE Securities Exchange.

The absence of the systematic day-of-the-week pattern suggests that investors may have improved risk pricing due to higher efficiency of the stock market.

It is not advisable for investors to use any kind of active trading strategy based on exploiting the previously reported day-of-the-week anomaly.

DECLARATION

I, Stanislav Ioffe, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

(Stanislav Ioffe)

Signed at …….

On the …….. day of ……. 2008

DEDICATION

I should like to dedicate this research to my mother and father who have always believed in me and have helped me to develop and achieve my dreams and goals.

ACKNOWLEDGEMENTS

I should like to acknowledge the help and support of the following people:

Terri Carmichael, my supervisor, for her consistent advice in the development of this report,

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CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The purpose of the research was to determine whether or not the day of the week has an impact on the return of shares traded on the JSE Securities Exchange (JSE) and whether the findings obtained correspond to prior research into day of the week effect on the JSE.

1.2 Context of the study

The first study of the daily return behaviour on the JSE was conducted by Bhana (1985) over the period 1978 – 1983. The study revealed a negative return on Monday and the highest positive return on Wednesday.

Gaag (1990) conducted the study on the calendar effect on the JSE observing the period of 1980 – 1989. He also found that calendar effects, and in particular, day of the week effects are present on the JSE. His findings pertaining to the negative Monday returns coincided with the results obtained by Bhana (1985).

Davidson and Meyer (1993) examined seasonal patterns in daily price movements of the JSE All Share Index (JSE ALSI) over the period from 1986 to 1991. They presented evidence that day of the week effect, and in particular the Monday effect, no longer exists on the JSE. These findings contrasted to that of Bhana (1985) and Gaag (1990).

Roux and Smit (2001) revisited earlier studies on the seasonal patterns on the JSE and, in particular, the day-of-the-week pattern to determine whether those patterns still existed. The time period was split into two sub-periods, from 1978 to 1989, and from 1990 to 1998. In the first sub-period (1978 - 1989) the Monday effect was found for the JSE All Share Index, JSE Industrial Index and JSE All Gold Index. These results were in line with those of Bhana (1985) and

Gaag (1990) over the same period of time. However, the analysis of the same JSE indices over the second sub-period (1990 - 1998) showed that the day-of-the-week effect was no longer present. Over this period of time the day-of-the-week effect was found on the JSE Financial Index only.

This study intended to establish whether there is any evidence of the day-of-the-week anomaly still existing on the JSE Securities Exchange over the period from 1995 to 2007. This period represents a new post-apartheid era in South African history. It is well-known that political and economic processes and events have a profound effect on the financial markets such as equity and bond markets. The first democratic election in South Africa in 1994 changed political and economic situation in the country. The immediate post-apartheid period (up to approximately 1996) saw a large volume of policy initiatives (Booysen, 2001:128). The government post-apartheid anti-poverty strategy, Reconstruction and Development Program (RDP) was launched in 1994 to help eradicate the consequences of apartheid. Another economic policy, namely, Growth, Economic and Redistribution (GEAR) strategy, was started in 1996 as the programme “which signalled a shift in ANC priorities towards macroeconomic balance and an investor-friendly environment” (Luiz 2002:596). From 2000 on, the government indicated its shift from a macroeconomic to a microeconomic emphasis (Booysen, 2001).

These economic changes resulted in the upturns in the economy after the years of economic stagnation and international isolation.

One of the outcomes of the government shift in post-apartheid economic policy was the creation of the strong internal competition among firms that was lacking in South Africa before 1994 (Brent 1996). This competition could result in the JSE stock exchange becoming more actively traded compared to before-apartheid period.

Another outcome of the economic changes was increased private investment, and an inflow of foreign capital (Brent 1996). Because of these inflows, South Africa could afford to let the economy expand at a faster rate, foreign reserves increased sharply and foreign exchange controls were further relaxed

(Stephanou et al. 2003:173). Attracting foreign capital, increasing productivity, growth and trade could lead into increased volumes of the stocks traded on the JSE.

The modern history of South Africa encompasses at present as many ethnic groups as possible (Verbeeck 2000). Multiculturalism, as the acknowledgement of cultural diversity in post apartheid era, led to some of the peculiar transactions taking place on the JSE. Black Economic Empowerment (BEE) gathering momentum in the last years can present an example of such transactions.

The political and economic changes in South Africa following the years of apartheid influenced financial markets, and in particular, the JSE Securities Exchange. It can be assumed that the JSE might have absorbed these specific to the country changes, processes and events and as the result of having seasonal patterns, in particular, day-of-the-week patterns which differ from those seen in South Africa before 1994

1.3 Problem statement

The purpose of the research is to provide evidence of whether or not weekly anomalies on the JSE identified over the period from 1978 to 1998 have also occurred from 1995 to 2007.

1.4 Significance of the study

This study develops further the previous studies conducted by Bhana (1985), Gaag (1990), Davidson and Meyer (1993), Roux and Smit (2001) into anomalies within a week on the JSE from 1978 to 1998 in terms of the observed period of time. The studies conducted by Bhana (1985), Gaag (1990), Roux and Smit (2001) demonstrated significant seasonal pattern of the JSE daily returns

and, in particular, negative returns on Monday and highest returns on Wednesday, in 1980s. However, examination of the same seasonal patterns over the periods of 1990s by Davidson and Meyer (1993) and Roux and Smit (2001) proved that such an anomaly no longer existed. This research shows that the day-of-the-week effect may be sensitive to the observation period. However, difference in the period observed might not be the only reason. Market efficiency that increased in the 1990s due to the advent of the Internet may also present a partial explanation to the vanishing of the daily calendar phenomenon on the JSE. The investigation of the JSE daily seasonal pattern over the period from 1995 to 2007 can demonstrate the impact of these factors, and/or the existence of some others, on the JSE daily returns.

The study will provide guidance to the traders and investors on the JSE in terms of market timing based on the day of the week effect. The day-of-the-week patterns might enable investors to take advantage of this effect by designing trading strategies which account for such predictable patterns.

1.5 Delimitations of the study

- The JSE Securities Exchange has been selected for the study.
- The period from 1 January 1995 to 31 December 2007 is examined.
- The JSE daily closing prices make up the time series.
- Weekends and Public Holidays are excluded from the time series.

1.6 Definition of terms

A) Trading-Time Hypothesis

The trading-type hypothesis states that expected return is the linear function of

the trading period. Therefore, the expected return will be the same for each day of the week (Bhana 1985:10).

B) Calendar-Time Hypothesis

The calendar-time hypothesis states that the expected return 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 (Bhana 1985:10).

C) Settlement Effects

Settlement effects refer to the distortions in prices that may result when transactions are settled several business days after the transactions rather than instantaneously (Keim and Stambaugh 1983).

D) Efficient Market Hypothesis

The efficient market hypothesis (EMH) posits that stocks are priced efficiently to reflect all available information about the intrinsic value of the security. An efficient market is one where all unexploited profit opportunities are eliminated by arbitrage (Ajayi et al. 2004:53).

E) Monday Effect

The average stock return on Monday is lower than on any other day of the week (Lakonishok and Levi 1982).

F) ANOVA

ANOVA is a parametric test. It tests for differences in sample means assuming the observations are drawn from normally distributed populations with a common variance (Davidson and Meyer 1993:85).

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Over the last several years there has been a considerable number of studies conducted to investigate the weekly anomalies on the international stock exchanges. Anomalies present the variation of expected returns during the week over a long period of time. Bhana (1985), Gaag (1990), Davidson and Meyer (1993), Roux and Smit (2001) conducted research of the JSE daily returns to determine whether any daily seasonal patterns were present. The observation period was from 1980 to 1998. This report will extend analysis into daily seasonalities on the JSE for the latest period of time from 1995 to 2007.

2.2. Background discussion

2.2.1. General Notes

A considerable amount of research into stock exchange price behaviour has been conducted. The question was how well the patterns of the stock exchange past price behaviour can be applied to enable forecasting of future behaviour.

One of the issues brought up in 1960s was the impact that specific day of the week may have over the price behaviour of stock exchange (Fama 1965).

Fama (1965) examined variances of daily returns for eleven shares on the New York Stock Exchange (NYSE) and found that variance of daily returns on Monday is 20% greater than daily returns on other days of the week. However, he did not examine the daily mean returns.

Merrill (1965) found that between 1952 and 1965 the Dow Jones Industrial

Average advanced on 64.6% of all Fridays, but on only 43.0% of all Mondays. The chances of a rise on Tuesday, Wednesday, and Thursday were, respectively, 54.0%, 56.3%, and 56.5%.

Cross (1973) found that between 1953 and 1970 the Standard & Poor's Composite Stock Index (S&P Composite) rose 62.0% of all Fridays, whereas it rose only 39.5% of all Mondays. The mean percentage change of daily return was 0.12% on Friday against -0.18% on Monday. He found that the difference between price changes on Fridays and Mondays was consistent from year to year and that the S&P Composite performed better on Fridays than on Mondays in terms of mean percentage change of the index (Cross 1973).

French (1980) proposed and examined calendar-time and trading-time hypotheses. He observed the daily returns of the Standard and Poor's composite portfolio from 1953 to 1977. He found that those returns were inconsistent with both the calendar-time and trading-time models. As the result both of the hypotheses were rejected. He also found that the mean return for Monday was significantly negative in each of sub-periods within 1953-1977, as well as over the full period. He suggested that the negative Monday returns could exist because of market efficiency. The listed companies release negative information over the weekends to give investors time to digest the bad news, and prevent them from panic selling. As the result, Monday returns reflect negative investor sentiments to a higher degree than at any other day of the week.

Gibbons and Hess (1981) also documented the existence of day of the week effects in stock exchange returns with the strong and persistent negative mean returns on Monday. In addition to the analysis of the Dow Jones Industrial Index, they also found negative Monday returns for the 30 individual stocks of the Dow Jones Industrial Index in contrast to many researches on the day-of-the-week effect that examined the phenomenon with either large stocks (e.g., the individual Dow Jones 30) or with indices of primarily large stocks (e.g., Dow Jones 30 or Standard & Poor's 500 (S&P 500)). The hypothesis of equal expected returns across days of the week was rejected. They also found lower

average Monday returns in the Treasury bills (T-bills) security market. They concluded that institutional characteristics of share trading are unlikely to present an explanation for the day-of-the-week anomaly. Gibbons and Hess (1981) also examined equal-and value-weighted indices of all New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) stocks. Their findings suggested that the magnitude of the weekend effect varied cross-sectionally with firm size. Although the average Friday returns were larger for the equal-weighted index (which is more influenced by small firms) than the value-weighted index (which is dominated by large firms), the mean Monday returns remained the same for both indices.

