DAY-OF-THE-WEEK EFFECT: EVIDENCE FROM NINE SECTORS OF THE SOUTH AFRICAN STOCK MARKET

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ABSTRACT

The day-of-the-week effect in share prices is one of the most extensively researched anomalies, especially in developed markets. However, emerging African stock markets have received little attention in this regard. This study breaks new ground in using non-parametric tests directly on skewness and kurtosis to examine whether the day-of-the-week effect exists in nine listed stock market sector indices of the JSE Securities Exchange of South Africa (JSE). Different day-of-the-week effects were found to be present in the statistical moments of returns of these nine JSE sectors.

Key words: Day-of-the-week effect, seasonality, statistical moments, stock market sector indices.

DECLARATION

I, the undersigned, Douglas Mbululu, hereby declare that, except for references specifically indicated in the text, this dissertation is my own original work, and that it has not been submitted, and will not be presented at any other university for a similar or any other degree award.

Signature: ----------

Date: ----------

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I dedicate this thesis to my family and friends who supported me through the years. Mr Mackenzie Mbululu, this is for you. Patty, you stood by me throughout all the rough tides, I love you.

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CHAPTER ONE
INTRODUCTION

1.1 CONTEXT OF RESEARCH

Financial markets have been subjected to rigorous tests ever since the introduction of the Efficient Market Hypothesis (EMH) by Fama (1970). The EMH assumes that security prices reveal all available information, therefore investors cannot outperform the market and there are no opportunities to earn excess returns unless investors are privy to special information. The oversimplified assumptions of the EMH has stimulated a plethora of studies that looked at, among other things, the reaction of stock markets to information announcements, the predictability of stock returns, and stock market anomalies. By definition, an anomaly is an incidence that cannot be explained by a prevailing theory (Al-Loughani *et al*., 2005). In the case of stock markets, anomalies are occurrences that dispute the Efficient Market Hypothesis (Brooks & Persand, 2001:155).

Existence of anomalies in stock markets can be attributed to several factors, such as variations in seasons or the weather, or changes in liquidity preferences before vacations or holidays. The stock returns tend to underperform in summer months compared to winter, and to do better on sunny compared to rainy days. Investors sell their securities towards holidays or vacations for liquidity reasons (see Bouman & Jacobsen, 2002; Cao & Wei, 2004; Kamstra *et al*., 2003). Anomalies can also be attributed to tax-loss selling late in the financial year (Grinblatt & Markowitz, 2003).

The validity of the Efficient Market Hypothesis became contentious after the detection of various anomalies in stock markets. These include, among others, the January effect, first identified by Rozeff & Kinney (1976) using data from the New York Stock Exchange (see also subsequent studies by Bhardwaj & Brooks, 1992; Bhabra *et al*., 1999; Maxwell, 1998); the weekend effect, also known as the day-of-the-week effect, the Monday effect or the Monday seasonal; the holiday effect; the turn-of-the-month effect; the small-firm effect; the weather effect; and the price/earnings ratio effect.

The existence of these anomalies in stock markets suggests the possibility – and the existence – of profitable trading strategies and, most importantly, the inefficiency of the stock markets in quickly incorporating information (whether public or private) into the price of stocks if trading costs are ignored. The discovery of these anomalies casts doubt on the validity of the Efficient Market Hypothesis. It is possible for a fundamental analyst to make a better-than-average estimate of the intrinsic value of a security and thus make above-average profits before the market corrects the discrepancy between the market price and the intrinsic value of a security (Boudreaux, 1995:15).

There has been considerable scrutiny of anomalies in developed stock markets over the decades and emerging markets have been neglected due to data constraints. Research conducted in developed markets includes studies on the British stock market (Lewis, 1989); the Italian stock market (Barone, 1990); the Canadian stock market (Tinic *et al*., 1987) and the Tokyo Stock Exchange (Aggarwal *et al*., 1990), among others. These studies span all the stock market indices for the stock markets in the various countries. With the assistance of non-parametric and parametric tests, significant anomalies have been identified in these developed stock markets, ranging from weekend effects, monthly effects and small-firm effects to holiday effects.

One anomaly that has often been studied in several developed stock markets is the weekend or day-of-the-week effect (Basher & Sadorsky, 2006:2). This refers to the tendency of stocks to exhibit relatively large returns on Fridays compared to those on Mondays. Some empirical investigations have reported compelling evidence that there are day-of-the-week (weekend) effects in US stock returns. Mean returns on Mondays have been reported to be negative (Smirlock & Starks, 1986) compared to Fridays. A weekend effect in the mean return distribution of several stock markets was also identified (Jaffe & Westerfield, 1985).

In the face of the global integration of financial markets, intermittent economic problems inherent in Africa and constant and multiple efforts by African governments to restructure their economies and refashion the stock exchanges, there is a great need to

constantly monitor the present return characteristics of African stock markets. It is against this backdrop that this study seeks to investigate the existence of the day-of-the-week effect on nine JSE industry sectors.

1.2 OBJECTIVES OF THE STUDY

The aim of this study is to ascertain whether the day-of-the-week effect is present in the nine major industrial sector listings on the Johannesburg Securities Exchange (JSE) for the period beginning July 1995 and ending October 2008. In particular, it seeks to investigate the existence of the day-of-the-week effect on skewness and kurtosis of returns in the nine JSE industry sectors. This represents an implicit test of the extent to which the JSE is efficient in weak form. Analysts following particular shares and particular sectors, or both, can benefit from such an analysis in that, if a day-of-the-week effect is identified in a particular sector, apt seasonal trading strategies can be adopted, assuming that transaction costs are trivial.

1.3 MOTIVATION FOR THE STUDY

While there is vast literature on anomalies in developed markets, few studies focus on emerging markets, and those that have done so, exclude stock markets in African countries. Greater scrutiny of anomalies in emerging stock markets has recently been apparent (Basher & Sadorsky, 2006; Brooks & Persand, 2001; Dubois & Louvet, 1996; Jaffe & Westerfield, 1985). This can be attributed to emerging markets being associated with greater nominal returns in the last five years, portfolio diversification involving emerging stock markets, globalisation, financial integration and deepening of stock markets, as well as the availability of data to undertake such research (Aron & Ayogu, 1997). However, there is still a gap in the literature, especially on emerging stock markets.

With the increased importance of emerging markets in portfolio diversification, this study seeks to close this gap. Whilst the majority of studies on anomalies have focused on the investigation of day-of-the-week effects on entire stock market indices, this study takes a microscopic view by considering subsector indices of the stock market that are likely to

give a more accurate picture of anomalies. In addition, this study uses the two-sample Komolgorov–Smirnov (K–S) test on higher statistical moments, first used by Tang (1996), to test for the presence of the day-of-the-week effect. This has not been applied in any of the existing literature on the South African or African stock markets, nor has it been applied extensively in studies of developed stock markets.

1.4 ORGANISATION OF THE STUDY

The study is organised as follows: Chapter Two reviews both the theoretical and the empirical literature on equity market efficiency and anomalies in developed and emerging stock markets. First, the theory underpinning stock market efficiency is discussed, followed by the empirical literature on developed and emerging markets. Chapter Three describes the data and econometric methods to be used in this study. The results of the empirical work are presented and discussed in Chapter Four. Chapter Five concludes this study and gives suggestions for further research.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the theoretical background and empirical findings underlying the efficiency of stock markets. The first section discusses the Efficient Market Hypothesis (EMH), while the second section reviews empirical literature on seasonality in both developed and emerging equity markets with an emphasis on the day-of-the-week effect. The second section is divided into developed equity markets and emerging equity markets.

2.2 THEORETICAL BACKGROUND

2.2.1 EFFICIENCY IN EQUITY MARKETS

The Efficient Market Hypothesis (EMH) forms the backbone of modern finance theory and is used to explain efficiency in equity markets. In its simplest form, the EMH posits that all information is quickly and efficiently incorporated in a security‟s price, to such an extent that historical information cannot be manipulated to earn non-normal returns. There are weak, semi-strong and strong versions of the EMH. The weak version states that the latest security prices, which are easily accessible, already mirror past price and volume information, thus current security prices incorporate the information enclosed in the past price series (Fama, 1970). The weak version of the EMH renders technical analysis worthless and implies that no investor should earn excess returns using information that "everybody else knows”. Thus, security prices resemble a “random walk”, which makes it difficult to predict future prices.

The semi-strong version of the EMH states that all publicly available information is already incorporated into a security‟s price, thus a company‟s financial statements, announcements and economic factors, among others, are of no use in forecasting future security prices as they are already reflected in a security‟s current price.

The strong version of the EMH stipulates that private or insider information has been incorporated into the current security price, therefore no investor can benefit from exploiting such information (Fama, 1970). Thus, even a company‟s managers cannot benefit from inside information they might possess, as it has already been incorporated in the security‟s current market price.

2.2.2 DEVELOPMENTS IN THE EMH

Fama (1965) states that, in an efficient equity market, information is swiftly incorporated into the asset‟s price before market participants can exploit such information. However, there are time lags between the release of information and the incorporation of this information into the security‟s price. The length of these lags depend s on factors such as the liquidity and depth of a market. Thus, astute investors can manipulate this time lag and gain in the process. Jensen (1978) states that a market is efficient with respect to information set θ_t if it is impractical to earn economic profits by trading on the basis of information set θ_t. Malkiel (1992), in support of Jensen (1978) and Fama (1965), posits that a capital market is efficient if it "fully and correctly" reflects all relevant information required in determining security prices, hence it is impossible to earn economic profits from trading on the basis of information set θ_t. Malkiel (1992:12) argues that "the market prices stocks so efficiently that a blindfolded chimpanzee throwing darts at Wall Street can select a portfolio that performs as well as those managed by the experts". However, this fails to explain exceptional performance by fund managers who have collectively outperformed the major stock markets.

Fama (1970) suggests that security prices reflect all available information. This strong version of the EMH is based on several assumptions, such as zero costs of information gathering and no trading costs. This version is impugned by Grossman & Stiglitz (1980) who argue that information gathering is not a costless exercise and there are rewards for gathering information. They further argue that efficient markets with perfect information are impossible given the costs associated with information gathering, and economic agents will gather information if the marginal benefits from such activities outweigh the marginal costs. It is also crucial to note that markets are neither perfectly efficient nor

perfectly inefficient, as market efficiency is nuanced. The paradox of efficient markets is that, if markets were efficient, then no investor would analyse securities and hence the market would be inefficient. Markets depend on investors who believe the market is inefficient and provide liquidity in an attempt to outperform the market.

The weaker version of the EMH is based on the notion that prices reflect information to the point that the marginal benefits of acting on the information do not exceed the marginal costs. Thus the expected marginal value of abnormal returns is zero. In an economic sense, the weak version of the EMH is more appealing than the strong version, a view which is supported by Jensen (1978).

Timmerman & Granger (2004) propose that it is impossible to gain from trading on the basis of signals produced from a forecasting model M_t defined over predictor variables in the information set and selected using a search technology. Thus, even advanced econometric and statistical models cannot be used to forecast future security price trends. However, deviations of security prices from expected values have been documented in literature in the developed and some of the emerging stock markets. Lo & MacKinlay (1988) assert that certain individuals can outperform the market consistently due to intensive information gathering, portfolio management and diversification, cherry-picking of stocks, and forecasting models. They argue that the application of advanced technology combined with tick-by-tick feeds of market transaction data, reveal regularities in stock prices that could not be identified five years before their study.

2.3 RANDOM WALK THEORY

The Random Walk Theory (RWT) insists on the idea that consecutive security prices are independent and identically distributed over time. Thus, the probability of a security‟s future price to increase or decrease in a given interval of time is identical. Yesterday‟s price changes are independent of today‟s price changes, thus an investor cannot predict future prices based on historic price changes (Malkiel, 2003; Thompson & Ward, 1995). This is analogous to the weak version of the EMH. The RWT renders technical and

fundamental analyses useless as a means of earning greater-than-average returns on securities.

The implications of the EMH and the RWT are that no investor can outperform the market either by security selection or market timing. The EMH and RWT suggest that market outperformance can be purely attributed to luck rather than skill or information gathering. Grossman (1976) and Grossman & Stiglitz (1980) argue that perfectly efficient markets are impossible, as information gathering and processing is not a costless excise. They further argue that non-normal returns can be earned if there are no costs to gathering information. Because of the information-gathering costs, how much information to acquire becomes an important decision to investors. Since expectation formation is costly, agents often choose strategies that are simpler and thus cheaper than rational expectations. The expectations model‟s dynamics can be expressed by market precision, which represents the amount of information acquired by the average economic agent. Under certain conditions, market precision follows an unstable and highly irregular time path. This irregularity affects observable market quantities. If the EMH is valid, investing in information gathering is neither important nor beneficial. However, a fundamental analyst can estimate a security‟s intrinsic value more accurately than average. As a result, above-average profits can be earned before the market corrects this discrepancy between the market price and the intrinsic value of a security (Boudreaux, 1995:15).

