CALENDAR EFFECTS ON THE NINE ECONOMIC SECTORS OF THE JOHANNESBURG STOCK EXCHANGE

by

Brishan Rowjee

Student Number: 308360

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF COMMERCE (FINANCE)

in the

SCHOOL OF ECONOMIC AND BUSINESS SCIENCES

at the

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Supervisor: MR D. MBULULU

SCHOOL OF ECONOMIC AND

BUSINESS SCIENCES

Declaration Regarding Plagiarism

I (full names & surname):	Brishan Rowjee
Student number:	308360

Declare the following:

1. I understand what plagiarism entails and am aware of the University's policy in this regard.
2. I declare that this assignment is my own, original work. Where someone else's work was used (whether from a printed source, the Internet or any other source) due acknowledgement was given and reference was made according to departmental requirements.
3. I did not copy and paste any information directly from an electronic source (e.g., a web page, electronic journal article or CD ROM) into this document.
4. I did not make use of another student's previous work and submitted it as my own.
5. I did not allow and will not allow anyone to copy my work with the intention of presenting it as his/her own work.

ABSTRACT

Calendar effects have been extensively researched in developed and emerging markets. Observing a number of these effects in one study is limited, especially in a South African context. This study investigates the day-of-the-week, January and pre-holiday effects in nine listed stock market indices of the Johannesburg Stock Exchange. Applying the most recent sample period and including dividends, two methodologies are employed; a regression analysis and a non-parametric Kolmogorov-Smirnov test, which tests directly on skewness and kurtosis to examine if any calendar effect exists. Monday and Wednesday effects are found to exist in the Health Care (J540) sector and July shows some monthly seasonality in the Consumer Services (J550) sector. These effects persist regardless of which test is employed. No pre-holiday effect is found to exist on any of the indices observed. Consulting both methodologies, there is overwhelming evidence to support the dissipation of calendar effects on the South African stock market. This study also reveals the JSE to be weak-form efficient.

LIST OF TABLES

:

TABLE OF CONTENTS

CHAPTER ONE

1. INTRODUCTION

Over the past four decades, global integration of financial markets has made considerable progress. The main objective of global integration is to seek higher rates of returns, opportunities and diversification (Agenor, 2003). The African continent is richly endowed with its variety of resources and is receiving overwhelming interest from the international financial community (Subramoney, 2010). Senbet and Otchere (2008) investigated African stock markets and found that both absolute as well as risk-adjusted (Sharpe ratio) performance is similar to those realised in Latin America and Asia. Countries like Japan, India, the US and China, for example, could create successful partnerships with African countries by taking part in joint ventures, technology transfers, and investment and trade agreements (Diarra, Gurria, & Mayaki, 2011).

South Africa is described as the most developed market on the African continent. Established in 1887, the Johannesburg Stock Exchange (JSE) has grown to become the largest on the continent. In relation to other African countries, South Africa appeals to investors in terms of offering some of the best opportunities to raise capital, secure investments and close any outstanding deals. Arguably other benefits of South Africa include its political and macro-economic stability, as well as its highly developed financial system (Denman, 2012).

Despite the distinct advantages, such benefits can only be realized if the stock market in question is efficient. An efficient market can be described as one with prices that reflect all available information, which lends itself to the Efficient Market Hypothesis (EMH) (Fama, 1970). Essentially, the EMH states that investors cannot outperform the market and there are no opportunities to earn abnormal returns consistently. Due to the excessive assumptions about the EMH, numerous studies have inspected stock price behaviour with respect to, but not limited to, information announcements, investor sentiment, and stock market anomalies (Cheung & Coutts, 1999).

In recent years, improvements in technology and computing facilities have enabled investors to analyse seasonality or anomalies. Broadly speaking, a calendar or stock market anomaly can be described by a financial asset return exhibiting systematic patterns at certain times of the day, week, month or year (Coutts, Kaplanidis, & Roberts, 2000). Calendar anomalies are events that dispute the EMH. Three well-distinguished calendar anomalies, amongst others, are: the day-of-the-week effect; the January effect; and the pre-holiday effect. Wachtel (1942) describes the January effect by its abnormally high returns in the month of January when compared to the rest of the year. The day-of-the-week effect or weekend effect exhibits significantly higher returns on Friday and lower returns on Monday. Lastly, pre-holiday effects point to significantly higher returns on days prior to public holidays (Lakonishok & Smidt, 1988). These calendar anomalies have been extensively investigated, however, most empirical evidence limits their tests to only one effect in each study. Chatterjee and Manaim (1997) assess three market anomalies over a single period, aiming to reveal whether over a number of years, firms experience various types of seasonality in stock returns (see also Holden, Thompson & Ruangrit, 2005). Thus far, multiple calendar anomaly tests are limited in a South African context.