A further investigation of the weekend effect in stock returns were undertaken by Keim and Stambaugh (1983). They considered Standard and Poor's Composite Index. But, in contrast to Cross (1973) and French (1980) who examined Standard and Poor's Composite Index from 1953, they doubled the length of the observed period. The examined time period was extended to 55 years from 1928 until 1983. Also, they examined additional stocks, such as those of small (low-capitalization) firms and those traded over the counter. In all cases, a weekend effect was at least as strong as that which was manifested in previous studies by Cross (1973), French (1980) and Gibbons and Hess (1981). The results for the 1928-1952 period were similar to those reported by French (1980) for the 1953-1977 period. An average Monday return was even more negative for the period 1928-1953 than for the later period of 1953-1982 (Table 1). They also split the 55 year period from 1928 to 1983 into eleven five-year sub-periods. The average Monday returns were negative in each of these eleven five-year sub-periods. The hypothesis of equal means across days of the week was rejected at any reasonable significance level in the overall period and in the two large sub-periods. Equality was rejected at a five-percent significance level in nine of the eleven five-year sub-periods.

Table 1: Percent Returns on the S&P Composite Index by Day of the Week (Keim and Stambaugh 1983)

Percent Returns on the S & P Composite Index by Day of the Week[a]

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	All Days[b]
1928–1982							
Mean	−.1859	.0484	.0941	.0496	.0635	.1474	.0207
Std. Dev.	1.215	1.094	1.176	1.093	1.134	1.010	1.162
t Statistic	−7.81	2.26	4.16	2.35	2.88	4.72	2.17
Observations	2610	2603	2707	2692	2649	1046	14,863
F (p-value)[c]							26.1 (.0001)
1928–1952							
Mean	−.2230	.0756	.0836	.0659	.0287	.1474	.0161
Std. Dev.	1.511	1.395	1.526	1.432	1.507	1.010	1.459
t Statistic	−5.13	1.85	1.91	1.61	0.66	4.72	0.95
Observations	1207	1171	1219	1218	1195	1046	7326
F (p-value)[c]							9.88 (.0001)
1953–1982							
Mean	−.1539	.0261	.1028	.0361	.0920		.0251
Std. Dev.	0.883	0.763	0.780	0.697	0.688		0.771
t Statistic	−6.53	1.30	5.08	1.99	5.10		2.82
Observations	1403	1432	1488	1474	1454	0	7537
F (p-value)[c]							25.9 (.0001)

[a] Returns computed as $r_t = (v_t/v_{t-1} - 1) \cdot 100$, where v_t is the value of the S & P Composite index on day t.

[b] Number of observations may exceed the total of the individual weekdays. The results for individual weekdays exclude any multiple-day returns (or returns over more than three days for Monday).

[c] For subperiods before 1953, the F statistic tests equality of means across all six days from Monday through Saturday. For the overall period and the subperiods after 1953, equality is tested across the five weekdays. The degrees of freedom are $K - 1$ and $T - K$, where K is the number of weekdays (five or six) and T is the number of observations.

The Keim and Stambough (1984) study also reported that day-of-the-week effect depends on the firm size with low Monday and high Friday returns being more evident for small-sized securities.

Ariel (1987) found that positive average returns occur only around the beginning and during the first half of calendar months, and negative average returns during the second half. The result was based on the examination of the daily returns of a value-weighted index over the period 1963 to 1981. The idea of the interrelationship of the day-of-the-week and week-of-the-month patterns was raised. Ariel (1987) also found that the last trading day of the month and the third trading day of the following month had the highest returns of all trading days. This finding was confirmed later by Pettengill and Jordan (1988) who

found consistently higher average returns on the last and first trading days of each month, often accounting for more than fifty percent of total monthly returns.

Rogalski (1984) discovered that the Monday's negative returns actually occur during the non-trading period from the Friday's close of the market until the Monday's open, rather than during the trading period on Monday. Hence, he proposed to use the term "weekend effect" instead of "Monday effect". He also confirmed strong interrelationships between the firm size and day-of-the-week patterns presented by Gibbons and Hess (1981) and Keim and Stambourgh (1983). One of the possible explanations of the weekend effect could be a release of negative information by the firms over the weekend that, in its turn, brought Monday opening prices to the lower level. This concurred with the potential explanation of the daily seasonal patterns proposed by French (1980).

Dyl and Maberly (1988) conjectured that something happens after the close of the market on Friday. They suggested that the release of adverse information may cause mean returns over weekends to be negative. They provided some evidence regarding this possible explanation of the weekend effect. The distribution of large changes in the price of the S&P 500 futures index over days of the week was examined to test whether there was any systematic pattern in the distribution of "good news" versus "bad news." It was found that in more instances the arrival of important information occurred over the weekend than during overnight non-trading periods during the week. They explained this by the fact that over the weekend the market is closed for a longer period, and as the result, more information becomes available (Dyl and Maberly 1988). The evidence that the weekend market closure was predominantly characterized by unfavourable news was also given. "There is an unusually high incidence of information in general, and of unfavourable information in particular, arriving on weekends." (Dyl and Maberly 1988:84) They suggested that this phenomenon may present a partial explanation of the negative returns on Monday.

There have been studies examining holiday returns in stock markets.

Ariel (1990) found that pre-holiday return equals nine to fourteen times the

return accruing on non-pre-holidays based on the analysis of equally- and value-weighted indexes. The fact that pre-holiday returns were higher than those ones of other days coincided with the findings made by Merrill (1966) on Dow Jones Industrial Average and Fosback (1976) on S&P 500 index returns.

Kim and Park (1994) also confirmed the existence of the holiday effect in three USA stock markets, i.e. the NYSE, AMEX and NASDAQ (National Association of Securities Dealers Automated Quotation System) and in the United Kingdom (UK) and Japanese stock markets. The existence of the holiday seasonalities in the international markets suggested that institutional factors such as trading methods, settlement procedures, and clearing mechanisms cannot be possible explanations to the seasonal anomalies of daily returns.

Mehdian and Perry (2001) re-examined the Monday effect in the US stock market, using daily returns from three large-cap and two small-cap indices over the period from 1964 to 1998. They split this period into two sub-periods, 1964 – 1987 and 1988 – 1998. The empirical analysis of the first sub-period (1964 – 1987) supported previous findings that the average return on Mondays is significantly negative in the US stock markets. However, the analysis of Monday returns in the second sub-period (1987-1998) showed that Monday returns are significantly positive for the large-cap indices and are negative and insignificant for the small-cap indices. These results indicated a significant reversal of the Monday effect from negative to positive in large-cap stocks over time.

Brusa et al. (2005) investigated Monday returns for four major US stock markets: the Dow Jones Industrial Average (DJIA), the Standard and Poor's 500 (S&P 500), the CRSP (Center for Research in Security Prices) value-weighted, and the NASDAQ stock indexes over a period of eleven years from 1988 to 1998. They presented evidence of a 'reverse' weekend effect where Monday returns were significantly positive and higher than the returns on any other day of the week. They also found that the degree of the 'reverse' weekend effect was directly related to firm size. Small firms showed 'diminishing' weekend effect, while large firms had strong 'reverse' weekend effect. These findings strongly supported those of Brusa et al. (2005).

2.2.2. Futures and Other Types of Securities

Atempts have been made to examine whether the seasonality patterns discovered for common stock will be the same for the other types of security markets. This chapter will represent the findings made on the day-of-the-week effect across the different types of securities such as futures, Treasury bills (T-bills), Treasury bonds (T-bonds), and others.

On April 21, 1982 the futures contracts written on the S&P 500 began trading. Cornell (1985) examined whether the pattern of weekend effect of stock market carries over to the futures market. Using data for the S&P 500 over the period 1982 – 1984, he found evidence of the Monday effect in the stock market. However, there was no evidence of the Monday effect in the futures market. In fact, the mean return in the futures market was even higher on Monday than on any other day of the week.

Flannery and Protopadakis (1988) examined whether intra-week seasonality was uniform across different types of securities. They felt this could shed light on the sources of day-of-the-week anomaly, since uniform seasonality across different type of securities could be explained by fluctuation in economic factors. On the other hand, the difference in the seasonal patterns for different types of securities could mean that the cause of the day-of-the-week effect lies not in economic factors, but rather in clearing procedures or other institutional characteristics (Flannery and Protopadakis 1988). Intra-week seasonality has been tested on daily return data over the period of 8 years from 1976 till 1984 on eleven securities:

- Three stock indices such as equally weighted (EW) and value weighted (VW) returns and the Standard and Poor 500 (S&P500);
- Overnight repurchase agreements;
- Seven maturities of Treasury securities such as Treasury bills with approximately one-, three-, six-, and twelve-month maturities, and

Treasury bonds maturing in approximately three, seven, and thirty years.

Firstly, it was found that substantial intra-week seasonality did exist in all the examined assets. However, the seasonality patterns differed between the Treasuries and the Stocks. Stock returns were higher on Wednesday and Friday, whilst Treasuries had the highest return on Thursday. “It indicates that intra-week return seasonality is unlikely to derive exclusively from broad economic forces that affect all asset markets similarly.” (Flannery and Protopadakis 1988:447)

Even within similar securities, seasonal pattern differed significantly. Since the similar securities exhibited significantly different seasonal patterns Flannery and Protopadakis (1988) suggested that market-specific, institutional features could not explain all seasonality. The hypothesis that the day-of-the-week pattern is the same across all securities for each day of the week was rejected. Although Monday’s returns varied across assets, it was discovered that the Monday’s returns for a Stock were negative, while for the Treasuries they were the lowest becoming more negative as the security’s maturity developed (Flannery and Protopadakis 1988).

Johnston et al. (1991) conducted another comprehensive study of day-of-the week anomalies in the security markets of different kind. Government National Mortgage Association (GNMA) contracts, Treasury bond (T-bond), Treasury note (T-note), and Treasury bill (T-bill) futures were analysed. Significant seasonal patterns were found in returns on GNMA, T-bond, and T-note futures returns with no significant patterns in T-bill futures returns. Monday negative returns appeared in GNMA and T-bond futures returns (Table 2). Monday returns were statistically nonzero at the 0.01 level of significance for the GNMA contract and at the 0.05 level for the T-bond contract. Expected returns on GNMA, T-bond, and T-note contracts were positive on Tuesday. T-bill futures did not present the evidence of the significant seasonal patterns with returns being not significantly different from zero at the 0.05 level. These findings confirmed the findings made by Flannery and Protopadakis (1988) that intra-week seasonality is not uniform across different types of securities.