Neither the EMH nor the RWT can explain the existence of many fundamental value anomalies in the stock market. In fact, the existence of anomalies contradicts the EMH as well as the RWT (Brooks & Persand, 2001:155). These include, among others, the size effect (equity premium puzzle), where small cap stock prices are more volatile and higher-yielding compared to large cap stocks; the value effect, which is related to the notion that distressed stocks on average earn higher returns than growth stocks; and the price/earnings effect, where stocks with low P/E ratios outperform those with high P/E ratios (Basu, 1977). Seasonal effects, which are discussed in the next section, refer to the

statistical moments of stock returns being greater at some times than others, when returns are measured at frequencies ranging from minutes to months.

2.4 EMPIRICAL LITERATURE

This section focuses on seasonal anomalies found in both developed and emerging markets. The various anomalies to be considered are the January effect, the turn-of-the-month effect, the day-of-the-week effect and the holiday effect. The section is divided into developed markets and emerging markets.

2.4.1 DEVELOPED MARKETS

The study of seasonal anomalies in developed stock markets span several decades. Recent studies now focus on trying to establish if stock market anomalies are persistent over time. Extensive research has been conducted in developed stock markets on almost all known anomalies mainly because these stock markets are liquid and transparent. The day-of-the-week effect has often been studied in developed stock markets. This anomaly refers to the differences in mean returns across days of the week. Returns on Mondays are negative mainly because of bad news released during weekends and investors preferring to close short on Fridays to avoid a disruption to their strategy as a result of developments during the weekend. Gibbons & Hess (1981) examined whether the day-of-the-week effect exists following studies done by Cross (1973) and French (1980) using the same Standard & Poor‟s (S&P 500) share index. Cross (1973) and French (1980) confirmed the existence of negative mean returns on Mondays. However, Gibbons & Hess (1981) find a negative mean Monday return across individual stocks. This finding exists even after the use of market-adjusted mean returns. Gibbons & Hess (1981) discover that aggregation of assets into portfolios may shrink the day-of-the-week effect on market-adjusted returns.

Lakonishok & Smidt (1988) use ninety years of Dow Jones Industrial Average daily closing prices to test for the existence of anomalies. After using parametric and non-parametric methods, they report very high returns being earned in January, especially for small companies. The day-of-the-week effect is also detected with negative returns on

Mondays. This effect, which may persist over time, is attributed to the selling of stocks on a Monday subsequent to the release of bad news over the weekend. This is consistent with the findings of Gibbons & Hess (1981) for the S&P 500. Lakonishok & Smidt (1988) also detect higher returns on the last trading day of the week, irrespective of whether the last day of the week is a Friday or a Saturday. However, Friday returns are greater even if Friday is not the last trading day of the week.

Pre-holiday returns are found to be twenty-three times higher than the daily rate of return. Lakonishok & Smidt (1988) find that holidays account for about half of the price increases in the Dow Jones Industrial Average, and pre-holiday rates of return to be two to five times greater than pre-weekend rates of return. This holiday effect may persist over time. Exploitation of such an anomaly is a different question, however, and should be treated with caution as other factors such as transaction costs must be accounted for. A strong turn-of-the-month effect is also reported with rates of return especially high for one day before the end of the month and three days into the subsequent month. Strong patterns on dividend effects are also found on returns.

Lakonishok & Maberly (1990) study the trading patterns of individuals and institutions to determine irregularities related to the day of the week, using the daily data on trading volume on the New York Stock Exchange and daily odd-lot sales and purchases. Odd-lot sales and purchases provide data for individual investors. The results show that individuals are most active on Mondays and Tuesdays. Institutional investors trading volume on Mondays (regarded as the strategic decision-making day) is much less than on other days of the week, and highest on Tuesdays (Lakonishok & Maberly, 1990:239). This could also explain high volatility in stock markets returns on Mondays and Tuesdays. These findings reveal the importance of examining the volume of trade when investigating whether seasonal effects exist in stock markets.

Ziemba (1990) investigates the existence of anomalies on the Tokyo Stock Exchange using data on the Nikkei Stock Average (NSA) and TOPIX share market indices from 1949 to 1988 and finds excess returns in January, especially for small stocks, as well as

excess returns in June and December. The January effect is attributed to tax-loss selling as firms pay tax on capital gains. Ziemba (1990) also finds that risk in January and June is lower than in other months. Ziemba (1990) argues that the excess gains in June and December are due to semi-annual bonuses and year-end bonuses being paid out by most Japanese companies. He further argues that these bonuses are often the equivalent of three months‟ worth of salaries. Higher returns of 0.10% or more on average are found during the turn of the month when employees are paid. Holiday effects, just like those in America (see Ariel, 1987; French & Roll, 1986; Lakonishok & Smidt, 1988), are also found. Ziemba (1990) finds that pre-holiday returns are five times greater than the average return on all days on the NSA during the 1949–1988 period, but less risk is associated with the pre-holiday period. This seems to be anomalous, as high risk is expected to correspond to high returns. Ziemba (1990) also finds high returns for the three pre-holidays of a Golden Week, the period between late April and early May with three holidays in one week, 29 April, 3 May and 5 May. The turn-of-the-year effect is also detected in Japan using the NSA data. Thus, anomalies are not only an American phenomenon.

Berument & Kiymaz (2001) looked for the day-of-the-week effect in the US stock market using closing prices for the S&P 500 stock index. Apart from adding to the general body of literature, they examine whether there any day-of-the-week variations in volatility of stock market returns from January 1973 to October 1997. None of the preceding studies had examined the day-of-the-week effect in stock return volatility (Berument & Kiymaz, 2001:182). Using the mean return equation, which assumes a constant residual term, Monday returns are the least, whereas the greatest returns are earned on Wednesdays. With a GARCH model that admits time-varying volatility, the least returns are earned on a Monday and the greatest on a Wednesday. A persistent and strong volatility effect is also detected. A modified GARCH model yields similar results. However, volatility is highest on Friday and lowest on Wednesday. Dividing the sample period into pre-1987 stock market crash and post-1987 stock market crash yields similar results. These findings are analogous to earlier studies on the day-of-the-week effect using the S&P 500 (see Cross, 1973; French, 1980; Gibbons & Hess, 1981).

Egan (2008) assesses autocorrelation patterns in three American stock market indices, namely the S&P 500 (1962–2007), Dow Jones Industrial Average (1929–2007) and the NASDAQ Composite Index (1972–2007 period). Using the autocorrelation patterns, Egan (2008) finds statistically significant autocorrelation in the S&P 500, Dow Jones Industrial Average and the NASDAQ Composite Index during a period of nearly six decades, which refutes the Random Walk Theory. Egan (2008) also finds the persistence of the January effect, especially for small cap stocks.

2.4.2 EMERGING MARKETS

Literature on seasonality, especially in Africa, is very limited, mainly due to the lack of good quality data (Aron & Ayogu, 1997). Aggarwal & Rivoli (1989) investigates the emerging markets of East Asia using equity market indices, and discover lower mean returns on Mondays and Tuesdays in the stock returns of Hong Kong, Singapore, Malaysia and the Philippines, for the period September 1976 to June 1988. They focus on mean return equations to ascertain the existence of the day-of-the-week effect in the four Asian countries. However, a major deficiency in their study is the exclusion of risk in their analysis of the day-of-the-week effect.

Balaban (1995) examines the day-of-the-week effect in an emerging stock market of Turkey, using the Istanbul Securities Exchange Composite Index (ISEC) closing prices from 4 January 1988 to 5 August 1994. He employs the mean return equation (using OLS) to test for the day-of-the-week effect. Average negative returns are reported for all Tuesdays for each year except 1989 and 1993. Friday has the highest positive returns for the sample period, while Monday is reported to have the highest volatility for each year over the whole sample period. While Friday has the highest return, it is reported to have the lowest volatility. This contradicts the risk-return trade-off and suggests the possibility of inefficiency in stock pricing in the Turkish stock market. The sign tests employed by Balaban (1995:7) show that there is a strong and positive relationship between mean return signs on Friday and mean return signs on Monday. The binary dummy variable

regression model reports statistically significant coefficients for Wednesday and Friday, leading to higher returns on these days than on others (Balaban, 1995:7).

Al-Khazali (2002) examines the Amman Financial Market to determine the turn-of-the-year and weekend effects using stochastic dominance and parametric analysis. Al-Khazali‟s major contribution is the inclusion of the stochastic discount factor. However, the use of parametric tests is questionable, as the mean/variance of emerging stock market returns are non-normally distributed as for all financial data. Monthly data from 1978 to 2001 and weekly data from 1988 to 2001 are used. The results from parametric tests show high returns for weeks one and two and low returns for weeks three and four. The January effect is also detected using the parametric tests. The stochastic dominance results dispute the January effect detected using the parametric tests. On the other hand, the stochastic dominance test provides weak evidence of the existence of the weekend effect. However, week one‟s returns are higher in all the models used. Al-Khazali (2002:76) suggests that parametric results could be influenced by violations of the parametric assumptions such as normal distribution of returns. The use of the stochastic dominance model is appealing in the investigation of seasonalities, particularly if mean returns show significant skewness and kurtosis in returns. Most studies overlook the skewness and kurtosis results, hence leading to less accurate results.

Ajayi, Mehdian & Perry (2004) study eleven Eastern European emerging markets. They use daily closing values of these emerging stock market indices with the sample running from the commencement date of these stock markets in each of these countries to 6 September 2002. Their paper presents the foremost evidence of day-of-the-week effects for these emerging markets (Ajayi *et al*., 2004:61). Statistically significant negative returns on Mondays in only two of these eleven stock markets (Estonia and Lithuania) are reported. Positive mean returns on Monday for five emerging stock markets are reported, but were only significant in Russia. Tests for differences of variance illustrate that the volatility of stock returns on Mondays is significantly greater than the volatility during the rest of the week in four of these markets. The outcome for the Eastern European emerging stock markets provides no statistical evidence to suggest the presence of a

Monday return anomaly, except for Estonia. Despite the speculation about inefficiencies in the development phase of emerging stock markets, a certain level of efficiency does exist in these emerging stock markets, excluding Estonia.

Holden, Thompson & Ruangrit (2005) use daily returns of the Thailand stock market Index (SET) to determine the existence of calendar anomalies such as the day-of-the-week, month-of-the-year, days before or after the holiday, and within-month effects concurrently. Particular attention is given to the period prior to, during and after the Asian crisis of 1997. Unlike preceding studies done on the Thai stock market that looked at these calendar effects in isolation (Ko & Lee, 1991; Miyakoshi, 2006), this paper focuses on all calendar anomalies. Daily closing prices from December 1994 to December 2000 are used to detect the existence of the day-of-the-week, month-of-the-year and turn-of-the-year effects. Holden, Thompson & Ruangrit (2005) further test if the anomalies detected can be used to generate superior forecasts of future security prices. Using the Root Mean Square Error which penalises large errors in both directions, they find that models which incorporate these calendar effects in forecasting perform better than those that ignore anomalies.

Al-Saad & Moosa (2005) investigate the nature of seasonality in the emerging stock market of Kuwait. Using the Global Market Index, they test for monthly patterns in the Kuwait stock market. Al-Loughani *et al*. (2005) also scrutinise the highly speculative emerging stock market of Kuwait for the existence of holiday effects. They used a data sample divided into the pre-invasion (1984–1990) period and the post-liberation (1993–2000) period. Seven holidays are investigated, but no distinctions are made as to whether such holidays fall on weekdays, or before or after weekends. It is dubious to attribute an anomaly observed on a weekend which also happens to be a holiday, to a holiday effect. The methods used include the non-regression parametric T-test and non-parametric Wilcoxon–Mann–Whitney test to test for the difference between two means and medians respectively. The Kruskal–Wallis test is also applied to test the difference between these means and medians, as these two tests cannot be used for three means or medians. The Anderson–Darling test, which tests for normality, is employed to decide between using

parametric or non-parametric tests. Pre-holiday mean returns for the post-liberation period are observed to be non-normally distributed. After the computation of the means and medians, the post-liberation period mean returns of 0.008 are greater than the mean returns of -0.025 for all days. However, the post-liberation period mean returns have a lower standard deviation compared to the pre-liberation period. Al-Loughani *et al.* (2005) argue that the higher mean returns relative to lower standard deviation in the post-liberation period are due to the development of the Kuwait Stock Exchange and greater participation of institutional investors. The Kruskal–Wallis test is applied to determine the existence of the holiday effect, pre-holidays, post-holidays and other ordinary days. The results show no evidence of the holiday effect in the pre-invasion period. However, post-holiday returns in the post-liberation period are statistically significant and greater than those on other days. Of the holidays, seventeen occur on Saturdays, which is the first trading day of the week in Kuwait. This leads to the speculation of whether the holiday effects found are actually weekend effects.