Coutts and Sheikh (2002) looked at the January, day-of-the-week, and pre-holiday effects on the All Gold Index on the JSE from 1987–1997. Overall, no calendar anomalies are found to exist in South Africa. However, the use of the All Gold Index as a proxy for the entire JSE is a major drawback of their study. The All Gold index in isolation cannot give a true and accurate picture of the entire South African stock market. Coutts and Sheikh (2002) also stress the need for future research into their work on the JSE.

This study will investigate the January, pre-holiday, and day-of-the-week effects on nine of the ten JSE economic industrial sector indices spanning 30 June 1995 to 31 December 2012. In addition to using an updated sample period, considering nine of the ten economic sector indices will provide clearer insight as to the existence or non-existence of calendar anomalies in South Africa. This study will also include the effects of dividends through the utilisation of total returns, proposed by Tang (1996). Lastly, this study will employ two methodologies; one new and one old. A Kolmogorov-Smirnov test will be employed, which focuses on the distributional properties of returns on third and fourth moments (i.e. skewness and kurtosis). The other technique includes an Ordinary Least Squares (OLS) regression model. If calendar anomalies are found to prevail using two methods, one can eliminate differences in methodologies as the reason for anomalies existence.

1.1 PROBLEM STATEMENT

The existence of calendar effects refutes the EMH, which states that markets are informationally efficient, and thus abnormal returns are unachievable (Plimsoll, Saban, Spheris, & Rajaratnam, 2013). The existence of calendar effects has taken centre stage due to investors seeking profitable trading strategies in an attempt to exploit any visible seasonality. Many studies have investigated the January effect in the US (Rozeff & Kinney, 1976; Mehdian & Perry, 2002; Keim, 1983; Rogalski & Tinic, 1986), and outside the US (Berges, McConnell, & Schlarbaum. 1984; Robins, Sandler & Durand, 1999; Auret & Cline, 2011). The day-of-the-week effect has received scrutiny in many US and UK studies (Doyle & Chen, 2009; Steeley, 2001; Gibbons & Hess, 1981), as well as other developed and emerging markets (Basher & Sardorsky, 2006; Plimsoll *et al.*, 2013; Jaffe & Westerfield, 1985; Sutheebanjard & Premchaiswadi, 2010). The pre-holiday effect includes numerous studies in developed and developing markets (Bhana, 1994; Lakonishok & Smidt, 1988; Vergin & McGinnis, 1999; Marret & Worthington, 2009; Alagidede, 2013; Kim & Park, 1994; Brockman & Michayluk, 1998).

Most of the empirical literature cited, however, focuses on one of these anomalies in each study (Holden *et al.*, 2005). Recently, studies are including a number of calendar effects in one study to investigate whether over a number of years, stock market returns experience various types of seasonality in their stock returns (see for example Chatterjee & Manaim, 1997; Chan, Khanthavit & Thomas, 1996; Ziemba, 1991; Holden *et al.*, 2005). Studies done on multiple calendar effects in South Africa are extremely limited. Coutts and Sheikh (2002) is the only known published paper that tests for all three chosen calendar effects at once on the South African stock market. Coutts and Sheikh (2002) look only at the All Gold Index, thus their results cannot be generalised with regard to the entire South African market. A study giving attention to the whole South African stock market is needed to contribute to the research gap of multiple calendar effects in Africa. Additionally, Coutts and Sheikh (2002) scrutinise calendar effects from 1987 to 1997, which does not take into account recent changes in technology, rules and regulations as well as economic changes. Thus, there is a need to re-analyse these calendar effects using a more recent sample period.

This study assesses the existence of the January, day-of-the-week and pre-holiday effects on the JSE by looking at nine of the ten industrial economic sectors from June 1995 to December 2012.