Table 2: Statistical Summary of Daily Returns (%) by Type of Futures Contracts for the entire Sample Period Classified by Day of the Week (Johnston et al. 1991)

Statistical Summary of Daily Returns (%) by Type of Futures Contract for the Entire Sample Period Classified by Day of the Week[a,b,c]

	Mon.	Tues.	Wed.	Thurs.	Fri.	F_5
Panel A. Returns (%) Computed from Closing Price to Closing Price						
GNMA Futures Contract						
Mean Return	−0.113	0.046	−0.022	0.031	0.039	4.133*
t-Statistic	−2.71*	1.52	−0.84	1.03	1.15	
Sample Size	450	462	488	478	441	
T-Bond Futures Contract						
Mean Return	−0.114	0.081	−0.052	−0.001	0.046	4.035*
t-Statistic	−2.47**	2.21**	−1.61	−0.03	1.11	
Sample Size	512	526	554	541	502	
T-Note Futures Contract						
Mean Return	0.004	0.119	−0.016	0.020	0.015	2.695**
t-Statistic	0.11	3.86*	−0.56	0.69	0.40	
Sample Size	302	312	327	318	296	
T-Bill Futures Contract						
Mean Return	0.004	−0.020	−0.010	−0.004	0.026	0.404
t-Statistic	0.12	−0.76	−0.44	−0.16	0.89	
Sample Size	589	610	642	625	580	

a t-statistic tests the null hypothesis that the mean return equals zero using a two-tailed test; *, and **, indicates significance at the 0.01 and 0 05 levels, respectively.
b F5 is the F-statistic testing the null hypothesis that mean returns are equal across all five days of the week; * and **, indicate significance at the 0.01 and 0.05levels, respectively.
c Sample size indicates the number of daily returns included in the computation of each mean by day of the week

The Monday effect observed on GNMA and T-bond contracts was similar to the Monday effect observed previously by Dyl and Maberly (1986) in the market for stock index futures but contrary to the Cornell (1985) findings on the future's market. This contradiction comes from the fact that weekly seasonality depends

on the time period studied (Johnston et al. 1991).

It was also found that observed seasonal effects became more evident in the months prior to a delivery month that coincided with the findings made by Cornell (1985).

The existence of the day-of-the-week anomalies in the stock futures market was also confirmed by the Khaksari and Bubnys (1992) study of the S&P 500 and NYSE over the period 1982 -1988. Attempts were made to investigate the interrelationship between the spot markets and futures markets. It was found that stock index futures have even more evident day-of-the-week anomalies than their underlying spot prices. Using both mean rate of return and risk adjusted rate of return it was found that the day-of-the-week effect is reduced in spot and futures index returns when risk adjustment is made (Khaksari and Bubnys 1992). The risk rate of common stocks could be a partial explanation of day-of-the-week anomalies.

There have been attempts to investigate if there is day-of-the-week effect in foreign exchange markets.

One of the most recent studies on the issue was conducted by Ke et al. (2007). The exchange rates of eight currencies: Australian dollar, Canadian dollar, Euro, Hong Kong dollar, Japanese yen, Swiss franc, United Kingdom pound and the US dollar were examined against New Taiwan dollar over the 1992-2006 period. For the 1992-1997 period higher returns fell on the first three days of the week for all currencies. Higher returns for the first three days of the week for all currencies except the Euro and the United Kingdom pound were also documented for the 2001-2006 period. The only study of the 1998-2000 period presented no clear evidence of the day-of-the-week pattern (Ke et al. 2007). These findings provided evidence of the day-of-the-week effect on the Taiwan foreign exchange market with higher returns appearing in the first three days of the week (Monday through Wednesday).

However, it contradicted the results of the study conducted by Yamori and Kurihara (2004). The day-of-the-week effect for currency spot rates at the New

York foreign exchange market was documented in the 1980s, but there was no evidence of the same effect in 1990s. It was found that day-of-the-week effect disappeared for almost all currencies (Yamori and Kurihara 2004).

Nippani and Pennathur (2004) investigated day-of-the-week effects in the changes in daily yields of the US commercial paper (short-term debt instrument issued by reputable corporations to minimize short-term financing costs) market for three- and six-month maturities for the period from 1981to 2000. They presented evidence of a statistically significant negative return on Wednesdays for both the three- and six-month maturities during most of the sample period. Once again, it demonstrated that the day-of-the-week effect was not uniform across equity and non-equity markets as found in prior studies by Flannery and Protopadakis (1988) and Johnston et al. (1991).

2.2.3. Foreign Stock Markets

Considerable attention has been paid to the day-of-the-week anomaly on the stock exchanges around the world.

Jaffee and Westerfield (1985) documented weekend anomalies in foreign stock returns. In their study of four countries they found that the lowest returns occur on Tuesdays in Australia and Japan. They examined whether this finding was due to a time zone difference between the USA and both of these countries. They found partial support for this explanation in Australia, but not in Japan.

Barone (1990) examined calendar anomalies on the Milan Stock Exchange over the period 1975 to 1989. He found that, in contrast to the United States, where lowest average daily returns fall on Monday, in Italy, Japan and Australia low average returns fall on the first two days of the week with Tuesday, in particular, having the lowest one. The difference in the times zones may suggest that the calendar effect may be imported from U.S. (Barone 1990).

Even more controversial findings came from Steeley (2001). He examined the London Stock Exchange daily returns over the period 1991 to 1998. In contrast

to his predecessors he linked daily returns to the directions of the market and to the announcements made during the weekend and during the week. He found evidence of the Monday effect in returns partitioned by market direction. However, this effect was not significant when the announcement variables were used to explain returns (Steeley 2001). He found that the UK weekend effect more often appeared in larger rather than smaller capitalised firms. It contradicted the findings of Sullivan and Liano (2003) based on the analysis of daily returns of New-York Stock Exchange that the Monday effect disappeared in the value-weighted composite index (Sullivan and Liano 2003).

Steeley (2001) stated that the UK weekend effect was not persistent and appeared stronger during market downswings. The same conclusion was made by Sullivan and Liano (2003). “The periods when the Monday seasonal in stock returns was the most pronounced were also the periods with the largest difference in the percent of declining issues for Mondays compared with other weekdays.” (Sullivan and Liano 2003:65).

The stock index of the Tokyo Stock Exchange over the period 1978 – 1987 was examined by Kato (1990) into the day-of-the-week effect. The hypothesis of equal expected returns for each day of the week was rejected for this period. However, it was found that expected returns were negative and lowest on Tuesday (Table 3) in contrast to many findings which witnessed the negative expected return on Monday.

Table 3: Tokyo Stock Exchange Index (TOPIX) April 4, 1978 – June 18, 1987 (Kato 1990)

Tokyo Stock Exchange Index (TOPIX) April 4, 1978–June 18, 1987

Period	Statistic	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1978–1987	Mean	0.0039	−0.0902	0.1449	0.0648	0.1049	0.1397
	t-value	(0.13)	(−3.08)	(4.95)	(2.22)	(3.60)	(4.11)
	Standard Deviation	0.64	0.65	0.62	0.69	0.66	0.46
	Skewness	−1.66	−0.08	−0.59	0.37	0.66	0.07
	Kurtosis	8.78	9.37	3.71	5.15	5.45	3.74
	Observations	449	464	464	465	467	343

It was conjectured that the negative return on Tuesday might be caused by the negative Monday's return in the USA. Since Tokyo is 14 hours ahead of New York, the Japanese weekly pattern may be analogous to the American pattern led by one day (Kato 1990). Correlation coefficients were analysed between the Dow Jones Index in the New York Stock Exchange and the Nikkei Stock Average in the Tokyo Stock Exchange during the period 1980 - 1987. The hypothesis of correlation between Monday's low return in USA and Tuesday's low returns in Japan was not rejected. Kato (1990) concludes that the Japanese Tuesday effect could be a reflection of the Monday's effect in the USA.

Agrawal and Tandon (1994) examined the weekend effect in eighteen countries for the period 1971 to 1987. Large positive returns on Fridays and Wednesdays were found in most countries. Seasonal patterns of low or negative returns over the early part of the week (Monday and Tuesday) and high and positive returns over the latter part of the week (Wednesday through Friday) characterized almost all examined countries.

As to the Monday effect in particular, the mean Monday returns were negative in thirteen countries, of which seven were statistically significant. Tuesday returns were negative in twelve countries and significant in as many as eight (Table 4). The term "Tuesday effect" was proposed.

There were five countries in the sample which have a time difference of twelve hours or more with the USA. The time zone hypothesis predicts Tuesday returns to be negative in these countries (Agrawal and Tandon 1994). The Tuesday mean returns appeared to be negative in three of these countries (Australia, Hong Kong and Japan), and insignificant in two others (New Zealand and Singapore).

Table 4: Mean percentage rates of return on common stock indices by day-of-the-week (Agrawal and Tandon 1994)

Mean percentage rates of return on common stock indices by day-of-the-week.[a] The *F*-test is for the equality of the mean returns across all days of the week.

	Monday	Tuesday	Wednesday	Thursday	Friday	Average	*p*-value for *F*-test
Australia	−0.056*	−0.098***	0.06*	0.153***	0.137***	0.041***	<0.001
Belgium	0.052**	−0.072***	0.032	0.069***	0.09***	0.033***	<0.001
Brazil	−0.189**	0.083	0.625***	0.427***	0.615***	0.312***	0.026
Canada	−0.134***	0.026	0.109***	0.106***	0.131***	0.051***	<0.001
Denmark	−0.062**	−0.023	0.081***	0.055*	0.062**	0.023*	0.001
France	0.044	−0.116***	0.128***	0.094**	0.087**	0.048***	<0.001
Germany	−0.078*	−0.017	0.086**	0.091**	0.101**	0.037**	0.002
Hong Kong	−0.088	−0.157**	0.173**	0.092	0.176**	0.041	0.006
Italy	−0.044	0.102**	0.113	0.135***	0.178***	0.056**	<0.001
Japan[b]	−0.005	−0.084***	0.164***	0.046	0.078***	0.053***	<0.001
Luxembourg	0.001	0.218***	−0.054	0.042	0.014	0.046*	0.005
Mexico	−0.028	0.008	0.319***	0.41***	0.578***	0.255***	<0.001
Netherlands	0.006	−0.072**	0.006	0.024	0.146***	0.019	0.002
New Zealand	0.089***	−0.005	0.022	0.022	0.085***	0.042***	<0.001
Singapore	−0.047	−0.023	0.085**	0.063	0.133***	0.043**	0.044
Sweden	−0.037	−0.096**	0.009	0.073*	0.174***	0.02	<0.001
Switzerland	−0.082***	−0.066***	0.061***	0.057**	0.107***	0.016	<0.001
UK	−0.165***	0.138***	0.073**	0.018	0.11***	0.037**	<0.001
USA[c]	−0.126***	0.017	0.107***	0.028	0.082***	0.023**	<0.001

[a]The time period (where different from 1/1/71–6/30/87) and index for each country are as follows: Australia: All Ordinaries; Belgium: Belgium SE; Brazil: Rio de Janeiro SE, 1/1/72–12/31/88; Canada: Toronto SE, 1/1/76–12/31/87; Denmark: Copenhagen SE, 1/17/73–6/26/87; France: CAC General; Germany: FAZ Atkien, 1/1/71–6/26/74 and 1/1/80–6/29/87; Hong Kong: Hang Seng Bank, 2/16/73–6/30/87; Italy: Banca Comm. Ital.; Japan: Nikkei Dow, 1/1/70–6/30/87; Luxembourg: Luxembourg Shares Index, 1/1/77–12/31/84; Mexico: Bolsa Mexicana de Valores, 1/1/77–12/31/88; Netherlands: ANP-CBS Industrial 1/1/71–12/2/79 and 4/5/83–6/29/87; New Zealand: Barclays Bank Indl., 1/1/66–12/31/88; Singapore: Straits Times, 6/20/73–6/30/87; Sweden: Jacobson & P, 1/1/71–12/31/79; Switzerland: Swiss Bkg. Corp. Index, 1/1/63–11/23/88; UK: Fin. Times Ordinary, 1/1/63–6/30/87.