Further scrutiny of the results in Al-Loughani *et al.* (2005) indicates that there is a Saturday effect rather than a holiday effect, which is consistent with Al-Loughani & Chappell (2001), who find significantly greater returns on Saturday in the Kuwait Stock Exchange. Probably the major deficiency of the study conducted by Al-Loughani *et al.* (2005) (as with many papers that only focus on mean returns) is its inability to include volatility in its analysis.

Basher & Sadorsky (2006) investigate the day-of-the-week effect in twenty-one emerging stock markets. This paper extends the existing literature by including unconditional and conditional risk factors in the analysis. Daily closing prices for the twenty-one emerging stock markets are used for the period December 1992 to October 2003. Daily excess stock returns are calculated by subtracting the daily yield on a three-month US Treasury bill from the continuously compounded daily stock returns. This study contains five models. The first model (which is a simpler test of the day-of-the-week effect) regresses the excess returns of these emerging stock markets on the five daily dummy variables. Statistically significant estimated coefficients in this model indicate the presence of the

day-of-the-week effect. The downside of this model is that it leaves out volatility, which is instrumental in determining securities prices. This takes us to the second model, which incorporates risk (volatility), but assumes risk to be constant across all days of the week, which is its downside. It is crucial to note that volatility varies across days and even hours, minutes and seconds, therefore this assumption might be misleading. The third model introduces the interaction dummy variables which allow risk to vary across days. However, all these models use world market risk, thus they are unconditional models. Unconditional models assume that world market risk has a symmetric impact on emerging stock markets returns. It is imperative to note that world market risk does not have a homogeneous shock effect on either developed or emerging stock markets. Thus, a fourth model that relates stock market returns to risk is crucial. In order to incorporate this, Basher & Sadorsky (2006) include a dummy variable that takes on a value of 1 if market returns are positive and 0 otherwise. The fifth conditional model relates excess stock returns to market returns. This model also makes use of the five dummy variables for each day of the week and allows risk to vary across days.

The results from the first three models are similar in that they all find day-of-the-week effects on the various emerging stock markets. Beta values of less than 1 are observed, indicating less volatility in these emerging stock markets compared to the world market. The conditional models produce slightly different results, which include the disappearance of the day-of-the-week effect in some markets (Monday effect in Taiwan, Tuesday effect for the Philippines) and detection of this effect in others (Monday effect in Thailand and South Africa; Tuesday effect in Indonesia, Israel and Pakistan; Wednesday effect in Argentina; Thursday effect in Turkey; Friday effect in the Philippines, Taiwan and Turkey). Observed upmarket returns are statistically significant in eight out of the twenty-one emerging stock markets, while downmarket returns are significant in fifteen of the twenty-one markets. However, day-of-the-week effects diminish with the addition of more interaction dummy variables. The fifth model indicates the presence of the day-of-the-week effect in South Africa and the Philippines, Tuesday effect in Pakistan, Thursday effect in Poland, and Friday effect in the Philippines and Taiwan.

While a significant amount of literature exists for some emerging markets, this cannot be said for emerging stock markets in Africa. The study of anomalies in emerging African stock markets is mainly hampered by a lack of data (where data are available, they are insufficient or not accurate) and the fact that these markets are thinly traded and are marred by operational and institutional deficiencies (Album, 1996). In an attempt to fill this gap, Ayadi *et al*. (1998) investigate the turn-of-the-year effect in Ghana, Nigeria and Zimbabwe‟s stock markets using the Kruskal–Wallis, the Friedman and the Wilcoxon–Mann–Whitney tests.

Monthly data for these three stock market indices obtained from the International Finance Corporation (IFC) are used. Both the Friedman test and the Wilcoxon–Mann–Whitney test show the presence of seasonality in the Ghana stock market, but not so for Nigeria and Zimbabwe. Ayadi *et al*. (1998:31) attributes the presence of the January effect in Ghana to international spillover effects, considering that Ghana is the most open economy of the three economies under investigation.

In a study of the South African stock market, Coutts and Sheik (2002) find no evidence of day-of-the-week, weekend, January and pre-holiday effects using dummy regression models to detect any seasonal patterns in returns of the JSE All Gold Index from January 1987 to May 1997. Despite finding insignificant negative Monday and January returns, Coutts & Sheik (2002) find no significant evidence of seasonality in the All Gold Index. Moreover, no persistent pre-holiday effect is found over the sample period. These findings are contradictory to many findings for both developed and emerging markets. However, it is imperative to note that this study made use of dummy regression variables which only consider the mean returns for different days or months without analysing volatility on such days and months. This is a major drawback of their study, as volatility and return vary throughout the days of the week and also through all the months. Apart from that, the All Gold Index is but one of many indices listed on the JSE Securities Exchange, hence it cannot in isolation give a true and accurate picture of the whole South African stock market.

For this reason, the current study focuses on all the major industrial sector indices listed on the JSE. It also takes into account the differences in higher statistical moments across all the days of the week and the distribution of returns, rather than assuming normality in return distribution, as does the study conducted by Coutts & Sheik (2002).

Heymans (2005) investigates the existence of the day-of-the-week effect on the South African stock market using the closing prices for the All Share Index (ALSI). Using parametric, non-parametric and dummy regression variable equations, Heymans identifies the presence of the day-of-the-week effect. Mean returns on Thursdays are reported to be higher than on any other day of the week. However, it is crucial to investigate the existence of this anomaly in all sectors of the JSE, by means of models that capture stochastic rather than deterministic seasonality, as was used by Heymans (2005). Furthermore, Heymans (2005) did not examine the day-of-the-week effect variations in stock market volatility or higher statistical moments. As mentioned above, these aspects are dealt with in the current study.

Chukwuogor (2008) analyses the day-of-the-week effect on five African stock market indices for Botswana, Egypt, Ghana, Nigeria and South Africa for the period 1997– 2004. Chukwuogor (2008) finds no evidence of the day-of-the-week effect in all these African stock markets using the Kruskal–Wallis test, although insignificant daily return volatility is observed in the stock markets of Botswana, Egypt, Ghana and South Africa.

While many studies document seasonality in developed stock markets, emerging African stock markets are neglected due to a lack of data, especially at the level of industry sectors. The purpose of the empirical analysis, described in the following chapters, is to address this issue. The next chapter presents the data and methods to be used in examining the existence of the day-of-the-week effect on nine JSE industry sectors.

CHAPTER THREE
EMPIRICS

3.1 INTRODUCTION

This chapter outlines the analytical framework that will provide answers to the objectives of this study as set out in Chapter One. Following Tang (1996), this study tests for the presence of the day-of-the-week effect directly on skewness and kurtosis in nine industrial sectors listed on the JSE Securities Exchange of South Africa (JSE). These sectors are Oil & Gas (OILGAS), Basic Materials (BMATS), Industrials (INDI), Consumer Goods (CGDS), Health Care (HC), Consumer Services (CSVS), Telecom (TELEC), Financials (FINI) and Technology (TECH). The next section describes the data to be used, while the section thereafter outlines the methods to be used in determining whether a day-of-the-week effect exists in any of these JSE industry sectors.

3.2 DATA

Empirical studies on anomalies (discussed in Chapter Two) use daily closing return series to investigate anomalies on stock markets. Return series for the nine JSE indices are not readily available and have to be computed from the stock market indices. Sector index returns are computed from daily closing value-weighted index values for nine of the 36 market sectors listed on the JSE during the period 3 July 1995 to 22 October 2008. The continuously compounded rate of return is expressed in percentage terms as:

$$R_t = (\ln P_t - \ln P_{t-1}) \times 100$$

where P_t represents the most recent closing index value of one of the nine indices; and P_{t-1} represents the previous day‟s closing index value for one of the nine indices, all of which are drawn from Thomson Datastream. The nine sector indices selected serve as a proxy for the whole share market, since these sectors comprise most of the JSE‟s market capitalisation. These sectors also represent the most widely held shares listed on the JSE.

The choice of the data frequency is informed by the nature of the study, which seeks to investigate the day-of-the-week effect, therefore daily data are more appropriate. However, there are distortions in daily data due to noise trading and non-trading days such as holidays. In this study the matter of noise trading during the day is resolved by employing closing values of the sector index. Glezakos *et al*. (2007:28) suggest the calculation of a particular index by simulation on a non-trading day as a way to resolve the problem of non-trading days. Chowdhury (1994) and Chang *et al*. (2006) suggest the elimination of non-trading days. Using simulation does not guarantee accurate calculation of the index had the market opened on a particular holiday, hence this study follows Chowdhury (1994) and Chang *et al*. (2006) by way of eliminating non-trading days. Simulation is also likely to inflate or deflate the mean returns for each index, which could jeopardise the accuracy of results. The sample size is also large, hence the elimination of all public holidays is not expected to have any effect on the empirical findings. In order to isolate the day-of-the-week effect from the holiday effect – the JSE is closed for trade on holidays – all South African public holidays (Table 3.1) have been identified. To control for the holiday effect, the mean returns before and after the holidays are deleted since the focus of this study is the investigation of the day-of-the-week effect. Thus, the holiday effect is separated from the day-of-the-week effect. All holiday returns have been omitted in the investigation of the day-of-the-week effect.

TABLE 3.1: SOUTH AFRICAN PUBLIC HOLIDAYS (SINCE 1994)

NATIONAL HOLIDAYS	DATE
New Year's Day	01-Jan
Human Rights Day	23-Mar
Good Friday	Friday before Easter Sunday
Family Day	Monday after Easter Sunday
Freedom Day	27-Apr
Workers Day	01-May
Youth Day	16-Jun
National Women's Day	09-Aug
Heritage Day	24-Sep
Day of Reconciliation	16-Dec
Christmas Day	25-Dec
Day of Goodwill	26-Dec

3.3 METHOD

Empirical studies on stock market anomalies employ a variety of methods to uncover stock market anomalies. These methods range from parametric tests, non-parametric tests, and dummy regression models with conditional and unconditional mean variances (see Chapter Two). Parametric test are suitable for application on normally distributed returns, while non-parametric methods are more suitable for non-normally distributed returns.

This study will firstly compute descriptive statistics of the indices and for each weekday of the indices to assess whether returns are normally distributed, in view of the assumption that continuously compounded returns follow the normal distribution. This will determine whether a parametric, semi-parametric or non-parametric approach will be used to detect seasonal patterns in returns, given that the traditional approaches used in the detection of the day-of-the-week effect depend on the assumption that returns follow a normal distribution. The descriptive statistics computed are the arithmetic mean, standard deviation, skewness, kurtosis, autocorrelations and the Ljung-Box Q-statistic for each stock market sector index, as given in Table 4.1.

Skewness measures the asymmetry of the probability density function of returns around their means. If skewness is negative, the data are spread out more to the left of the mean than to the right. If skewness is positive, the data are spread out more to the right. The skewness of the normal distribution (or any perfectly symmetric distribution) is zero. Skewness is extremely important in finance and investing. By knowing which way data is skewed, one can better estimate whether a given (or future) data point will be more or less than the mean. Kurtosis measures the peakedness of returns. Distributions with kurtosis exceeding three have fat tails and are leptokurtic and hence contain extreme values, while those with a kurtosis value of less than three have thin tails and are platykurtic. Normally distributed returns have a kurtosis value of three.

The Ljung-Box Q-statistic with the null hypothesis of serial independence in returns, informs us about the presence versus the absence of heterogeneity in returns of the nine

indices. It is also a form of testing for weak-form efficiency in equity markets. Negative significant first-order autocorrelation signifies the dependence of returns on past security prices, implying weak-form inefficiency in equity markets

As the returns for the nine industry sectors in this study are non-normally distributed, a non-parametric test is used. There are several non-parametric tests that can be used to investigate whether stock market anomalies exist for non-normally distributed returns. These are sometimes referred to as "distribution free tests". It is assumed that economic agents prefer maximal mean returns for a given level of risk, positively skewed returns and kurtosis in returns. These correspond to risk aversion, risk neutrality or a preference for risk.

These assumptions are accommodated by Tang (1996), whose method insists in the detection of the day-of-the-week effect in the mean, variance, skewness and kurtosis of returns. The application of the foregoing method, which this study follows, is accomplished in several stages. Firstly, mean returns are converted into standard scores by subtracting mean returns from each corresponding weekday mean return and dividing it by the corresponding standard deviation of each weekday for each sector index. For a normal distribution, this converts the mean to zero and the standard deviation to one. For an asymmetric distribution, this converts the mean to zero and the standard deviation to one without affecting skewness and kurtosis. This is vital as it enables one to identify distribution differences, if any, due to higher statistical moments, and allows for a direct test of the day-of-the-week effect on skewness and kurtosis of returns (Tang 1997:10).