[b]Saturday's value for Japan, when the market was open, is 0.147***.

[c]Figures for the USA are for the S & P 500 over 7/1/62–12/31/83 from Jaffe and Westerfield (1985).

***, **, and * denote statistical significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively, in two-tailed tests, based on the *t*-statistic for the difference of the mean return from zero.

These findings supported the time-zone hypothesis made by Jaffe and Westerfield (1985) and Kato (1990).

However, time zone hypothesis could not explain the findings of negative Tuesday returns in five European countries (Belgium, France, Netherlands, Sweden and Switzerland), where the time difference from New York is only six to seven hours. Hence, the time zone hypothesis can only partially explain Monday and Tuesday effects.

Chen and Qian (2002) showed that the day-of-the-week effect on the Chinese stock exchanged vanished after December 16, 1996, when price limitation regulation was put into effect by the Chinese Securities Regulatory Commission. The regulation stipulated that the fluctuation of common stock prices could not exceed 10 percent in a single trading day and it was considered to have a strong effect on stock returns.

However, re-examination of the daily stock returns on the Chinese stock exchange over the later period by Cai et al. (2006) contrasted to the findings of Chen and Qian (2002). Strong evidence was given to the day-of-the-week effect with significantly negative average returns on Tuesday. They also found that day-of-the-week effect was more evident during some specific weeks of a month with Monday returns from A-share (traded among individual Chinese citizens in China's two exchanges) indices being significantly negative during the third and fourth weeks of the month and Tuesday returns on most of the A-share and B-share (traded among individual and institutional investors of foreign countries and people from Hong Kong, Macao, and Taiwan) indices being negative during the second week of the month. The interaction of the Monday and Tuesday returns with the specific week of the month confirmed week-of-the-month effect reported by Ariel (1987), but this made it more difficult to find adequate explanations of anomalous behaviours of expected returns on Monday and Tuesday.

Ajayi et al. (2004) conducted an investigation of the day-of-the-week anomaly

using major market stock indices in eleven Eastern European emerging markets (EEEM) during the period from the mid-1990s through to 2002. The empirical results showed negative Monday stock returns in six of the EEEMs, namely Czech Republic, Estonia, Latvia, Lithuania, Romania, and Slovakia. However, these negative returns were significant in only two of the markets, in Estonia and Lithuania. Positive Monday returns were documented in the remaining five markets but were significantly positive in only one of the countries (Russia).

Yakob et al. (2005) studied the day-of-the-week, month-of-the-year, monthly and holiday effects in ten Asia Pacific countries over the period January 2000 to the March 2005. The day-of-the-week effect, in particular, was documented in five countries, namely India Indonesia, Taiwan, Australia and China. However, patterns of daily seasonality differed from one country to another. No evidence was found to suggest the existence of the day-of-the-week effect in Hong Kong, Japan, Malaysia, Singapore, and South Korea.

Mlambo and Biekpe (2006) examined stock market seasonal effects on seventeen indices from nine African stock markets. The periods of observation ranged from four to six years for different African stock markets from 1997 through to 2002. The significant day of the week effect was documented only on two of Botswana's indices, the Foreign Companies Index (FCI) and the All Companies Index (ACI), and on Morocco's stock exchange. Once again the evidence was provided that popular day-of-the-week effect vanished from the international, and in particular, African continent, stock markets.

2.2.4. JSE Securities Exchange

Bhana (1985) tested both trading-time and calendar hypotheses on the daily returns of the JSE Securities Exchange. The period of observation was six years from 1978 to 1983. Both hypotheses were rejected. The mean return for Monday was negative with the highest mean return for Wednesday. A similar pattern of daily returns was also found for returns of Treasury Bills. He suggested that the weekend effect existed across other types of financial

assets. The obtained results were accounted to the market inefficiency.

The negative return on Monday on the JSE Securities Exchange was also confirmed by Gaag (1990) who examined daily returns from 1981 to 1989. And again Wednesday had the highest mean return over the full period.

Davidson and Meyer (1993) investigated daily seasonalities of shares on the JSE for the period from 1986 to 1991. Their findings coincided with that of Bhana (1985) and Gaag (1990) when dividends were excluded. Mondays did have negative mean returns and Wednesdays the highest one. However, Monday effect vanished when adjustment for dividends was made. Monday expected return was neither negative nor the lowest for the week. They concluded that the difference in methodologies could create the bias towards analysis of a day-of-the-week effect.

Watson and Smit (1994) examined three of JSE futures contracts, namely the All Share Near Future, All Gold Near Future and the All Industrial Near Future. They gave evidence of seasonal similarities between the futures and their spot markets. The day-of-the-week pattern was present for each of the futures contracts and for their underlying spot markets. These findings concurred with that of Khaksari and Bubnys (1992) but contradicted to that of Cornell (1985) and Johnston, Kracaw and McConnel (1991).

Roux and Smit (2001) provided evidence of the day-of-the-week seasonal pattern on the JSE over the period 1978 through to 1989. The JSE All Share Index, JSE All Gold Index and JSE Industrial Index had the lowest and negative average return on Mondays. The JSE All Share Index and JSE All Gold Index had the highest return on Wednesdays and JSE Industrial Index on Tuesdays. In the period 1990 – 1998 the JSE All Share Index and JSE Industrial Index had the lowest but non-negative returns on Mondays. The JSE Financial Index had the lowest and negative returns on Mondays. The JSE All Gold Index had the lowest returns on Tuesdays. The highest return for the JSE All Share Index, JSE Financial Index and JSE Industrial Index was documented on Wednesdays and for JSE All Gold Index on Thursdays. However, formal statistical analysis showed that the null hypothesis of equal means across different days of the

week could be rejected (5% significance level) for all indices for the period 1978 through 1989 and could not be rejected (5% significance level) for the period 1990 through 1998 for all indices but JSE Financial Index. The study showed that day-of-the-week pattern which existed on the JSE in 1980s started to disappear in 1990s.

2.2.5. Possible Explanations for the "Monday effect"

Although many studies conducted gave evidence to the negative Monday return, or "weekend effect," it had yet to be explained. The potential explanations of the weekend effect will be discussed in this section.

Settlement Hypothesis

Lakonishok and Levi (1982) made an attempt to explain the intraweek pattern of daily stock market returns observed by Cross(1973), French (1980), Gibbons and Hess (1981), and others. They conjectured that the weekend effect-abnormally high returns to common stocks on Fridays and negative returns to common stocks on Mondays could be explained by settlement procedures and cheque clearing delays.

Lakonishok and Levi (1982) established that it takes one business day to clear the cheques via the United States Federal Reserve System 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 cheque is deposited in a bank, the funds which are credited (clearing house funds) cannot be used for settlement until the next business day (Lakonishok and Levi 1982). They said that the clearing delay meant that in weeks without a holiday, stocks purchased on business days other than Friday gave 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 cheque clearing day (Lakonishok and Levi 1982). However, they continued, payment for stock purchased on a Friday would not occur until the second Monday, ten calendar days after the trade.

These ten days are the five business days for settlement, the two weekends, and the cheque clearing day. “Buyers should therefore be prepared to pay more on a Friday than on other days by the amount of two days interest whilst 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.” (Lakonishok and Levi 1982:884). Hence, the average returns on Fridays should be higher than on other days, they conclude. Similarly, the average returns on Mondays should be lower by two days of interest than the return expected from either a trading time or calendar time view (Lakonishok and Levi 1982).

The empirical evidence presented by Dyl and Martin (1985) proved that settlement procedures were not related to the intraweek pattern of daily stock market returns. Since the anomalous daily returns existed before 1968 they assumed that if settlement/clearing procedures did affect daily returns, then a change in the return pattern in 1968 should be expected. Moreover, if settlement/clearing procedures influenced the pattern of daily returns, then the weekend effect should be more pronounced in the post-1968 period than in the pre-1968 period. To test for this effect, they divided the 25-year period from 1957 through 1981 into pre-1968 and post-1968 sub-periods and examined the intraweek pattern of daily returns for each sub-period. Table 5 shows that there is no significant difference between the two sub-periods, which supported the hypothesis, that settlement procedure did not affect the weekly pattern of returns. They concluded that the weekend effect remains an anomaly. Settlement Hypothesis was rejected.

Table 5: Daily Returns for 1957-67 and 1968-81 (Dyl and Martin 1985)

Daily Returns for 1957–67 and 1968–81

Period	Monday	Tuesday	Wednesday	Thursday	Friday
1957–67	−0.185	0.024	0.106	0.023	0.091
($N = 473$)	(0.701)[a]	(0.619)	(0.657)	(0.588)	(0.547)
1968–81	−0.132	−0.003	0.069	0.007	0.061
($N = 547$)	(0.962)	(0.836)	(0.890)	(0.803)	(0.814)
t-statistic[b]	−0.9912	0.5785	0.7454	0.3582	0.6797

[a] Standard deviation.

[b] Two-tailed t-test of the difference between the 1957–67 mean and the 1968–81 mean. None of the t-statistics are significant at the 0.20 level.

Measurement Errors Hypothesis

Gibbons and Hess (1981) suggested that if Monday’s negative returns were explained by upwardly biased prices on Friday, then the deviation of Monday's returns from the overall mean should be exactly offset by Friday's.

If the low Monday returns were due to positive high returns on Friday i.e. higher-than-average returns on Friday were caused by lower-than-average returns on Monday then the correlation between Friday's return and Monday's return should be lower than between returns on other successive days (Keim and Stambaugh 1983).

Using returns of the 30 individual stocks in the Dow Jones Industrial Index, Keim and Stambaugh (1983) conducted tests based on offsetting Friday and Monday mean returns. They expected to have a lower correlation between Friday's returns and Monday's returns than between returns on other successive days. However, the correlations between Friday’s returns and Monday’s returns were the highest. These results were inconsistent with the measurement-error explanation.
Hypothesis of measurement error was rejected.

Specialist-Related Hypothesis

Returns for common stocks listed on the New York or American Stock Exchanges were often computed from "closing" prices, where the closing price is the price at which the day's last transaction occurs (Keim and Stambaugh 1983). Often, this transaction involved the specialist (Keim and Stambaugh 1983).). “The bid price at which the specialist fills a limit buy order (or buys for himself) is usually less than the ask price at which the specialist fills a limit sell order (or sells for himself) (Keim and Stambaugh 1983:831). Thus, they said, closing prices (or transaction prices recorded at any point in time) often represented a bid or an ask rather than the "true” price at which market orders

would "cross" in a trade not involving the specialist. “Transactions at bids and asks no doubt occurred with equal frequency overall, but there could be systematic differences in their relative frequencies during the week.” (Keim and Stambaugh 1983:831) They suggested that relatively small variations in the bid vs. ask frequency during the week could contribute to day-of-the-week effects in computed returns.

Using closing bid and ask quotations for actively traded NASDAQ stocks, Keim and Stambaugh (1983) computed returns going bid to bid and ask to ask. It showed that day-of-the-week effect was not due to the bid-ask bias. Specialist-related hypothesis was rejected.

All of the hypotheses, such as settlement effects, measurement errors and specialist-related biases have been rejected.

Some attempts were made to link earnings information seasonality to stock market seasonalities. According to the findings made by Peters (1990) companies earnings information seasonality was not likely to cause the stock index seasonalities and in particular day-of-the-week effect.

There were also a number of other hypotheses presented such as institutional factors, the trading behaviour of individual and institutional investors, the release of bad news over the weekend and interrelationships of the various seasonal anomalies. Some of these theories presented partial explanations for the seasonal anomalies on stock exchanges and other financial markets. However, there was still no unanimous opinion on the plausible reasons causing these anomalies.

2.2.6. Application of the day-of-the-week effect

Sun-Woong (1988) investigated potential profits from the application of the day-of-the week rule and supported an idea that there were opportunities to profit from timing on trading. He considered the stock exchange indexes of six countries: USA, UK, Canada, Korea, Japan and Australia over the period of five

years from 1980 until 1984. The results presented in Table 6 show that day-of-the-week trading strategies outperformed buy-and-hold strategy for most cases except 1983. He concluded that investors could actually profit from the day-of-the-week rule in all six stock markets.

Table 6: Annual Returns for Six Countries, 1980-1984 (Sun-Woong 1988)

Annual Percent Returns for Six Countries, 1980-1984

Year		U.S.	U.K.	Canada	Korea	Japan	Australia
1980	CR[a]	34.72	16.72	34.73	17.86	10.64	32.01
	BH[b]	27.49	11.10	23.79	0.79	7.85	30.05
	N[c]	46	45	42	47	37	45
	ER[d]	7.23	5.62	10.94	17.07	2.79	1.96
	ER[T][e]	−19.84	−17.37	−13.99	−7.14	−15.38	−24.02
1981	CR	−0.98	16.13	6.77	41.80	16.23	−8.49
	BH	−9.12	10.23	−15.58	38.06	14.45	−18.13
	N	45	45	44	43	36	49
	ER	9.11	5.90	22.35	3.74	1.78	9.64
	ER[T]	−11.38	−16.97	1.66*	−23.03	−16.82	−9.86
1982	CR	18.14	14.71	10.43	15.52	4.15	−6.09
	BH	13.81	12.89	1.46	3.22	2.83	−19.36
	N	46	46	46	46	38	50
	ER	4.33	1.82	8.97	12.30	1.32	13.27
	ER[T]	−19.40	−21.21	−13.24	−10.95	−16.21	−7.12
1983	CR	15.05	21.91	23.33	3.93	15.63	30.39
	BH	18.02	26.28	20.18	1.31	22.69	56.31
	N	46	45	44	48	38	49
	ER	−2.97	−4.37	3.15	2.62	−7.06	−25.92
	ER[T]	−26.05	−28.33	−20.63	−19.07	−26.48	−53.50
1984	CR	1.62	24.21	7.92	28.10	21.47	28.13
	BH	−1.73	18.15	−7.66	23.32	17.53	−8.05
	N	47	46	39	45	34	50
	ER	3.35	6.06	15.58	4.78	3.94	36.18
	ER[T]	−17.47	−18.90	−3.10	−20.44	−14.48	8.27*

Notes:

[a] CR : cumulative returns from the day-of-the-week trading rule;

[b] BH : buy-and-hold returns;

[c] N : number of trading weeks in year y for the day-of-the-week trading policy;

[d] ER : annual excess returns (CR - BH); and

[e] ER^T: excess returns after transaction cost of 0.5% on each round-trip transaction.

* fully eliminated assuming a 1% round-trip transaction cost.

Day-of-the-week anomalies and their implications for asset allocation decision were also considered by Shahriar and Edward (1992). While the strategic, or long-term, asset allocation (SAA) decision was the most important investment decision the investor must make, they said, the patterns of daily or monthly market returns have timing and trading strategy implications. “If recurring purchases and sales could be timed to take advantage of these anomalies without incurring significant transaction costs, then such tactical asset allocation decisions would generate better risk-adjusted performance than strict adherence to the SAA.” (Khaksari and Bubnys 1992:550).

2.3. Conclusion of Literature Review

The studies conducted in the 1970s and 1980s provided strong evidence of the daily anomalies across various types of securities in different countries. However, from the 1990s the day-of-the-week effect became less evident in some countries and started to disappear in others. The patterns of the anomaly for those countries where it still existed were also different. Various theories tried to present an explanation of such different results. The difference in time zones, difference in market directions, i.e. long-term bull or bear market, size of the companies which comprised the stock portfolio, trading and non-trading activities, (bad) news flows, various security instruments, maturity of the financial markets, institutional factors, methodology employed and many others were raised in the academic literature to provide an explanation of the calendar anomaly itself and of the diverse results of the calendar anomalies obtained for different countries, different types of markets and different periods of observations.

The fact that the day-of-the-week effect was often documented in some countries and not confirmed in others over the same period indicated the uniqueness of the effect in each particular country and, hence, the need to conduct analysis for the specific country to give an answer if the anomaly still persisted or not.

The hypothesis of the equal mean returns over different days of the week was identified to investigate day of the week effect on the JSE over the thirteen year period from 1995 to 2007.

2.3.1 Hypothesis of mean returns across different days of week

The expected returns on the JSE over the period of thirteen years from 1995 to 2007 is the linear function of the trading period which is the same for each day

of the week.

The null hypothesis states that the mean returns across different days of the week are equal on the JSE over period 1995 through 2007.

The hypothesis based on the studies conducted by Bhana (1985), Gaag (1990), Davidson and Meyer (1993) and Roux and Smit (2001).

CHAPTER 3: RESEARCH METHODOLOGY

This section describes the methodology that will be followed to address the hypotheses of equal mean returns across different days of the week

The paradigm and method (eg qualitative, quantitative or mixed) of the research will be discussed in section 3.1. The description of the methodological approach will be presented in section 3.2. The population, sample, and sampling method will be described in section 3.3. Data collection, data analysis and interpretation will be presented in sections 3.5 and 3.6. The study limitations and potential weaknesses will be discussed in section 3.7. The external and internal validity of the study as well as its reliability will be investigated in section 3.8.

3.1 Research methodology /paradigm

Leedy and Ormrod (2001) categorise research studies into two broad categories: quantitative research and qualitative research. Creswell (2003) also presents mixed research methods, in which both quantitative and qualitative approaches are applied. Quantitative research is used to answer questions about relationships among measured variables with the purpose of explaining, predicting, and controlling phenomena (Leedy and Ormrod 2001). The purpose of the research is to test the theory that there is relationship between day-of-the-week and expected daily return on the JSE and confirm the findings made by Bhana (1985) and Gaag (1990). According to Leedy and Ormrod (2001) “to confirm” and “to test theory” are parts of quantitative research. The relationship between day-of-the-week and expected daily returns was expressed in the form of a hypothesis in Chapter 2.3.1. According to Creswell (2003:20) a hypothesis presents an integral part of the quantitative approach where “the researcher tests a theory by specifying narrow hypotheses and the collection of data

to support or refute the hypotheses". The practices of quantitative research such as testing/verifying theories, observing and measuring information numerically, and employing statistical procedures described by Creswell (2003) as quantitative approaches, constitute the core of this research. All of these factors provide evidence of the research fitting into a quantitative framework.

3.2 Research Design

"Description of past price changes and predictive statements about future prices usually rely on insights from mathematics, economics and behavioural theory" (Taylor 2005:13). Statistical analysis is commonly being employed to find out more about price changes in the past and about probabilities of possible prices in the future (Taylor 2005). This research examines daily price changes on the JSE over the 13 year period 1995 – 2007. Hence, the design of the research is constituted by statistical analysis of the historical time series. The relevant statistical approach had to be chosen. Price changes are often examined by empirical analysis of prices (Taylor 2005). Mean variance examination and multiple regression have been chosen for this research to test day of the week hypothesis.

Statistical analysis of price changes, in general, and empirical analysis, in particular, has advantages and disadvantages. While it enables the researcher to determine the probability distribution of future prices it remains difficult to make a correct prediction of future price changes (Taylor 2005). The model also cannot explain the cause of the price changes in most instances. Political, economic, business, financial, and behavioural components have to be taken into consideration in this regard. This research primarily focused on examining the day-of-the-week pattern on the JSE over the past 13 years rather then on explaining the cause of any specific pattern in any specific period of time. It makes empirical analysis suitable for the research and determines this mathematical model as a core of the research design.