The test of equal mean returns between two weekdays is then conducted using the two-sample Kolmogorov–Smirnov (K–S) test. The two-sample K–S test tests the equality of cumulative distribution functions between two samples. The K–S test is one of the best known non-parametric tests to compare two cumulative distribution functions to test for any differences in distribution between two samples. The null hypothesis is that the mean and variance of the computed standard scores between two weekdays for each stock market sector index must be equal. A rejection of this hypothesis (signified by a small p-

value) implies that the two samples have different kurtosis and skewness, therefore they differ in higher statistical moments. This will also imply the existence of a seasonal pattern in daily stock returns. The two-sample K–S test will directly be applied to the skewness and kurtosis to compare the differences in higher statistical moments between two weekdays of each stock market sector. This approach follows Tang (1996), who tests directly for the equality of higher moments between two return series. The advantage of using the K–S test in this study is that it is sensitive to any differences in statistical moments such as mean, variance, skewness and kurtosis. This represents a more direct test of higher statistical moments, such as the third and fourth moments, unlike the traditional non-parametric methods which test for differences in the first and second moments only, as discussed in Chapter Two. This is also consistent with recent trends in the pricing of securities where coskewness and cokurtosis extend the Capital Asset Pricing Model (CAPM) (Sears & Wei 1985). The two-sample K–S test uses the maximum vertical difference to compare two cumulative distribution functions and is represented as:

$$\text{Max } |F_m(X) - F_n(Y)|$$

where $F_m(X)$ is the observed cumulative distribution function of variable X; $F_n(Y)$ is the observed cumulative distribution function of variable Y; and *m* and *n* are the respective sample sizes. The bars denote the modulus of the difference in the two cumulative distribution functions. The two-sample K–S test takes into account the asymptotic distribution of sector returns (Tang, 1996:340).

3.4 CONCLUSION

In this chapter, the chronologically analytical framework to determine if the day-of-the-week effect is present in any of the nine JSE industry sector indices was set out. First, the data and proxies used in this study were discussed, such as issues arising from non-trading days and the use of daily data. Second, the analytical framework to decide whether to use parametric or non-parametric tests was discussed. Finally, the analytical framework to determine the existence of the day-of-the-week effect has been described.

Having set out the analytical framework, the next chapter applies this framework with the aim of achieving the objectives set out in Chapter One.

CHAPTER FOUR
ANALYSIS OF EMPIRICAL RESULTS

4.1 INTRODUCTION

Following the objectives set out in Chapter One and the theoretical background given in Chapter Two, this chapter applies the analytical framework that was set out in Chapter Three to determine if the day-of-the-week effect is present in any of the nine industry sectors listed on the JSE Securities Exchange of South Africa (JSE). The chapter is organised as follows: the first section analyses the descriptive statistics of the returns on the nine indices in general; the second analyses the descriptive statistics of each weekday for each index; the third describes the skewness and kurtosis of returns for each weekday for each index; and the fourth discusses the results from the two-sample Kolmogorov–Smirnov (K–S) test applied directly to skewness and kurtosis of returns for each weekday for the nine indices.

4.2 DESCRIPTIVE STATISTICS FOR NINE JSE INDICES

Table 4.1 provides a summary of the statistics for the nine JSE indices, namely the mean, standard deviation, skewness, kurtosis, autocorrelation and the Q-statistic. The mean returns for all the sectors range between 0.0123 percent for Technology (TECH) and 0.0641 percent for Telecom (TELEC), while the highest and lowest standard deviations recorded are 2.12 percent for TELEC and 1.15 percent for Industrials (INDI) respectively. The TELEC sector‟s returns are the highest of all the sectors, which may be the result of rapid innovation in the telecommunications sector during the period, which compensates for the high volatility in the sector‟s shares. High volatility in the case of TELEC high returns is also expected. The TECH sector‟s mean returns are less than the returns for other sectors, which may indicate the lack of competitiveness in South Africa‟s technology industry compared to its counterparts in the Far East, and the technology bubble‟s conclusion late in the twentieth century. Overall, the volatility in returns of all the indices is high (above 1.15 percent), which is well in line with most theory and empirical literature (Aron & Ayogu, 1997) on emerging stock market volatility.

TABLE 4.1: DESCRIPTIVE STATISTICS (3 JULY 1995–22 OCTOBER 2008)

Index	Abbreviation	Mean (%)	Standard Deviation (%)	Skewness	Kurtosis	Autocorrelations (1st0rder)	Q-statistic
FTSE/JSE Oil & Gas	OILGAS	0.0532	1.7709	-0.1519	7.0255	-0.4548	718.7913[a]
FTSE/JSE Basic Materials	BMATS	0.0349	1.6124	-0.2718	7.2595	-0.4629	744.4517[a]
FTSE/JSE Industrials	*INDI*	0.0437	1.2864	-0.629	11.2061	-0.4647	750.2733[a]
FTSE/JSE Consumer Goods	*CGDS*	0.0595	1.8025	0.3694	8.3737	-0.4802	801.2546[a]
FTSE/JSE Health Care	*HC*	0.0287	1.4116	-0.8892	10.6719	-0.4562	723.253[a]
FTSE/JSE Consumer Services	*CSVS*	0.0281	1.1545	-0.8892	10.6719	-0.431	645.5962[a]
FTSE/JSE Telecom	*TELEC*	0.0641	2.1277	0.0451	9.765	-0.4533	714.085[a]
FTSE/JSE Financials	*FINI*	0.0306	1.3285	-0.5138	11.1623	-0.4279	636.3181[a]
FTSE/JSE Technology	*TECH*	0.0123	2.111	-0.7745	12.9786	-0.479	796.9400[a]

[a] denotes the 1% significance level, [b] denotes the 5% significance level and [c] denotes the 10% significance level.

From Table 4.1, skewness is negative for returns of all sectors except Consumer Goods (CGDS) and TELEC. Given that the median in a negatively skewed distribution is above the mean, the actual returns are therefore likely to be above the mean. However, if actual returns are below the mean, this implies that returns are likely to deviate far more than returns above the mean. CGDS and TELEC have positive skewness, suggesting that the actual returns on these two indices are likely to be greater than the mean returns. Investing in TELEC and CGDS while ignoring transaction costs, seems to suggest that actual returns will be more than the average mean returns for these two indices. In addition, all the indices are leptokurtic in distribution, as shown by positive excess kurtosis, which is evidence of fat tails. This implies that the distribution of sector returns for all the sector indices tend to contain extreme values and are non-normally distributed. These results are consistent with the stylised facts of empirical finance data such as the non-normality of data. Thus, extreme returns occur more often than implied by the normal distribution. The general pattern of a negative skew and leptokurtosis indicates

that the returns contained in the sample follow a non-normal distribution. Non-parametric tests should therefore be used to detect any day-of-the-week effects among the nine JSE sector indices.

Weak-form efficiency in the markets for shares belonging to each index can be tested by computing the autocorrelation coefficient and the associated autocorrelation function. Negative and significant autocorrelation signifies the dependence of returns and contradicts the notion that returns follow a random walk. Negative first-order autocorrelation is very high for all the sector indices and is significant at the 1% level using the Ljung-Box Q-statistic with the null hypothesis of serial independence in returns. This implies weak-form inefficiency, which may be the result of only a few shares comprising each index, of which a significant proportion may be illiquid.

4.3 DESCRIPTIVE STATISTICS FOR EACH WEEKDAY

The arithmetic mean, standard deviation, kurtosis and skewness in returns for each day of the week for each index appear in Table 4.2.

For Oil & Gas (OILGAS), the highest mean rate of return is observed on Thursday and Friday, while the highest standard deviation is observed on Tuesday. Wednesday‟s mean returns are negative and the lowest. Monday to Wednesday‟s mean returns are negatively skewed, while Thursday and Friday‟s returns have a positive skew. This implies that Monday to Wednesday‟s returns are likely to deviate further down from the mean, while Thursday and Friday‟s returns are likely to deviate further up from the mean. Excessive peakedness is observed on Monday and Tuesday (8.5696 and 8.483 percent respectively), but diminishes towards the end of the week, culminating in a slight increase on Friday.

Negative mean returns are observed for Basic Materials (BMATS) on Wednesday and Friday, with highest returns on Thursday, mirroring those of OILGAS. Heymans (2005) also finds higher returns on Thursday using the JSE All Share Index. Monday has the highest volatility of 1.6957 percent. Monday, Wednesday and Thursday have negatively skewed returns and Monday again has the largest value of skewness which is -0.7048.

This indicates that returns on the BMATS index are likely to decline from the mean on Monday, Wednesday and Thursday. Negatively skewed returns on Monday and Wednesday seem to persist for the OILGAS and BMATS indices, while positively skewed Friday returns also persist for these two indices.

TABLE 4.2: DESCRIPTIVE STATISTICS: DAILY RETURNS (3 JULY 1995–22 OCTOBER 2008)

DAY	BMATS	CGDS	CSVS	FINI	HC	INDI	OILGAS	TECH	TELEC
Mean (%)									
Monday	0.0673	0.1075	0.0461	0.0141	0.0602	0.0506	0.0803	0.1458	0.1759
Tuesday	0.0626	0.0837	0.0624	0.0815	0.0645	0.1059	0.0057	0.0673	0.1377
Wednesday	-0.0217	0.0068	0.0406	0.0808	0.0407	0.0395	-0.098	-0.022	-0.0212
Thursday	0.0931	0.0798	0.0127	0.0111	-0.0051	0.0505	0.1525	-0.0957	0.0713
Friday	-0.0266	0.0198	-0.0223	-0.0344	-0.0171	-0.0279	0.1258	-0.0342	-0.0435
Standard Deviation (%)									
Monday	1.6957	1.6945	1.1879	1.3047	1.3838	1.3483	1.7032	1.9407	2.0006
Tuesday	1.62	1.9145	1.1648	1.4086	1.4935	1.3438	1.8495	2.108	2.2757
Wednesday	1.5762	1.7916	1.1587	1.3681	1.3366	1.3092	1.7627	2.4058	2.0502
Thursday	1.6051	1.8333	1.2179	1.2845	1.4077	1.2663	1.7798	2.1241	2.1442
Friday	1.5625	1.7745	1.0376	1.2714	1.4336	1.1543	1.7495	1.9394	2.1545
Skewness									
Monday	-0.7048	0.1016	-1.3257	-0.6956	-0.567	-1.2581	-0.8474	-0.6122	-0.0037
Tuesday	0.0863	0.6934	-1.2443	-1.3477	-1.1938	-1.4537	-0.0704	-1.6575	0.0415
Wednesday	-0.5393	0.4516	-0.3218	0.2556	0.214	0.3411	-0.3733	-0.6009	0.2104
Thursday	-0.2476	0.0684	-1.1539	-0.8406	-0.2251	-0.1819	0.1875	-1.1278	-0.2547
Friday	0.112	0.4394	-0.1064	0.1543	0.3867	-0.3817	0.2719	0.4154	0.2396
Kurtosis									
Monday	8.4802	8.7045	10.156	7.7167	8.6205	12.5137	8.5696	11.4266	5.4773
Tuesday	7.5762	11.9644	14.0033	16.7091	17.3732	20.107	8.483	22.7976	17.9196
Wednesday	8.7024	5.7786	8.3409	8.8966	6.9059	6.9931	6.5025	10.2733	7.1632
Thursday	5.6329	5.4089	11.4775	10.3464	5.5257	6.3907	5.3936	9.127	6.1992
Friday	5.4629	9.079	7.7719	10.3816	10.5219	5.9475	5.921	10.5269	8.2335
Autocorrelations (1st Order)									
Monday	-0.481	-0.5402	-0.4837	-0.4869	-0.4892	-0.4903	-0.4674	-0.499	-0.4669
Tuesday	-0.523	-0.4672	-0.4727	-0.4668	-0.5152	-0.4796	-0.5195	-0.4847	-0.4984
Wednesday	-0.4763	-0.4995	-0.4899	-0.4694	-0.4832	-0.4845	-0.5265	-0.4788	-0.5356
Thursday	-0.4503	-0.5334	-0.511	-0.4982	-0.4808	-0.5001	-0.4898	-0.5303	-0.551
Friday	-0.5204	-0.5237	-0.4862	-0.4683	-0.5305	-0.5116	-0.5341	-0.5037	-0.5102
Q-statistic									
Monday	161.2772	203.4242	163.1046	165.2474	166.8295	167.5737	152.2702	173.5453	151.9266
Tuesday	190.627	152.1612	155.7259	151.881	184.9836	160.3128	188.09212	163.7816	173.1661
Wednesday	158.1212	173.9115	167.2945	153.5464	162.7602	163.5817	193.234	159.7642	199.963
Thursday	141.1025	198.0516	181.7291	172.748	160.9114	174.0474	166.9608	195.7283	211.3364
Friday	188.5061	190.9	164.5151	152.6598	195.883	182.166	198.5271	176.5747	181.1862

All values are significant at the 1% level.