3.3 Population and sample

3.3.1 Population

Time-series data measures a particular variable during successive time periods or at different dates (Intriligator 1978). The time period is often a year (i.e., annual data), but it can be a quarter, month, or week (i.e., quarterly, monthly, or weekly data). (Intriligator 1978). The time series of this research is a successive sequence of the days during which the JSE was open. The variable measured is JSE daily closing index.

The time series of the JSE daily closing prices represent the population of the research.

3.3.2 Sample and sampling method

Taylor (2005) states that at least four years of daily prices with more than 1000 observations will be required to obtain valid results. However, eight or more years of prices with more than 2000 observations should be analysed whenever possible.

The sample for the research is a time series of the JSE daily closing prices from 1 January 1995 to 31 December 2007 inclusive. A period of 13 years comprises approximately 3000 observations.

The JSE daily index reflects capital appreciation and does not include dividend payments, which are ignored in this research.

3.4 The research instrument

The presence of the day of the week pattern will be tested by conducting daily return mean variance examinations and formal statistical analyses of trading-time hypothesis. The latter will be implemented by means of regression analysis. This model has been widely used internationally for the detection of calendar effects on the world stock markets over different periods of time. The findings of French (1980), Gibbons and Hess (1981), Laconishok (1982) Jaffe and Westerfield (1985), Bhana (1985), Agraval (1994), Kamara (1997), Steely (2001) and many others relating to the day-of-the-week pattern were based on this model. The model was criticised for ignoring nonnormality and conditional heteroskedasticity (Connolly 1989). However, the model remained the dominant one for the later studies.

3.5 Procedure for data collection

The objective of data collection is to produce reliable data. This means that such data is consistent over time and place (Mouton 2006).

From 1960th the JSE/Actuaries All Share Index, Code CI01 represented overall index of JSE. On 24 June 2002 the JSE Actuarial Indices Series ceased to be calculated and the FTSE/JSE Africa Index Series took its place (JSE official site, 2008). For example, J200 (FTSE/JSE Africa Top 40) was rebased to the value of F101 (ALSI 40) so that the start of business value for the Top 40 on Monday the 24th of June, 2002 was equal to the close of business value of the ALSI 40 on Friday the 21st of June (JSE official site, 2008).

In the same manner JSE/ Actuaries All Share Index (Code: CI01) was replaced by FTSE/JSE All Share Index (Code J203). The business value of 10815.08 on Monday morning the 24th of June, 2002 for FTSE/JSE All Share Index (Code: J203) was equal to the close of business value of on Friday the 21st of June,

2002 for JSE/ Actuaries All Share Index (Code: CI01).

JSE/ Actuaries All Share Index (Code: CI01) for the period 1st of January, 1995 till 21st of June 2002 was obtained directly from JSE Securities Exchange.

FTSE/JSE All Share Index (Code: J203) for the period of 24th of June, 2002 till 31st of December, 2007 was obtained from McGregor BFA database.

The two indices together form a time series of JSE daily returns over 13 years period from 1995 until 2007 with approximately 3000 observations.

3.6 Data analysis and interpretation

3.6.1 Model of Daily Stock Returns

Stock return quantities appear in empirical researches in the following forms (Taylor 2005):

$$R_t^{'} = P_t + D_t - P_{t-1} \quad (3\text{-}1)$$

$$R_t = (P_t + D_t - P_{t-1}) / P_{t-1} \quad (3\text{-}2)$$

$$R_t^{*} = ln((P_t + D_t) / P_{t-1}) \quad (3\text{-}3)$$

with

P_t = share price at the end of period *t*

P_{t-1} = share price at the end of period *t-1*

$R_t^{'}$ = share price change during period *t*

R_t = simple return of a share during period *t*

R_t^* = compound return of a share during period *t*

Taking into account that many researches ignore dividend payments, i.e. $D_t = 0$, (3-2) and (3-3) can be reduced to

$$R_t = (P_t - P_{t-1}) / P_{t-1} \quad (3\text{-}4)$$

$$R_t^* = ln(P_t / P_{t-1}) \quad (3\text{-}5)$$

The return measures R_t (3-4) and R_t^* (3-5) have very similar numbers, since

$$P_t / P_{t-1} = 1 + R_t = e^{R_t^*} = 1 + R_t^* + \frac{1}{2!} R_t^{*2} + ... \quad (3\text{-}6)$$

and daily returns are almost always within the range -10% to +10% (Taylor 2005). Hence, it is a choice of a researcher to use one or another type of return. "Some people prefer to study the continuously compounded return R_t^*, others prefer the simple return R_t "(Taylor 2005:16). French (1980), Khaksari and Bubnys (1992), Steely (2001), Tonchev and Kim (2004), Tsangarakis (2007) calculated return series using the continuously compound variable (3-5), while Gibbons and Hess (1981), Jaffe and Westerfield (1985), Bhana (1985), Picou (2006) used a simple variable (3-4). Simple return R_t (3-4) will be used for calculation of the JSE price changes in this research.

3.6.2 Distribution of Daily Returns

Regression analysis presents an integral part of the statistical model of this research. This type of analysis requires several assumptions about the population to be made (Albright, Winston and Zappe, 2006). Normal distribution of dependant variables and probabilistic independence of the errors are some of

them (Albright, Winston and Zappe, 2006).

Previous studies on the calendar effect on stock exchanges examined normality of daily return time series by means of tests of Kurtosis and Skewness (French, 1980) and conducted autocorrelation analysis to test assumptions of probabilistic independence of the errors (Gaag, 1990).

Most of these tests gave similar results. Taylor (2005) gave evidence that the distribution of daily returns is not normal commonly and that there is almost no correlation between daily returns for different days. “The distribution of returns is approximately symmetric and has high kurtosis, fat tails, and a peaked center compared with normal distribution. The autocorrelation of returns are all close to zero” (Taylor, 2005:93).

Since the fact of non-normal distribution has been statistically proved, this research did not dwell on the kurtosis and skewness results for normality tests. However, kurtosis and skewness estimates, are presented in the mean variance analysis chapter.

3.6.3 Mean Variance Analysis

The means of the daily returns for each day of the week over the period 1995 – 2007, and two subperiods (1995 – 2001 and 2002 – 2007) were calculated. The expected returns for each day of the week were tested for significance using a t-test. Confidence levels were specified at 95%. If an expected return for a specific day of the week is significantly different from zero then the t-statistic for this day has to have a value of over 1.96 at 95% confidence level (Makridakis and Wheelwright, 1978).

The summary statistics of the expected daily returns from Monday to Friday over 1995 – 2007 period, and its two subperiods (1995 – 2001 and 2002 – 2007) are presented. It also includes t-statistic, standard deviation, kurtosis,

skewness results and number of observations taken for each day of the week.

Inspection of the means for each year for the full 13 years period were conducted to examine whether the expected returns were constant through the week in a specific year or not.

NCSS computer software was used to determine expected values of daily returns, t-statistic, standard deviation, kurtosis and skewness for each day of the week.

Obtained results are discussed in Chapter 5.

3.6.4 Regression Analysis

Trading time hypothesis states that the expected returns for different days of the week are the same (French 1980). The formal statistical test of this hypothesis was being used in the previous studies to examine the degree to which the daily expected returns were statistically different from Monday returns. This test was implemented by means of the following regression model (French 1980):

$$R_t = \alpha + \gamma_2 d_{2t} + \gamma_3 d_{3t} + \gamma_4 d_{4t} + \gamma_5 d_{5t} + \varepsilon_t ,$$

where

R_t = daily return at day *t*

α = expected return on Monday

d_{2t} = dummy variable for Tuesday, i.e. d_{2t}=1 if observation falls on Tuesday and zero otherwise

$d_{3t} - d_{5t}$ = dummy variables for Wednesday, Thursday and Friday

$\gamma_2 - \gamma_5$ = difference between expected return for Monday each of the other days of the week.

ε_t = error term.

"If the expected return is the same for each day of the week, the estimates of γ_2 through γ_5 will be close to zero and an F-statistic measuring the joint significance of the dummy variables should be insignificant" (French 1980:61).

Thus, the null hypothesis which states that, on average, rates of return remain

equal across days of the week, can be presented as:

$$H_0 : \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$$

The coefficients $\gamma_2 - \gamma_5$ will be found. *F*-test, determining significance of the overall model and *t*-test of the regression coefficients $\gamma_2 - \gamma_5$ will be conducted and results presented in Chapter 5.

NCSS computer software will be used to conduct regression analysis.

3.7 Limitations of the study

The study excludes dividend payments on the stock exchange and only reflects capital appreciation over the any given period of time. Davidson and Meyer (1993) presented evidence that inclusion or exclusion the dividend variable influences the results relating to the daily seasonality on the stock market.

The study examines JSE All Share Index and establishes the base for the conclusion pertaining to the existence of the day-of-the week effect on the JSE. However, the analysis of other JSE indices might present different results.

3.8 Validity and reliability

3.8.1 External validity

The external validity of a research study is the extent to which its results apply to situations beyond the study itself – in other words, the extent to which the conclusions drawn can be generalised to other contexts (Leedy and Ormrod 2001). They propose “three commonly used strategies that enhance the external validity of a research project”. Namely:

- A real-life settings, where research conducted outside the world “may be more valid in the sense that it yields results with broader applicability to

other real-world contexts" (Leedy and Ormrod 2001);

- A representative sample, where a sample from the category of objects or creatures is examined and then conclusion drawn about the category as a whole. Ideally, the participants in a research study are a Representative Sample of the population about which the conclusion has to be drawn;

- Replication in a different context, where the similar studies conducted in the different context reach the same conclusion. Under such circumstances, these studies, taken together, provide evidence that the conclusion has validity and applicability across diverse contexts and situations (Leedy and Ormrod 2001).

A Representative Sample strategy can be applied to test external validity by comparing the study results with the results obtained by Bhana (1985) and Gaag (1990).

Replication in a Different Context strategy can be also exploited to enhance external validity by comparing the study results based on the JSE over a period 1995 – 2007 with the studies conducted recently over the same period of time but on the other international stock exchanges.

3.8.2 Internal validity

The internal validity of a research study is the extent to which its design and the data that it yields, allows the researcher to draw accurate conclusions about cause-and-effect and other relationships within the data (Leedy and Ormrod 2001). The conclusion drawn must be warranted from the study conducted, they say. To reach that, the appropriate measurement instrument has to be used.

The validity of a measurement instrument is the extent to which the instrument measures what it is supposed to measure (Leedy and Ormrod 2001).