Industrials (INDI) returns are negative only on Friday, while Tuesday has the largest positive rate of return of 0.1059 percent. Volatility for INDI is highest on Monday. INDI‟s returns are negatively skewed for all the days of the week except Wednesday, indicating that actual returns are likely to decline from the mean returns for all days of the week except Wednesday, which has a positive skewness. Leptokurtosis is evident in the

distribution of returns and can be observed throughout the days of the week for all the index returns. Apart from INDI, negatively skewed Monday returns are also observed for the OILGAS and BMATS indices.

For CGDS, the highest mean return is observed on Monday (0.1075 percent), while the lowest mean return is observed on Wednesday (0.0068 percent). However, standard deviation is high (above 1.6 percent) throughout the days of the week, with the highest deviation on Tuesday. CGDS returns on all weekdays are positively skewed, indicating that actual returns from investing in CGDS, *ceteris paribus,* will be greater than the mean returns, with Tuesday expected to have a greater increase in returns and Thursday, which has the lowest increase in returns. This seems to suggest that investing in the CGDS sector will yield greater-than-mean returns across all weekdays if zero costs are assumed.

Health Care (HC) mean returns are only negative on Thursday and Friday and also lowest during these two days. Tuesday has the highest standard deviation of 1.4935 percent compared to 1.3363 percent for Wednesday. HC returns for Monday, Tuesday and Thursday are negatively skewed, indicating that actual returns on these three weekdays are likely to deviate downwards from the mean returns, with the worst decline in returns expected on Tuesday. Wednesday and Friday returns are expected to increase further up from the mean returns. Like the OILGAS, BMATS and INDI indices, the HC Monday returns are negatively skewed and Friday returns are positively skewed.

Consumer Services (CSVS) mean returns are negative on Friday and positive for other days of the week. Volatility is highest on Thursday and lowest on Friday. Lowest volatility and lowest returns on Friday are in line with theoretical and empirical findings regarding the relationship between risk and return, which states that high risk should be compensated by high returns. Similarly, low risk should suggest low returns. Negative skewness is observed for CSVS returns across all days of the week, suggesting that actual returns from investing in CSVS are expected to drop further from the mean across all the weekdays when zero transaction costs are assumed.

TELEC mean returns, just like the BMATS returns, are negative on Wednesday and Friday, while the highest mean returns of 0.1759 percent are observed on Mondays. TELEC index has the highest volatility of above 2 percent compared to all sector indices across all weekdays. Monday has the lowest standard deviation of 2 percent, while Tuesday‟s standard deviation is 2.27 percent. Monday and Thursday‟s returns are negatively skewed, while the remaining three weekdays‟ returns are positively skewed. This implies that actual returns for the TELEC sector are likely to go up from the mean on Tuesday, Wednesday and Friday, while they will decline from the mean on Monday and Thursday.

The Friday returns for Financials (FINI) are the lowest (-0.0344 percent), while the greatest mean returns are observed on Tuesday (0.0815 percent). Volatility is also highest on Tuesday and lowest on Friday, as can be expected. Actual returns for Monday, Tuesday and Thursday are likely to deviate downwards from the mean, as evidenced by negative skewness on these days. However, returns for Wednesday and Friday are likely to deviate further upwards from the mean, as indicated by positive skewness on these two days. The Monday negative skewness is persistent across all the sector indices, except in the CGDS sector.

The TECH sector returns are lowest on Thursday and highest on Monday (-0.957 percent and 0.1453 percent respectively). Skewness is only positive for returns on Friday, thus these returns are expected to deviate upwards from the mean. TECH‟s mean returns are negative on Monday, Tuesday, Wednesday and Thursday, suggesting lower actual returns on these weekdays than the mean returns. The highest standard deviation of 2.4058 percent is observed on Wednesday, while Friday has the lowest standard deviation of 1.9394 percent.

Generally, all mean returns for Monday and Tuesday are positive for all the sector indices, while mean returns for Friday are negative for all the sectors except CGDS and OILGAS. These findings reinforce Basher & Sadorsky‟s (2006) findings of positive Monday mean returns, although they contradict the study by Coutts & Sheik (2002),

which reported a negative Monday mean return for the JSE All Gold Index, as well as vast studies on international stock markets which reported negative Monday returns and positive Friday mean returns (see Balaban, 1995; Berument & Kiymaz, 2001; Dubois & Louvet, 1996; French, 1980; Gibbons & Hess, 1981). Kurtosis for all the sector returns is well above three, showing evidence of leptokurtic in the distribution of returns. The results also reveal weak-form inefficiency in the market for shares comprising each index across days of the week, with the Ljung-Box Q-statistic being significant at the 1% level. The results suggest that the returns for these nine stock market sectors are non-normally distributed around the mean, and have fatter tails and high peaks. Given that mean returns for the nine JSE sector indices do not follow the normal distribution, the use of non-parametric tests, which do not assume that index returns follow a particular distribution, are apt to the detection of seasonal effects, which is an implicit test of the weak version of the EMH (see Chapter Two). The next section presents the empirical findings from the application of these non-parametric tests.

4.4 SKEWNESS AND KURTOSIS FOR EACH WEEKDAY

Table 4.3 shows the skewness of daily mean returns of the nine JSE indices. Skewness measures the spread of returns around the mean, with negative skewness implying that actual returns are likely to deviate further downwards from the mean returns, while positive skewness implies that actual mean returns are likely to deviate further upwards from the mean returns. A normal distribution has a skewness value of zero. Table 4.3 shows the skewness for the nine indices by weekdays. Most empirical studies have overlooked skewness and kurtosis in mean returns, but these aspects are the major focus of this study (see Ajayi *et al*.; Berument & Kıymaz, 2001; Cross, 1973; French, 1980).

From the table, Monday returns are negatively skewed for all the stock market sectors except for CGDS, suggesting that Monday returns are likely to deviate downwards away from the mean. CSVS and INDI returns are likely to decline the most from the mean return on Mondays, while TELEC returns are the least skewed for the same day. TELEC contains stocks associated with low (if any) trading volumes, especially on Mondays before the year 2000. Of all the weekdays, Tuesdays on average has greater negative

skewness than all the weekdays, which may be due to investors‟ persistent efforts to rebalance their portfolios after the weekend. However, this requires empirical testing and would imply total market inefficiency.

TABLE 4.3: SKEWNESS FOR THE INDICES BY WEEKDAYS

INDEX	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
BMATS	-0.7048	0.0863	-0.5393	-0.2476	0.1120
CGDS	0.1016	0.6934	0.4516	0.0684	0.4394
CSVS	-1.3257	-1.2443	-0.3218	-1.1539	-0.1064
FINI	-0.6956	-1.3477	0.2556	-0.8406	0.1543
HC	-0.5670	-1.1938	0.2140	-0.2251	0.3867
INDI	-1.2581	-1.4537	0.3411	-0.1819	-0.3817
OILGAS	-0.8474	-0.0704	-0.3733	0.1875	0.2719
TECH	-0.6122	-1.6575	-0.6009	-1.1278	0.4154
TELEC	-0.0037	0.0415	0.2104	-0.2547	0.2396

Lakonishok & Maberly (1990) suggest that individual investors most actively trade on Monday, while institutional traders most actively trade on Tuesdays, which could help explain high volatility on Tuesdays because institutional investors form the bulk of most active traders in financial markets. This would also require further investigation.

Friday returns are positively skewed for all the sectors except INDI and CSVS, suggesting that actual returns on this day are more likely to increase further from the mean return. These findings on skewness are in line with findings reported on descriptive statistics for each weekday (see section 4.3).

CGDS returns are positively skewed across all the weekdays, suggesting greater-than-mean returns for investors in this sector. This seems to suggest greater-than-mean-returns for investing in CGDS when zero transaction costs are assumed. However, positive skewness for this sector can be attributed to the fact that consumption expenditure on goods and services supplied by companies comprising CGDS are fairly stable over time and likely to grow.

Negative skewness is observed for CSVS returns across all days of the week, suggesting that actual returns from investing in CSVS are expected to drop further from the mean across all the weekdays when zero transaction costs are assumed. This is quite a surprising finding, as this seems to suggest that investing in the CSVS sector will always yield lower returns than the mean across all days of the week, assuming that no other costs are incurred when investing in this sector. This is also in direct contrast to the findings reported for CGDS, where all weekday returns are positively skewed. The direct contrast between CGDS and CSVS also suggests the possibility that a beneficial portfolio consisting of CGDS and CSVS stocks can be compiled which may reduce risk, although further scrutiny of the relationship between the two is essential.

While Monday mean returns are positive and persistent across all sectors, overall Monday mean returns are negatively skewed, implying that less-than-mean returns are expected on this day of the week for all the industry sectors, except CGDS, where returns are positively skewed across all weekdays. Friday negative mean returns are also positively skewed and persistent for all the industry sectors except the CSVS and INDI sectors, implying a greater chance of investors earning greater returns than the mean on Friday, assuming that zero transaction costs are incurred. This is surprising, as it is not in line with other findings (see Ajayi *et al*., 2004; Berument & Kiymaz, 2001; Cross, 1973; French, 1980) of a negative mean Monday return and a positive mean Friday return. Lakonishok & Maberly (1990) suggest that investors tend to re-establish their positions on a Monday following the release of bad news over the weekend, thus investors tend to sell stocks on a Monday resulting in lower returns on this day. This does not seem to be the case for the nine JSE sectors, which all report positive Monday returns and negative Friday returns. However, Basher & Sadorsky (2006) report a positive Monday return for the JSE, as does this study. Negatively skewed returns for Wednesday are observed for the OILGAS, BMATS, CSVS and TECH industry sectors, while positively skewed returns for Wednesday are observed for the INDI and CGDS sectors.

Table 4.4 reports the kurtosis of returns for the nine JSE industry sectors. A normal distribution has a kurtosis value of three. Kurtosis greater than three indicates the

presence of leptokurtosis in the return distribution, while kurtosis less than three indicates platykurtic distribution in returns.

TABLE 4.4: KURTOSIS FOR THE INDICES BY WEEKDAYS

INDEX	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
BMATS	8.4802	7.5762	8.7024	5.6329	5.4629
CGDS	8.7045	11.9644	5.7786	5.4089	9.0790
CSVS	10.1560	14.0033	8.3409	11.4775	7.7719
FINI	7.7167	16.7091	8.8966	10.3464	10.3816
HC	8.6205	17.3732	6.9059	5.5257	10.5219
INDI	12.5137	20.107	6.9931	6.3907	5.9475
OILGAS	8.5696	8.4830	6.5025	5.3936	5.9210
TECH	11.4266	22.7976	10.2733	9.1270	10.5269
TELEC	5.4773	17.9196	7.1632	6.1992	8.2335

Leptokurtosis is evident in the distribution of returns for all sector indices across all weekdays. Excessive peakedness is observed on Tuesday for all nine sectors, while Monday has the second-highest peakedness in returns. Tang (1996) also finds excessive peakedness in Japanese returns on a Tuesday. This implies that volatility in stock prices on Tuesday is much higher than on the other days of the week. This is surprising and requires further investigation, as we would expect adjustment for weekend news to take effect on a Monday and thus expect Monday to be more volatile than any other day of the week. However, Lakonishok & Maberly (1990) suggest that individual investors most actively trade on Mondays, while institutional traders most actively trade on Tuesdays. This could help explain high volatility on Tuesdays, because institutional investors form the bulk of most active traders in financial markets. Kurtosis values on Wednesday are stable around six and nine, except for TECH with a value of 10.2733. TECH also has the highest kurtosis values throughout all the days of the week, indicating high volatility in return distributions of the TECH sector. Friday returns for BMATS, CSVS, INDI and OILGAS sectors are relatively less volatile compared to the other weekdays for these sectors. However, the kurtosis results vary across days of the week and also across the nine sectors of the JSE.

The evidence on skewness and kurtosis presented this far clearly shows that the returns for the nine JSE sector indices are non-normally distributed, hence non-parametric tests are suitable to determine whether a day-of-the-week effect exists. The next section reports results for the day-of-the-week effect tested directly on skewness and kurtosis using a two-sample Kolmogorov–Smirnov (K–S) test (Tang, 1996).

4.5 DAY-OF-THE-WEEK EFFECT TEST ON SKEWNESS AND KURTOSIS

The returns of the nine JSE industry sectors are non-normally distributed around the mean, prompting the use of a non-parametric test to detect any day-of-the-week effect. The two-sample K–S test, which is a non-parametric test, is employed in this study. The two-sample K–S test tests the null hypothesis that the mean and variance of the computed standard scores between two weekdays for each stock market sector index are equal. A rejection of this hypothesis (signified by a small p-value) implies that the two weekdays have different kurtosis and skewness and therefore differ in higher statistical moments. This will also imply the existence of a seasonal pattern in daily stock returns. The two-sample K–S test will directly be applied to the skewness and kurtosis to compare the differences in higher statistical moments between two weekdays of each stock market sector. To determine the presence of the day-of-the-week effect, the mean returns for each sector for the one weekday must be significantly different from those of all the other weekdays at the 10% level or lower.

The returns are first standardised before testing the null hypothesis. Standardising transforms the mean to zero and the standard deviation to one and does not affect skewness and kurtosis. This allows the day-of-the-week effect to be tested directly on skewness and kurtosis. Ten pairs of weekdays are constructed from the five weekdays. Table 4.5 shows the two-sample K–S test results for the day-of-the-week effect tested directly on skewness and kurtosis. The maximum vertical significant difference between two weekdays‟ returns is tested using the two-sample K-S test statistic and the results are presented in table 4.5.1. It should be noted that the p-values are not given as values in this case, although they do not affect the interpretation of results.

The positive BMATS mean returns for Monday are significantly different at the 1% level from the Wednesday and Friday mean returns due to differences in higher statistical moments. BMATS negative returns for Wednesday are also significantly different from the Monday, Tuesday and Thursday mean returns.

TABLE 4.5: TWO-SAMPLE KOLMOGOROV–SMIRNOV TEST USING STANDARD SCORES FOR EACH SECTOR'S RETURNS

Category	BMATS	CGDS	CSVS	FINI	HC	INDI	OILGAS	TECH	TELEC
Mon-Tue	0.0532	0.066	0.0676	0.0273	0.0432	0.0403	0.0561	0.0489	0.046
	p > .10	p < .10[c]	p < .10[c]	p < .10[c]	p > .10	p > .10	p > .10	p > .10	p > .10
Mon-Wed	0.0921	0.1007	0.0576	0.0288	0.1007	0.0863	0.0935	0.0475	0.0633
	p<.01[a]	p<.005[a]	p > .10	p > .10	p<.005[a]	p<.025[b]	p<.005[a]	p > .10	p > .10
Mon-Thur	0.0334	0.0726	0.0507	0.0698	0.0668	0.0521	0.0323	0.0538	0.0481
	p > .10	p < .10[c]	p > .10	p < .10[c]	p < .10[c]	p > .10	p > .10	p > .10	p > .10
Mon- Fri	0.0911	0.0798	0.0943	0.111	0.0754	0.1029	0.0409	0.1	0.0813
	p<.01[a]	p< .025[b]	p < .005[a]	p < .001[a]	p < .05[b]	p<.005[a]	p > .10	p<.005[a]	p< .025[b]
Tue-Wed	0.0662	0.0619	0.0532	0.0604	0.0734	0.0748	0.082	0.0504	0.059
	p < .10[c]	p > .10	p > .10	p > .10	p < .05[b]	p < .05[b]	p< .025[b]	p > .10	p > .10
Tue-Thur	0.0202	0.0391	0.0341	0.0669	0.0612	0.0521	0.0103	0.0426	0.0453
	p > .10	p > .10	p > .10	p < .10[c]	p > .10	p > .10	p > .10	p > .10	p > .10
Tue- Fri	0.0641	0.0569	0.0756	0.1101	0.0828	0.0914	0.0266	0.0626	0.0986
	p > .10	p > .10	p < .05[b]	p<.001[a]	p< .025[b]	p< .01[a]	p > .10	p > .10	p<.005[a]
Wed-Thur	0.0217	0.01	0.0287	0.0425	0.0284	0.0219	0.0001	0.0421	0.0101
	p<.001[a]	p > .10	p > .10	p > .10	p > .10	p > .10	p<.005[a]	p > .10	p > .10
Wed- Fri	0.0324	0.0295	0.0727	0.0842	0.0372	0.0511	0.0044	0.0598	0.0411
	p > .10	p > .10	p < .10[c]	p<.025[b]	p > .10	p > .10	p < .05[b]	p > .10	p > .10
Thur- Fri	0.1066	0.0548	0.072	0.0706	0.036	0.0865	0.0476	0.0562	0.0548
	p<.001[a]	p > .10	p< .10[c]	p < .10[c]	p > .10	p<.025[b]	p > .10	p > .10	p > .10

Upper row shows the K–S test statistic.
Lower row shows the Probab > K–S test statistic.
[a] significant at 1 %, [b] significant at 5% and [c] significant at 10% level.

Although the mean returns for Monday are significantly different from the Friday mean returns and significant at the 1% level, the highest significant difference in returns is observed between the returns for Wednesday and Thursday (0.0407 compared to 0.0714 percent respectively). Thus, the BMATS stock market sector index has a significant day-of-the-week effect due mainly to the mean, skewness and kurtosis of Wednesday returns, which are significantly different from those on other weekdays.

TABLE 4.5.1: TWO-SAMPLE KOLMOGOROV-SMIRNOV TEST ON WEEKDAY MEAN RETURN DIFFERENCES FOR EACH SECTOR

Category	BMATS	CGDS	CSVS	FINI	HC	INDI	OILGAS	TECH	TELEC
Mon-Tue	0.0047	0.0238	0.0163	0.0674	0.0043	0.0553	0.0746	0.0785	0.0382
	p > .10	p < .10[c]	p < .10[c]	p < .10[c]	p > .10	p > .10	p > .10	p > .10	p > .10
Mon-Wed	0.0456	0.1007	0.0055	0.0667	0.0195	0.0111	-0.0177	0.1238	0.1547
	p<.01[a]	p<.005[a]	p > .10	p > .10	p<.005[a]	p<.025[b]	p<.005[a]	p > .10	p > .10
Mon-Thur	0.0258	0.0277	0.0334	0.003	0.0551	0.0001	0.0722	0.0501	0.1046
	p > .10	p < .10[c]	p > .10	p < .10[c]	p < .10[c]	p > .10	p > .10	p > .10	p > .10
Mon- Fri	0.0939	0.0877	0.0238	-0.0203	0.0431	0.0227	0.0455	0.1116	0.1324
	p<.01[a]	p< .025[b]	p < .005[a]	p < .001[a]	p < .05[b]	p<.005[a]	p > .10	p<.005[a]	p< .025[b]
Tue-Wed	0.0409	0.0769	0.0218	0.0007	0.0238	0.0664	-0.0923	0.0453	0.1165
	p < .10[c]	p > .10	p > .10	p > .10	p < .05[b]	p < .05[b]	p< .025[b]	p > .10	p > .10
Tue-Thur	0.0305	0.0039	0.0497	0.0704	0.0594	0.0554	0.1468	-0.0284	0.0664
	p > .10	p > .10	p > .10	p < .10[c]	p > .10	p > .10	p > .10	p > .10	p > .10
Tue- Fri	0.036	0.0639	0.0401	0.0471	0.0474	0.078	0.1201	0.0331	0.0942
	p > .10	p > .10	p < .05[b]	p<.001[a]	p< .025[b]	p< .01[a]	p > .10	p > .10	p<.005[a]
Wed-Thur	0.0714	0.073	0.0279	0.0697	0.0356	0.011	0.0545	0.0737	0.0501
	p<.001[a]	p > .10	p > .10	p > .10	p > .10	p > .10	p<.005[a]	p > .10	p > .10
Wed- Fri	0.0049	0.013	0.0183	0.0464	0.0236	0.0116	0.0278	0.0122	0.0223
	p > .10	p > .10	p < .10[c]	p<.025[b]	p > .10	p > .10	p < .05[b]	p > .10	p > .10
Thur- Fri	0.0665	0.06	-0.0096	-0.0233	0.012	0.0226	0.0267	0.0615	0.0278
	p<.001[a]	p > .10	p< .10[c]	p < .10[c]	p > .10	p<.025[b]	p > .10	p > .10	p > .10

Upper row shows differences between weekdays mean returns
Lower row shows the Probab > K–S test statistic.
[a] significant at 1 %, [b] significant at 5% and [c] significant at 10% level.

Basher & Sadorsky (2006) also reports a Wednesday effect in Argentina, which may confirm that anomalies are a global phenomenon. This may be due to seasonal effects in the prices of commodities such as base metals, which determine the earnings of companies comprising BMATS. Heymans (2005) finds higher returns on a Thursday using the JSE All Share Index. The current study also finds significant higher returns on Thursday for the BMATS sector. Unlike Berument & Kiymaz (2001), who report the greatest returns on a Wednesday, this study reports the lowest returns on a Wednesday for the BMATS sector. However, this is inconsistent with the majority of findings on stock market anomalies, which document either a Monday or a Friday effect, with Monday returns significantly lower than those on Friday. Not only does this study find a Wednesday effect, it also observes the positive returns on Monday relative to the other weekdays for all nine JSE sectors. Friday returns also exhibit negative returns for all nine

sectors, which is inconsistent with common findings on day-of-the-week effects (see for instance Ajayi *et al*., 2004; Berument & Kiymaz, 2001).

The Monday mean returns for CGDS are statistically different from all other days of the week. Monday is significantly different from Tuesday and Thursday at the 10% level, Friday at the 5% level and Wednesday at the 1% level. CGDS returns, like BMATS returns, are more volatile on a Tuesday than on other days of the week. All other pairs of weekdays are not significantly different from each other. The highest difference in returns is observed between Monday returns and Wednesday returns and is significant at the 1% level. However, Monday returns are also significantly different from the low Friday returns at the 5% level, although this does not represent the maximum difference in returns between two weekdays, as is the case for BMATS. Monday returns are the highest returns, while Wednesday returns are the lowest for the CGDS index. Since the day-of-the-week effect is being examined on the mean and higher statistical moments, the mean return, skewness and kurtosis on Monday are significantly different from those on all other weekdays. Thus, a Monday effect exists for the CGDS stock market sector, confirming Basher & Sadorsky‟s (2006) findings for the JSE All Share Index. Since the Basher & Sadorsky (2006) study was done earlier, this finding might suggest the persistence of the Monday effect across some of the nine stock market sectors.

Ajayi, Mehdian & Perry (2004) also document a significant positive Monday mean return for Russia. However, most studies report a negative Monday mean return for developed stock markets (see for example Berument & Kiymaz, 2001; Cross, 1973; Gibbons & Hess, 1981) and some emerging stock markets (see for example Aggarwal & Rivoli, 1989; Ajayi *et al*., 2004).

The Monday mean returns for CSVS are significantly different from those on Friday and Tuesday at the 1% level and 10% level respectively. Friday mean returns for CSVS also differ from those on Wednesday and Thursday at the 10% level. Furthermore, returns on Friday differ from those on Tuesday and are significant at the 1% level. Thus Friday returns are significantly different from those on Monday, Tuesday, Wednesday and

Thursday. The maximum difference in returns is observed between returns on Monday and Friday and is significant at the 1% level. It can therefore be concluded that seasonality in CSVS is mainly due to Friday mean returns, skewness and kurtosis which differ significantly from all other weekdays. Negative skewness of mean returns for CSVS throughout the week can be attributed to illiquidity in this market and less investment in this sector. This is consistent with findings in other international stock markets, such as the Philippines and Taiwan, where a Friday effect has been identified (Basher & Sadorsky, 2006:628). This also confirms the global nature of the Friday effect in financial markets.

The FINI stock market sector mean returns are significantly different between Monday and Tuesday and Monday and Thursday at the 10% level. Monday FINI returns are greatly different from those on Friday and significant at the 1% level. Tuesday FINI returns are also significantly different from those on Friday at the 1% level. Tuesday and Thursday FINI mean returns are significant at the 10% level, as well as Thursday and Friday mean returns. However, Wednesday and Friday returns are significantly different at the 5% level. Although Monday returns for FINI are higher than those on Friday and significant at 1% level, the highest significant difference in returns of 0.0471 percent is observed between Tuesday and Friday returns, which investors can incorporate in their risk-return decisions.

While this study documents a higher mean return for the JSE FINI sector on a Tuesday, Balaban (1995) reports negative Tuesday mean returns for the emerging stock market of Turkey. The differences in these findings can be attributed to the use of sector indices in this study rather than the entire stock market index, as well as the differences in structure between the JSE and the Istanbul Stock Exchange.

The seasonality in the JSE FINI sector is mainly due to Friday returns, skewness and kurtosis, which are significantly different from all other weekdays. This is also in line with the findings for the CSVS sector. Because it comprises banks and insurance shares, the FINI sector is one of the most traded sectors of the JSE. This results in much smaller

spreads and less volatility compared to all the other sectors of the JSE, as indicated by low standard deviation, skewness and kurtosis values.

The mean returns for HC are significantly different between Monday and Wednesday (at the 1% level), Monday and Thursday (at the 10% level) and between Monday and Friday (at the 5% level). HC mean returns for Tuesday are also different from those on Wednesday and Friday at the 5% level. Monday returns are significantly higher than all the other weekday returns for the HC sector. The seasonality in the HC sector is mainly due to Monday returns, which are significantly different in mean, skewness and kurtosis compared to all other weekdays, as is the case for CGDS. Thus a Monday effect does exist for the HC sector. This reinforces earlier studies which document the existence of the Monday effect, although they find negative Monday returns (see Aggarwal & Rivoli, 1989; Ajayi *et al*., 2004; Berument & Kiymaz, 2001; Cross, 1973; Gibbons & Hess, 1981).