Sometimes there is universal agreement that a particular instrument provides a valid instrument for measuring a particular characteristic (Leedy and Ormrod, 2001). The empirical and regression analyses of time series of daily returns described by Taylor (2005), Intriligator (1978), Malinvaud (1970) and widely used by Cross (1973), French (1981), Gibbons and Hess (1981), Keim and Stambaugh (1983), Dyl and Maberly (1988), Flannery and Protopadakis (1988), Bhana (1985), Agraval (1994), Steely (2001) and many others proved a high level of internal validity of such instrument over the years.

The study will use the same technique to analyse the day-of-the-week effect on the JSE over the period 1995-2007. This technique should provide a high degree of internal validity to the study.

3.8.3 Reliability

The reliability of a measurement instrument is the extent to which it yields consistent results when the characteristics being measured have not changed (Leedy and Ormrod 2001).

Reliability refers to the fact that different research participants being tested by the same instrument at different times should respond identically to the instrument (Mouton 2006).

Taylor (2005), Albright, Winston and Zappe (2006), Intriligator (1978) demonstrated the high degree of reliability of the regression analysis. Examining of the day of the week effect using this technique can guarantee the high precision of the findings.

CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

The results of the study will be presented in this chapter.

Section 4.2 presents the summary statistics of the sample means including some statistical properties from Monday to Friday over 1995 – 2007 period, and its two sub-periods (1995 – 2001 and 2002 – 2007). It also lists mean daily returns for each of the thirteen years from 1995 to 2007.

Section 4.3 presents the summary statistics of the dummy – variable regression analysis for daily returns for the entire sample period from 1995 to 2007 and sub-period from 2002 to 2007.

4.2 Mean Variance Analysis

Table 7 shows the expected daily returns, t-statistics, standard deviations, kurtosis statistics, skewness statistics, and the number of observations which falls into the period from 1 January 1995 to 31 December 2007.

Table 7: Summary statistics of the JSE Daily Returns from 1995 to 2007

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Mean	0.1008	0.0322	0.0303	0.066	0.0518
Standard Deviation	1.1378	1.1733	1.1498	1.1474	1.0885
Skewness	-9.6818	-11.0438	1.2188	-5.5585	0.894
Kurtosis	9.2076	12.3575	8.6813	7.8368	7.8272
t-statistic	**2.2211**	0.7035	0.6742	1.4755	1.2105
Observations	629	658	656	659	647

t-value 5 per cent significance = 1.96, t-value 1 per cent significance = 2.58

As can be seen from Table 7, the average daily returns for the entire period 1995 - 2007 indicate that the returns were not constant for the various days of the week. In particular, while the daily returns were statistically insignificant for each day from Tuesday to Friday, the Monday return is statistically significant at the 5% level (*t* = 2.2211) and has highest daily return of 0.1008%.

The summary statistics for the sub-periods 1995 – 2001 and 2002 – 2007 presented in Table 8 and Table 9 respectively.

Table 8: Summary statistics of the JSE Daily Returns from 1995 to 2001

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Mean	0.0971	0.0521	0.0622	0.0217	-0.0312
Standard Deviation	1.1694	1.2118	1.2293	1.1047	1.081
Skewness	-9.0503	-10.9204	0.2563	-4.3052	-0.1498
Kurtosis	8.1997	10.3589	7.4014	5.998	6.9007
t-statistic	1.5269	0.8031	0.9502	0.369	-0.5373
Observations	338	353	353	354	346

t-value 5 per cent significance = 1.96, t-value 1 per cent significance = 2.58

In the first sub-period 1995 – 2001 the average returns from Mondays to Thursday are positive (Table 8). Friday has negative mean return of -0.0312%. However, the daily returns are statistically insignificant at the 5% confidence level.

Table 9: Summary statistics of the JSE Daily Returns from 2002 to 2007

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Mean	0.105	0.0092	-0.0069	0.1174	0.1472
Standard Deviation	1.1019	1.1207	1.0504	1.1949	1.0911
Skewness	-3.3776	-1.2521	1.6436	-3.7893	1.4311
Kurtosis	2.1365	4.3296	2.136	5.5925	4.139
t-statistic	1.6253	0.1428	-0.1144	1.7152	**2.3412**
Observations	291	305	303	305	301

t-value 5 per cent significance = 1.96, t-value 1 per cent significance = 2.58

In the second sub-period 2002 – 2007 the average returns are positive for all

days but Wednesday (Table 9). Wednesday has negative mean return of -0.0069%. However, it is only on Friday the mean return is statistically significant at the 5% confidence level (t = 2.3412), while the returns for the other days of the week are statistically insignificant at any conventional statistical level.

The annual mean returns, presented in Table 10, provide additional insights into the daily returns for each of the 13 years from 1995 to 2007.

Table 10: Annual summary statistics of Average Daily Returns in per cent from 1995 to 2007

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1995	-0.0925	0.0415	0.1149	0.0556	0.0142
1996	-0.0422	-0.0105	0.0380	0.0530	0.1075
1997	0.1331	-0.0987	0.1870	-0.1237	-0.2055
1998	0.0004	0.0177	0.2506	-0.3693	-0.0946
1999	0.3347	0.1122	-0.0163	0.2429	0.2729
2000	0.0694	0.2572	-0.1080	-0.0952	-0.1215
2001	0.2728	0.0539	-0.0338	0.3903	-0.1916
2002	-0.1719	0.1080	-0.2649	0.0972	0.0230
2003	0.2382	-0.1056	-0.0516	-0.1174	0.3047
2004	-0.0574	0.1744	-0.0219	0.2032	0.1057
2005	0.3989	-0.0636	0.0397	0.2256	0.1375
2006	0.0737	-0.0898	0.3147	0.1431	0.2474
2007	0.1438	0.0315	-0.0565	0.1520	0.0660

In 4 of the 13 (31%) years studied, the average return for Monday was negative, while Wednesday average returns are negative in 7 (53%) years, the largest number of negative returns. Monday, Thursday and Friday have the highest number of positive returns, 9 of the 13 years (69%). Wednesday average returns are highest in 4 of the 13 (77%) years, the largest number of highest returns. The lowest returns in 3 of the 13 years fell on Monday, Wednesday and Friday.

The highest Monday returns for the period 1995 – 2007, statistically significant at the 5% confidence level, do not support the findings of Bhana (1995) and Gaag (1990) who reported negative and lowest Monday returns in earlier data.

Only in 4 of the 13 years Monday had negative returns.

The highest Friday returns over the period 2002 – 2007, statistically significant at the 5% confidence level, also contradicts the findings of Bhana (1985) and Gaag (1990) who reported highest Wednesday returns.

Normal distribution has kurtosis of three and standard error of $\sqrt{24/n}$ (n – number of observations) for random samples from such a distribution (Taylor 2005). The time series of Monday returns (Table 7) has 629 observations. Hence, the standard error is equal to $\sqrt{24/629}$ or 0,1953. The estimated kurtosis for this day (9.2076) exceeds 3 by more than twenty of these standard errors. According to Taylor (2005) this shows that the return-generating process is not approximately normal. All other days (Table 7) will have standard errors approximately equal to 0,2 and also indicate that distributions are not normal.

4.3 Regression Analysis

Table 11 presents the results of a regression analysis with four dummy variables for Tuesday, Wednesday, Thursday and Friday. The regression analysis was conducted over the entire sample period from 1995 to 2007.

Table 11: Regression analysis for daily returns from 1995 to 2007 (Tuesday to Friday dummy variables)

Number of observations (N), Regression results [coefficients and (t-statistics), R-squares and F-statistics] for the entire sample period 1995 - 2007

$$R_t = \alpha + \gamma_2 d_{2t} + \gamma_3 d_{3t} + \gamma_4 d_{4t} + \gamma_5 d_{5t} + \varepsilon_t ,$$

Regression coefficient	Parameter Estimate	t-value	Probability level
α Monday	0.1008	2.217	0.0267
γ_2 Tuesday	-0.0686	-1.079	0.2807
γ_3 Wednesday	-0.0705	-1.108	0.2679
γ_4 Thursday	-0.0348	-0.548	0.5839
γ_5 Friday	-0.049	-0.767	0.4431
R 2	0.0005		
F-statistic	0.413		
N	3249		

Notes: The dependent variable R_t is measured in percent. Observations represent daily rates of return. Returns for periods including holidays are omitted. The dummy variables indicate on which day of the week each return is observed (d_{2t} =Tuesday, d_{3t} =Wednesday, etc.)

The F-statistic tests the hypothesis that γ_{2t} through γ_{5t} are zero.

The results of regression analysis are mostly consistent with the results in Table 7. The estimates of the returns for the entire period 1995 - 2007 show Monday as having a positive and highest return that is statistically significant at the 5% confidence level (t = 2.217), while the returns for the other days are statistically insignificant at 5% confidence level, based on the coefficients' individual t-statistics. Table 11 shows that individual t-statistics are less 1.96 (5% confidence interval) for the regression coefficients from Tuesday to Friday. This implies that the expected returns on any day of the week are not significantly different from the return on Monday.

The F-statistic of 0.413 is not significant at the 5% level of significance. It confirms the joint insignificance of the regression variables and indicates that hypothesis $H_0 : \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$ cannot be rejected at 5% confidence level.

As the expected return on Fridays for the period 2002 – 2007 was statistically significant (Table 9) at 5% confidence level, the regression analysis was repeated with dummy variables from Monday to Thursday. The results are presented in Table 12.

Table 12: Regression analysis for daily returns from 2002 to 2007 (Monday to Thursday dummy variables)

Number of observations (N), Regression results [coefficients and (t-statistics), R-squares and F-statistics] for the sample period 2002 - 2007

$$R_t = \alpha + \gamma_2 d_{2t} + \gamma_3 d_{3t} + \gamma_4 d_{4t} + \gamma_5 d_{5t} + \varepsilon_t ,$$

Regression coefficient	Parameter Estimate	t-value	Probability level
α Friday	0.1472	2.295	0.0219
γ_2 Monday	-0.0423	-0.462	0.6443
γ_3 Tuesday	-0.1381	-1.527	0.127
γ_4 Wednesday	-0.1541	-1.702	0.089
γ_5 Thursday	-0.0299	-0.33	0.7411
R 2	0.0031		
F-statistic	1.157		
N	1505		

Notes: The dependent variable R_t is measured in percent. Observations represent daily rates of return. Returns for periods including holidays are omitted. The dummy variables indicate on which day of the week each return is observed (d_{2t} =Monday, d_{3t} =Tuesday, etc.)

The F-statistic tests the hypothesis that γ_{2t} through γ_{5t} are zero.

The F-statistic of 1.157 indicates insignificance of the regression variables. The

t-statistics of the regression coefficients for Monday to Thursday are not significantly different from zero at the 5% level of significance. Again, the hypothesis $H_0 : \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$ cannot be rejected at 5% confidence level.