The positive Monday returns in this study compared to negative Monday returns documented by other studies can be attributed to the differences in investor perspectives in the different markets, as well as differences in the microstructure of the stock markets that were investigated. The use of sector indices by this study could also be the source of these differences, as can the methodology that was used. The maximum difference in mean returns of 0.0551 percent is observed between Monday and Thursday, but is significant at the 10% level. Monday and Friday mean returns are different by 0.431 percent and significant at the 5% level. However, the least difference in returns between Monday and Wednesday is observed at 0.0195 percent. Surprisingly, the most significant difference in returns is between Monday and Wednesday, which are significant at the 1% level. The least but most significant difference in returns is thus observed between Monday and Wednesday mean returns, once again similar to CGDS. The CGDS and HC sectors have the same day-of-the-week effect and also similar days with the highest significant difference in returns. It would therefore make economic sense for market participants to sell HC stocks on Monday, when the returns are high and positive, and

buy them on a Wednesday, when the returns are low, provided that trading costs are negligible.

The INDI mean returns also resemble seasonality across days of the week. INDI Monday and Wednesday returns are different from each other and are significant at the 5% level. Monday INDI returns are highly statistically different from Friday returns and significant at the 1% level. Tuesday INDI mean returns are also different from those on Wednesday and Friday, at 5% and 1% level respectively. Thursday mean returns are also different from Friday mean returns at the 5% level. The maximum difference in mean returns is between those on Tuesday and Friday (0.078 percent) at the 1% level, followed by the difference between returns on Monday and Friday (0.0227 percent), which are also significant at the 1% level. This is in line with the findings in the FINI sector, where Tuesday returns are the maximum and Friday returns the minimum. Differences in skewness and kurtosis of mean returns are also greatest between Tuesday and Friday. Seasonality in the INDI mean returns is mainly due to Friday mean returns. Thus Friday mean returns are significantly different from those on all other weekdays, hence it can be concluded that a Friday effect for the INDI sector is present. Basher & Sadorsky (2006) also report a Friday effect in the Philippines, Taiwan and Turkey.

The OILGAS mean returns, like those of other stock market sectors, also show similar patterns of seasonality. The Monday mean returns for OILGAS are significantly different from those on Wednesday at the 1% level. Wednesday mean returns are significantly different from those on Tuesday, Thursday and Friday, and significant at the 5%, 1% and 5% levels respectively. The maximum and significant difference in mean returns for the OILGAS sector is between Wednesday and Thursday (0.0545 percent). Wednesday mean returns are significantly different in mean, skewness and kurtosis from all the weekday returns for the OILGAS sector, thus it can be concluded that a Wednesday effect exists for the OILGAS sector. This was also the case for Argentina (Basher & Sadorsky, 2006). This is contrary to the majority of findings regarding returns for the other JSE stock market sectors, which were subject to a Monday or Friday effect, as well as other international evidence (Gibbons & Hess, 1981; Jaffe & Westerfield, 1985). In addition,

the Monday returns are not significantly different from the Friday mean returns as observed in all the other stock market sectors. This difference in the nature of the day-of-the-week for OILGAS mean returns can be ascribed to the volatile commodity prices of oil and gas, which may be subject to seasonal effects, although this fails to explain the occurrence of such an anomaly on a Wednesday. The cause of the Wednesday effect for the OILGAS sector is a mystery and requires further investigation.

TECH mean returns are only significantly different between Monday and Friday returns at the 1% level. The mean returns, skewness and kurtosis for all other weekdays show no statistical difference. The maximum difference in returns between Monday and Friday is highly significant and consistent with findings in the other stock market sectors, which show Monday mean returns being different from Friday mean returns, except for the OILGAS sector. To an investor, this would imply buying the TECH stocks on a Friday when they are low and selling them on a Monday when returns are high, assuming transaction costs are trivial.

The TELEC Monday mean returns are different from the Friday returns and significant at the 5% level. Tuesday TELEC returns are also significantly different from Friday mean returns at the 1% level. This may indicate a Friday effect in the TELEC mean returns. All other pairs of weekdays are not significantly different from each other in mean, skewness and kurtosis. The highest difference in mean returns of 0.1324 percent is observed between Monday and Friday and is significant at the 5% level. Tuesday mean returns are higher than Friday mean returns by 0.0942 percent and significant at the 1% level. Although Monday returns are greater than Friday returns and significant at the 5% level, the most significant difference is observed between Tuesday and Friday mean returns. This is also consistent with the findings in the INDI and FINI sectors, where Tuesday returns were significantly higher than Friday returns.

4.6 RESULTS

Overall, the results reveal that BMATS and OILGAS sectors have a significant Wednesday effect, with the maximum difference in returns observed between Wednesday

and Thursday. The CGDS and HC sectors reveal a significant Monday effect, with both sectors displaying a significant maximum difference in returns between Monday and Wednesday. CSVS, FINI, INDI, TECH and TELEC sectors reveal a significant Friday effect.

However, the nature of differences in returns differs across these sectors. The CSVS, TECH and TELEC sectors display the maximum difference in returns between Monday and Friday and are significant at the 1% level. The maximum difference in returns for the FINI and INDI sectors is observed between Tuesday and Friday, and is significant at 1% level. The BMATS and OILGAS sectors represent the raw materials sector on the JSE, and a Wednesday effect has been found in these sectors. The CGDS and HC sectors represent the most basic necessities, and a Monday effect has been identified in these sectors. The FINI and INDI sectors all fall under financials, and a Friday effect has been identified in both these sectors. The CSVS, TELEC and TECH sectors maybe grouped under the services sector, and in all these sectors a Friday effect has been identified. It can thus be concluded that the day-of-the-week effect is uniform across all these segments of the stock market.

While there is a significant Friday effect in CSVS mean returns, Friday mean returns for CSVS are significantly different from all the other days of the week. A Friday effect is also more pronounced in FINI mean returns. A Monday effect is more prominent in the HC mean returns. INDI mean returns, like the CSVS mean returns, have a more prominent Friday effect. A prominent Wednesday effect is observed for the OILGAS mean returns compared to other days of the week, which is similar to results reported for the BMATS mean returns. Monday returns for the TECH sector are only significantly different from Friday returns. No seasonal pattern is observed for TECH mean returns across other days of the week. TELEC mean returns show a Friday effect, just like the mean returns for CSVS, FINI and INDI. Overall results show that Monday mean returns are significantly different from Friday mean returns for eight stock market sectors, except for OILGAS. This also augments findings by Basher & Sadorsky (2006) on South Africa using the JSE All Share Index, though these authors use conditional and unconditional

risk dummy variable regression models. To investors, this implies buying stocks when their prices are low and selling them when they are high, for instance buying CSVS stocks on a Friday and selling them on a Monday, provided transaction costs are trivial. However, it is important to note that transaction costs may erode away the profit opportunities that exist from following such a trading strategy.

The results of this study tentatively reveal a day-of-the-week effect on the nine JSE sectors due to differences in higher statistical moments. The Monday effect detected in the stock market sectors such as CGDS and HC can be attributed to the release of bad news during weekends and investors‟ preference to close short on Fridays to avoid a disruption to their trading strategy as a result of developments during the weekend. This contradicts Lakonishok & Maberly‟s (1990) suggestion that investors buy stocks on Friday (thus higher returns on this day) and reposition on a Monday (thus selling stocks on this day, resulting in lower returns on Monday). The contradiction between these findings can be attributed to the different methodologies applied as well as the peculiar nature of the JSE stock market compared to other stock markets, as suggested by Coutts & Sheik (2002).

The Wednesday effect is detected in the BMATS sector as well as the OILGAS sector. The cause of this anomaly is not clear and requires further investigation, as it is beyond the scope of this study. Seasonality in the CVS, FINI, INDI, TECH and TELEC sectors is mainly due to Friday mean returns. These day-of-the-week effects can be attributed to the differences in the day-of-the-week return volatilities, skewness and kurtosis, since the test was on differences in mean returns due to differences in higher statistical moments. Day-of-the-week effects exist due to differences in higher statistical moments across days of the week and across the nine sectors.

The discovery of these anomalies could be attributed to the use of stock market sector indices which is consistent with investors‟ choice of shares, unlike previous studies which used indices computed from companies belonging to all industries. Unlike in other markets where investors buy stocks on a Friday and sell on a Monday (Balaban, 1995;

Berument & Kiymaz, 2001; French, 1980; Dubois & Louvet, 1996), investors in these nine JSE stock market sectors seem to buy stocks on a Monday, resulting in higher returns on a Monday, and sell on a Friday, resulting in lower returns on a Friday. This behaviour suggests the risk-averse nature of investors in the JSE who close out their positions before the weekend to avoid the impact of – and worrying over – bad news released during the weekend. They then open up their positions again on Monday, after taking into account the weekend‟s news. This behaviour could also highlight the investors‟ preference for liquidity towards the weekend, as is the case when investors sell stocks before holidays (see for example Bouman & Jacobsen, 2002; Cao & Wei, 2004; Kamstra *et al*., 2003).

The exclusion of transaction costs in the analysis of the day-of-the-week effect is an important omission if these are non-trivial.

CHAPTER FIVE
SUMMARY, CONCLUSION AND AREAS FOR FURTHER RESEARCH

5.1 SUMMARY OF FINDINGS AND CONCLUSION

The study examined the existence of the day-of-the-week effect in nine major sector indices listed on the Johannesburg Securities Exchange of South Africa (JSE). These sectors included Oil & Gas (OILGAS), Basic Materials (BMATS), Industrials (INDI), Consumer Goods (CGDS), Health Care (HC), Consumer Services (CSVS), Telecom (TELEC), Financials (FINI) and Technology (TECH). The examination was conducted to assess the efficiency of the JSE stock market sectors, test the Efficient Market Hypothesis (EMH) and address the gap in the literature on anomalies in emerging stock markets. The purpose of the study was to ascertain whether any day-of-the-week effects are present in any of the nine JSE industry sectors. Owing to the oversimplified assumptions of the EMH, it is imperative to investigate the reaction of stock markets to information announcements, the predictability of stock returns and stock market anomalies, as investors can gain by exploiting such information if trading costs are trivial.

The first step was to review the relevant existing literature and empirical findings on anomalies in developed and emerging stock markets. The general findings were that day-of-the-week effects exist in both developed and emerging stock markets, regardless of whether parametric tests, non-parametric tests or regression models are used to identify these trends. Negative returns for Monday were observed in most stock markets and were significantly different from high returns on Friday. Most of the studies reviewed used the entire stock market index rather than sector stock market indices. The analysis of the existing literature also revealed that stock market returns are non-normally distributed, hence the need to use non-parametric methods to investigate the day-of-the-week effect. However, previous studies have used non-parametric methods that omit differences in distribution due to higher moments such as skewness and kurtosis. These aspects were specifically considered in this study, and as such constitute an approach that is still rare in

seasonality studies. Following Tang (1996), the mean returns for the nine JSE sectors were first standardised before testing for the day-of-the-week effect. Standardisation converted the mean returns to zero and standard deviation to one, allowing one to directly test for the day-of-the-week effect on skewness and kurtosis. Sector indices were used in line with investors‟ share preferences.

The empirical results show that there are day-of-the-week effects in skewness and kurtosis for all nine JSE stock market sectors. However, the effect varies from one sector to another and across weekdays, as shown in Table 5.1.

TABLE 5.1: DAY-OF-THE-WEEK EFFECT FOR NINE JSE SECTORS

FTSE/JSE index	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Oil & Gas (OILGAS)			X ↓	↑	
Basic Materials (BMATS)			X ↓	↑	
Industrials (INDI)		↑			X ↓
Consumer Goods (CGDS)	X↑		↓		
Health Care (HC)	X↑		↓		
Consumer Services (CSVS)	↑				X ↓
Telecom (TELEC)		↑			X ↓
Technology (TECH)	↑				X ↓
Financials (FINI)		↑			X ↓

X denotes the day-of-the-week effect, ↑ the maximum significant mean returns and ↓the lowest significant mean returns for each sector by weekday.

In particular, BMATS and OILGAS returns show a Wednesday effect, with the maximum difference in returns observed between Wednesday and Thursday. CGDS and HC returns show a Monday effect, with maximum differences in returns between Monday and Wednesday, while TELEC, CSVS, FINI, TECH and INDI mean returns show a Friday effect. CSVS, TECH and TELEC sectors display the maximum significant difference in returns between Monday and Friday returns. The FINI and INDI sectors show a maximum significant difference in returns between Tuesday and Friday, significant at 1% level. Overall results show that positive mean returns on Monday are

significantly different from negative mean returns on Friday for all stock market sectors, except OILGAS, although in some cases this does not represent the maximum difference in returns.