4.4 Summary of the Results

The results of the variance and regression analyses have provided statistical evidence that the daily expected returns are not significantly different for each day of the week over the period 1995 – 2007.

The hypothesis of all $\gamma_i = 0$ cannot be rejected at 5% confidence level. This means that there is no evidence of the day-of-the-week pattern on the JSE over the period 1995 – 2007.

CHAPTER 5: DISCUSSION OF THE RESULTS

5.1 Introduction

The results of variance and regression analyses obtained in the previous chapter will be presented and summarised. Conclusions regarding the hypothesis of equal means across different days of the week will be made.

5.2 Results pertaining to hypothesis of mean returns across different days of the week

In the research of daily returns on the JSE in the 1970s and 1980s (Bhana 1985, Gaag 1990), evidence was provided for the day-of-the-week calendar anomaly, with, in particular, negative Monday and highest Wednesday average returns. The later studies (Davidson and Meyer 1993, Roux and Smit 2001) rejected the existence of the daily seasonal pattern on the JSE over the period of 1990s. The results of this study support that of Davidson and Meyer (1993) and Roux and Smit (2001).

Mean variance analysis documented the highest average return on Monday for the period from 1995 to 2007 (Table 7), the result is statistically significant at 5% confidence level, and for its sub-period from 1995 to 2001 (Table 8), although, the result was not statistically significant at 5% significance level. It allows inferring that a ‘reverse’ Monday effect, detected by Mehdian and Perry (2001) and Brusa et al. (2005) on the US stock markets in the second half of 1990s also takes place on the JSE.

However, this result is the opposite to that of Bhana (1985) who found that Monday has a statistically negative (2% significance level) return on the JSE over the six year period from 1978 through 1983. The results of means variance analysis presented in Table 13. He says “Monday is the most unusual day of the week, because of its negative rate of return” (Bhana 1985:9). It agreed with

the prior research of French (1980), Gibbons and Hess (1981), Keim and Stambaugh (1983) and others who also have shown negative Monday returns in the United States.

Table 13: Summary statistics of the JSE Daily Returns from 1978 to 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 (5%)	-2.0151	0.1106	1.4230	0.8355	**0.5831**
Observations	286	290	298	302	295

Notes: Returns for periods including holidays are excluded. These returns are defined as: $R_t = (P_t - P_{t-1})/P_{t-1}x100$.

Gaag (1990) who examined day of the week effect on the JSE over the period from 1980 to 1989 also showed negative return on Monday (Table 14) which was statistically different from zero at the 5% significance level (*t*-value = -2,25). Monday was the only day with the negative mean return over the ten year period. This finding supports that of Bhana (1985) but contradicts to the findings of this research.

Table 14: Summary statistics of the JSE Daily Returns from 1980 to 1989

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Mean	-0.154	0.033	0.233	0.120	0.092
Standard Deviation	1.512	1.295	1.268	1.122	1.105
t-statistic	-2.25	0.58	4.16	2.40	**1.84**
Observations	492	510	512	504	492

Notes: Returns for periods including holidays are excluded. These returns are defined as: $R_t = ln(P_t / P_{t-1})x100$

The negative Monday mean return on the JSE was detected over the period from 1986 through 1991 by Davidson and Meyer (1993). The results are presented in Table 15.

Table 15: Summary statistics of the JSE Daily Returns from 1986 to 1991

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Mean	-0.019	0.037	0.217	0.082	0.037
Observations	295	305	305	301	295

Notes: Returns for periods including holidays are excluded. These returns are defined as: $R_t = (P_t - P_{t-1}) / P_{t-1} x100$.

However, this time, Monday returns were not significantly different (0.5% significance level) from the others. An ANOVA test determined that the null hypothesis that Monday mean return is no different from any other day could not be rejected with F-statistic = 1.58 and *p*-value = 0.18. This finding suggested that the Monday effect started to disappear from the pattern of JSE.

Roux and Smit (2001) showed that in period 1990 – 1998 JSE All Share Index had the lowest average return on Monday (Table 16). But now this return was non-negative, as opposed to the previous results of Bhana (1985), Gaag (1990), Davidson and Meyer (1993). As in the study by Davidson and Meyer (1993) an ANOVA test was employed to determine whether the Monday returns were significantly different from the returns on other days of the week. F-statistic = 0.85 and *p*-value = 0.49 indicated that Monday returns were not significantly different from returns on other days, and that, in turn suggested that there was no significant daily seasonal pattern on the JSE.

Table 16: Summary statistics of the JSE Daily Returns from 1990 to 1998

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Mean	0.00	0.02	0.10	0.07	0.03
Standard Deviation	1.05	1.00	0.96	0.91	0.82
Skewness	-13.30	-31.95	2.25	-8.73	2.54
Kurtosis	34.74	193.0	32.49	23.15	12.19
Observations	412	429	425	423	417

Notes: Returns for periods including holidays are excluded. These returns are defined as: $R_t = ln(P_t / P_{t-1}) x100$

This research showed highest positive return for Monday over 1995 – 2007 period (significant at 5% confidence level) that contrast to negative Monday returns documented by Bhana (1985), Gaag (1990), Davidson and Meyer (1993), and lowest Monday returns documented by Roux and Smit (2001). It seems that negative Monday return reversed over the years into a 'strong' positive effect.

Bhana (1985), Gaag (1990), Davidson and Meyer (1993), and Roux and Smit (2001) also showed that Wednesday had the highest average returns over the different periods that, again, contrasted with the results of this research where Wednesday had the lowest (Table 7) return over the period 1995 – 2007 and even negative (Table 9) for sub-period 2002 – 2007.

The analysis of the daily mean returns for each of the years over the period from 1995 to 2007 reveals that the highest and lowest mean returns are distributed approximately evenly across different days of the week. As can be seen from Table 10 it is only Wednesdays that have the largest number of negative returns (seven years in thirteen), compared to four- or five- years of negative returns on other days of the week.

In this regard previous research demonstrated more 'intense' patterns. For example, over the ten year period 1980 – 1989 Monday showed a negative return during seven years, compared to three years for Tuesday and Friday, and one year for Wednesday and Thursday (Gaag 1990). In four years of six (1978 - 1983) Monday had negative returns, compared to two years for Tuesday, and one year for Friday (Bhana 1985).

As it can be seen, it has become more difficult in the last years to pick up a specific day of the week with daily mean returns presenting some dominant highest or lowest value over the specific period of time.

Regression analysis of daily returns from 1995 to 2007 (Tuesday to Friday dummy variables) demonstrates that the returns for the different days of the week are not statistically different (5% confidence level) from the Monday

average return (Table 11). The null hypothesis of equal means cannot be rejected when assuming a 5% significance level. Hence, there is no evidence of day-of-the-week effects on the JSE over this period of time. Regression analysis of daily returns from 2002 to 2007 (Monday to Thursday dummy variables) demonstrates that the returns for the different days of the week are not statistically different (5% confidence level) from the Friday average return (Table 12). These findings correspond to that of Davidson and Meyer (1993), and Roux and Smit (2001) but contradict those of Bhana (1985) and Gaag (1990). It appears that the popular day-of-the-week effect (or Monday effect) documented on the JSE in 1970s and 1980s by Bhana (1985) and Gaag (1990) has not been present since the early 1990s.

5.3 Conclusion

This study re-examined the day-of-the-week effect in the JSE All Share Index of the JSE for a period from 1995 to 2007 (13 years) and selected sub-periods (1995 -2001 and 2002 - 2007) and annually.

The study demonstrates that the day-of-the-week effect is not present on the JSE over the entire sample period and its two sub-periods.

The hypothesis of equal average returns across different days of the week cannot be rejected at 5% confidence level for the period 1995 – 2007.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The findings and the conclusions of the research will be summarised in this chapter. Recommendations to investors, based on the outcome of the research, will be provided. Areas for further research will be identified and suggestions for further research will be made.

6.2 Conclusions of the study

The day-of-the-week effect in stock returns is examined on the JSE All Share Index over a period of thirteen years from 1995 to 2007.

The results provide evidence that day of the week effect does not exist on the JSE. The absence of the day of the week pattern, and in particular, the Monday effect over the recent period of time may suggest that South Africa now exhibit s a higher degree of market efficiency than at early stages. More knowledgeable investors and fund managers, being aware of any market anomaly, could adjust their trading behaviour in order to take the opportunity to make a profit. It could result in the disappearance of the day of the week phenomenon, thus making the market more efficient.

Development and growth of the South African futures market from the early 1990s might also present a possible explanation to the vanishing of the daily seasonalities on the JSE (Roux and Smit 2001).

The disappearance of day-of-the-week anomaly in South Africa, which has also been documented in many other countries of the world, can also be partially

explained by historical events, among others, in 1994, the political system changed dramatically in South Africa. The stock market became more open for foreign investors and cash inflow to the stock market. This could have led to the fact that South African stock markets became ‘stronger’ linked to the international ones in terms of day-to-day performance.

The study contributes to academic literature in that it documents a distinct ‘reverse’ weekend effect on the JSE - whereby Monday returns are significantly positive and higher than the returns on any other day of the week. This result agrees with that of Mehdian and Perry (2001) and Brusa et al. (2005) who detected ‘reverse’ weekend effect on the US stock markets over the period 1988 – 1998 predominantly for the large-cap indices.

6.3 Recommendations

The presence of predictable seasonal patterns could suggest exploitable trading opportunities for the investors. However, the study showed that the day of the week pattern no longer exists on the JSE. It indicated that no active strategy could be used by investors to exploit the anomaly.

6.4 Suggestions for further research

This study only presented the evidence that the day-of-the-week effect no longer exists on the JSE for the JSE All Share Index. However, to draw conclusions about the existence of such calendar anomalies on the JSE, analysis also has to be conducted on the other indices presented on the JSE such as the JSE All Gold Index, JSE Mining and Recourse Index, JSE Industrial Index.

Since day-of-the-week effects, in general, have become less evident in the past in some of the countries and have disappeared in others, it would be interesting

to examine other seasonal patterns such as holiday effect, week-of-the-month and month-of-the-year effect, and compare the findings with that of other international financial markets. Such an analysis may reveal some factors that are specific to South Africa's financial markets.

A reverse weekend effect has been detected on the JSE. Brusa et al. (2005) stated that this effect is subject to the size of the firms, being more pronounced in the segment of large size firms. Future research could try to determine whether the presence of 'reversal' Monday effect for the JSE ALL Share Index can be found in ALSI Top 40 Index (large companies) and Small Cap Index (small companies) and compare results with that of Brusa et al. (2005).

These, and other issues, can be covered in further studies.

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