The positive Monday effect and negative Friday effect found in this study signifies the unique nature of the JSE as compared to other markets, which investors should take into consideration. As such, this study presents new evidence for the day-of-the-week effect on the JSE and proves that the day-of-the-week effect is not only a developed stock market phenomenon, but a global phenomenon. It can be tentatively concluded from this study that day-of-the-week effects exist in the nine major JSE stock market sectors and that the JSE is weak-form inefficient. However, the exploitation of these anomalies is of importance in that investors could base their buying and selling decisions on the findings of this study, provided that they consider the inclusion of transaction costs. These costs may be non-trivial for non-institutional investors and may erode any possible profit derived from capitalising on day-of-the-week effects.

5.2 AREAS FOR FURTHER RESEARCH

While this study examined the day-of-the-week effect directly on higher statistical moments, future studies should apply the same method, but include transaction costs to determine the possibility of investors exploiting these anomalies.

Regarding the JSE, the use of stock market sectors rather than the All Share Index is more likely to give accurate results, hence future studies should focus on micro- rather than macrolevels.

It would also be worthwhile to investigate if there are portfolio diversification benefits from holding any combination(s) of these nine stock market sectors. The use of parametric methods, which are amenable to returns that follow statistical distributions other than the normal, would also be useful to detect seasonality.

Since this study could not ascertain the cause of the Wednesday effect, future studies should explore the possible causes of such an anomaly for the BMATS and OILGAS sectors, as well as the cause of high volatility on a Tuesday rather than on Monday when investors rebalance their portfolios following weekend news.

REFERENCES

AGGARWAL, R., RAO, P.R., and HIRAKI, T., 1990. "Regularities in Tokyo Stock Exchange Security Returns: P/E, Size and Seasonal Influences", *Journal of Financial Research*, 13:249–263.

AGGARWAL R. and RIVOLI, P., 1989. "Seasonal and Day-of-the-week Effect in Four Emerging Stock Markets", *Financial Review*, 24:541–550.

AGRAWAL, A. and TANDON, K., 1994. "Anomalies or Illusions?: Evidence from Stock Markets in Eighteen Countries", *Journal of International Money and Finance*, 13:83–106.

AJAYI, R.A., MEHDIAN, S., and PERRY, M.J., 2004. "The Day-of-the-Week Effect in Stock Returns: Further Evidence from Eastern European Emerging Markets", *Emerging Markets Finance and Trade*, 40(4):53–62.

ALBUM, A., 1996. "Guide to African Stock Markets", *African Business*, 15–16.

AL-KHAZALI, O., 2002. "Stochastic dominance as a decision technique for ranking investments", *Academy for Economics and Economic Education*, 5(1):1–8.

AL-LOUGHANI, N.E, AL-SAAD, K.M. and ALI, M.M., 2005. "The Holiday Effect and Stock Return in the Kuwait Stock Exchange", *Journal of Global Competitiveness*, 13:81–91.

AL-LOUGHANI, N.E and CHAPPELL, D., 2001. "Modeling the Day-of-the-Week effect in the Kuwait Stock Exchange: A non-linear Garch representation", *Applied Financial Economics*, 11: 353–359.

AL-SAAD, K., and MOOSA, I., 2005. "Seasonality in Stock Returns: Evidence from an Emerging Market", *Applied Financial Economics*, 15(1):63–71.

ARIEL, R., 1987. "A Monthly Effect on Stock Returns", *Journal of Financial Economics*, 18:161–174.

ARON, J. and AYOGU, M., 1997. "Foreign Exchange Market Efficiency Tests in Sub-Saharan Africa", *Journal of African Economies*, 6(3):150–192.

AYADI, F.O., DUFRENE, U.B. and CHATTERJEE, A., 1998. “Stock Return Seasonalities in Low-Income African Emerging Markets”, *Journal of Managerial Finance*, 24(3): 22–3.

BALABAN, E. 1995. Day-of-the-week Effects: New Evidence from an Emerging Market, *Applied Economics Letters*, 2:139–143.

BARONE, E., 1990. “The Italian Stock Market: Efficiency and Calendar Anomalies”, *Journal of Banking and Finance*, 14:485–510.

BASHER, S.A. and SADORSKY, P., 2006. "Day-of-the-Week Effects in Emerging Stock Markets," *Applied Economics Letters*, 13(10):621–628.

BASU, S., 1977. “The Investment Performance of Common Stocks in Relation to their Price to Earnings Ratio: A Test of the EMH", *Journal of Finance*, 32:663−682.

BERUMENT, H. and KIYMAZ, H., 2001. “The Day-of-the-Week Effect on Stock Market Volatility”, *Journal of Economics and Finance,* 25:181–193.

BHABRA, H.S., DHILLON, U.S. and G.G. RAMIREZ, G.G., 1999. "A November Effect? Revisiting the Tax-Loss-Selling Hypothesis," *Financial Management*, 28:5–15.

BHARDWAJ, R.K. and BROOKS, L.D., 1992. “The January Anomaly: Effects of Low Share Price, Transaction Costs and Bid-Ask Bias,” *Journal of Finance*, 47:553–575.

BOUDREAUX, D.O., 1995. The Monthly Effect in International Stock Markets: Evidence and Implications. *Journal of Financial and Strategic Decisions*, 8(1):15–20.

BOUMAN, S and JACOBSEN, B., 2002. “The Halloween Indicator, Sell in May and Go Away: Another Puzzle”, *American Economic Review*, 92(5):1618–1635.

BROOKS, C. and PERSAND, G., 2001. Seasonality In Southeast Asian Stock Markets: Some New Evidence On Day-of-the-week Effects. *Applied Economics Letters*, 8:155–158.

CAO, M. and WEI, J., 2004. “Stock Market Returns: A Temperature Anomaly”*, Journal of Banking and Finance*, 29(6):1559–1573.

CHANG, T., NIEH, C. and WEI, C., 2006. "Analysis of Long-Run Benefits from International Equity Diversification Between Taiwan and its Major European Trading Partners: An Empirical Note", *Applied Economics*. 38: 2277–2283.

CHOWDHURY, A. R., 1994. "Stock Market Interdependencies: Evidence from the Asian NIEs", *Journal of Macroeconomics.* 16:629–651.

CHUKWUOGOR, C., 2008. "An Econometric Analysis of African Stock Market: Annual Returns Analysis, Day-of-the-Week Effect and Volatility of Returns", *International Research Journal of Finance and Economics,* Issue 14.

COUTTS, J. A. and SHEIKH, M. A., 2002. "The Anomalies that Aren't There: The Weekend, January and Preholiday Effects on The All Gold Index on the Johannesburg Stock Exchange 1987-1997", *Applied Financial Economics*, 12:863.

CROSS, F., 1973. "The Behavior of Stock Prices on Monday and Friday" "*Financial Analysts Journal*: 67–69.

DUBOIS, M. and LOUVET, P., 1996. "The Day-of-the-week Effect: The International Evidence", *Journal of Banking and Finance*, 20:1463–85.

EGAN, W.J., 2008. "Six Decades of Significant Autocorrelation in the US Stock Market", Online: http://ssrn.com/abstract=1088861. [Accessed 02/10/2008].

FAMA, E.F., 1965. "The Behavior of Stock Prices", *Journal of Business*, 38:383–417.

FAMA, E.F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance,* 1:383–417.

FAMA, E.F., 1991. "Efficient Capital Markets: II", *Journal of Finance*, 46, (5):1575–1617.

FAMA, E., 1998. Market Efficiency, Long-term Returns and Behavioral Finance, *Journal of Financial Economics*, 49:283–306.

FAMA, E and FRENCH, K., 1992. "The Cross-Section of Expected Stock Returns", *Journal of Finance* 47:427–465.

FRENCH, K. R., 1980. "Stock Returns and the Weekend Effect", *Journal of Financial Economics*, 8:55–70.

FRENCH, K.R. and ROLL, R., 1986. "Stock Return Variance: The Arrival of Information and the Reaction of Traders", *Journal of Financial Economics*, 17:5–26.

GIBBONS, M.R. and HESS, P.J., 1981. "Day-of-the-week Effects and Asset Returns", *Journal of Business*, 54:579–96.

GLEZAKOS, M., MERIKA, A. and KALIGOSFIRIS, H., 2007. "Interdependence of Major World Stock Exchanges: How is The Athens Stock Exchange Affected?" *International Research Journal of Finance and Economics.* 7:24–39.

GRINBLATT, M. and MARKOWITZ, T., 2003. Predicting Stock Price Movement from Past Returns: The Role of Consistency and Tax-Loss Selling, *Journal of Financial Economics*, 71:541–579.

GROSSMAN, S.J., 1976. "On the Efficiency of Competitive Stock Markets Where Trades Have Diverse Information", *Journal of Finance*, 31(2):573–585.

GROSSMAN, S.J. and STIGLITZ, J.E., 1980. "On the Impossibility of Informationally Efficient Markets", *The American Economic Review*, 70(3):393–408.

HEYMANS, A., 2005. "*The Day-of-the-Week Effect as a Risk for Hedge Fund Managers*", Potchefstroom: NWU (M.Com Dissertation).

HOLDEN, K., THOMPSON, J. and RUANGRIT, Y., 2005. "The Asian crisis and calendar effects on stock returns in Thailand", *European Journal of Operational Research,* 163(1):242–252.

JAFFE, J. R. and WESTERFIELD, R., 1985. "The Weekend Effect in Common Stock Returns: The International Evidence", *Journal of Finance*, 40:432–54.

JENSEN, M., 1978. "Some Anomalous Evidence Regarding Market Efficiency", *Journal of Financial Economics*, 6:95–101.

KAMSTRA, M.J., KRAMER, L.A and LEVI, M.D., 2003. Winter Blues: Seasonal Affective Disorder (SAD) Stock Market Returns, *American Economic Review*, 93:324–343.

KO, K.S. and LEE, S.B., 1991. "A Comparative Analysis of the Daily Behavior of Stock Returns: Japan, the US and the Asian NICs",*Journal of Business Finance and Accounting*, 18: 219–34.

LAKONISHOK, J. and MABERLY, E., 1990. "The Weekend Effect: Trading Patterns of Individual and Institutional Investors", *Journal of Finance*, 45(1):231–245.

LAKONISHOK, J. and SMIDT, S., 1988. "Are seasonal anomalies real? A ninety-year perspective", *Review of Financial Studies*, 1:403–425.

LEWIS, M., 1989. "Stock Market Anomalies: A Re-Assessment Based On the UK Evidence", *Journal of Banking and Finance*, 13:675–696.

LO, A. and MACKINLAY, C., 1988. "Stocks Do Not Follow Random Walks", *Review of Financial Studies*, (spring) 41–66.

MAXWELL, W.F. 1998. "The January Effect In the Corporate Bond Market: A Systematic Examination," *Financial Management*, 27:18–30.

MALKIEL, B.G., 1992. "Efficient market hypothesis" In: New Palgrave Dictionary of Money and Finance. London: Macmillan.

MALKIEL B.G., 2003. "The Efficient Market Hypothesis and its critics", *Journal of Economic Perspectives* 17(1):59–82.

MIYAKOSHI, T., 2006. "News and Asian Emerging Markets", *Review of Pacific Basin Financial Markets and Policies,* 9(3):359–384.

ROZEFF, M.S. and KINNEY, W.R., 1976. "Capital Market Seasonality: The Case of Stock Returns", *Journal of Financial Economics,* 3:379–402.

SEARS, R.S. and WEI, K.C.J. 1985. "Asset Pricing, Higher Moments and the Market Risk Premium: A Note", *Journal of Finance*, 40: 1251–1253.

SMIRLOCK, M. and STARKS, L., 1986. "Day-of-the-Week and Intraday Effects in Stock Returns", *Journal of Financial Economics*, 17:197–210.

SULLIVAN, R., TIMMERMAN, A. and WHITE, H., 2001. Dangers of Data-Mining: The Case of Calendar Effects in Stock Returns, *Journal of Econometrics*, 105: 249–286.

THOMPSON, A.R. and WARD, M.J.D., 1995. "The Johannesburg Stock Exchange as an Efficient Market: A Review", *Journal for Studies in Economics and Econometrics*, 19 (3): 33-63.

TIMMERMANN, A. and GRANGER, C.W.J., 2004. "Efficient Market Hypothesis and Forecasting", *International Journal of Forecasting,* 20(1):15–27.

TANG, G.Y., 1996. "Day-of-the-Week Effect on Skewness and Kurtosis: A Direct Test and Portfolio Effect", *European Journal of Finance*, December 1996, 333–351.

TANG, G.Y.N., 1997. "Impact of the Day-of-the-Week Effect on Diversification and Exchange Rate Risks", *International Business Review,* 6:35–51.

TINIC, S.M., BARONE-ADESI, G. and WEST, R.R., 1987. "Seasonality in Canadian Stock Prices: A Test of the „Tax-Loss Selling‟ Hypothesis", *Journal of Financial and Quantitative Analysis*, 22:51–64.

ZIEMBA, W., 1990. "Japanese Security Market Regularities: Monthly, Turn-of-the-Month and Year, Holiday and Golden Week Effects", *Japan and the World Economy*, 3:119–145.