1.2 RESEARCH OBJECTIVES

The main objective is:

- To test the existence of the day-of-the-week, January, and pre-holiday effects on returns on nine of the ten economic sectors of the JSE and by doing so, the degree of market efficiency of the JSE will be indirectly tested.

1.3 IMPORTANCE OF STUDY

These types of calendar anomalies have had thousands of articles dedicated to them, so much so, that considerable motivation is required for the commencement of this study. This study attempts to fill a gap in literature in the following ways. Firstly, previous literature tends to focus on each individual anomaly with respect to various markets across the world (see for example Jaffe & Westerfield, 1985; Cadsby & Ratner, 1992; Rozeff & Kinney, 1976). Secondly, most work performed on calendar anomalies has concentrated exclusively on developed markets. The few existing studies focusing on developing economies pay little attention to the emerging markets of Africa (see Alagidede, 2013). Empirical examination of multiple calendar anomalies in one study in South Africa is limited. This study will take a magnified approach to the JSE with the intent of exposing the existence of various calendar anomalies over a single sample period. This technique is used by Chatterjee and Manaim (1997) and Holden *et al.* (2005). Both studies look at various calendar anomalies and are done outside the scope of Africa. The approach taken will follow the suggestion by Coutts and Sheikh (2002), by investigating the day-of-the-week, January and pre-holiday effects, considering sub-sector indices to give a microscopic, and more accurate view of the entire South African stock market (also see Ziemba, 1991; Chan *et al.*, 1996).

Seasonality will be directly tested on skewness and kurtosis on returns of stocks listed on the JSE using a non-parametric Kolmogorov-Smirnov (K-S) test. The K-S test, which focuses on higher statistical moments, is a rarely used approach in South African literature. Additionally, this study will also employ an OLS dummy variable regression model. Employing two methodologies, one new and one old, will allow the transparent comparison of results obtained in this study with previous literature. If a calendar anomaly is found to be present in one methodology but not the other, one can conclude that the existence of the anomaly is the direct result of the methodological approach taken. Also, the advantage of using these methods also lies in the fact that one tests for seasonality in lower moments (mean and standard deviation) while the other focuses on higher statistical moments (skewness and kurtosis) which is rare in seasonality studies.

Lastly, previous literature focuses solely on the price of a stock, specifically the closing price, to calculate returns used in the testing of the different forms of seasonality (see Mbululu & Chipeta, 2012; Doyle & Chen, 2009; Mehdian & Perry, 2002; Kim & Park, 1994). This study employs total returns, which include the effect of dividends, filling the gap in research as suggested by Tang (1996), who also tested a day-of-the-week effect on skewness and kurtosis.

1.4 ORGANISATION OF THE STUDY

The remainder of the paper is structured as follows: Chapter 2 reviews both the theoretical and the empirical literature on market efficiency and anomalies in developed and emerging markets. First, market efficiency, the day-of-the-week, January and pre-holiday effects are discussed in detail, followed by the empirical literature on multiple anomalies in one study. Lastly, a brief discussion on skewness and kurtosis is provided. Chapter 3 describes the data employed as well as the econometric methods to be used in this study. The results of the regression model are presented in Chapter 4 while chapter 5 presents results for the direct test on skewness and kurtosis. Chapter 6 summaries the empirical results and the study is concluded in Chapter 7.

CHAPTER TWO

2. LITERATURE REVIEW

This chapter reviews the theoretical background and empirical findings underlying the efficiency of stock markets by looking at each calendar anomaly. Section 2.1 discusses the Efficient Market Hypothesis (EMH), thereafter Section 2.2 to 2.4, review empirical literature on the day-of-the-week, pre-holiday and January effects, respectively. Section 2.5 looks at multiple calendar anomalies in one study, and the last section describes some of the relevant literature on skewness and kurtosis.

2.1 MARKET EFFICIENCY

Malkiel (2003), in support of Fama (1970), describes an efficient market to be one that fully and correctly reflects all information about individual stocks and the stock market as a whole. Fama (1970) provides explanations of the three forms of efficiency found in markets around the world. The first form is referred to as the weak-form efficiency, which displays the inability of past prices to predict future prices. The weak version of the EMH lends itself to the Random Walk Theory (RWT), which states that current security prices are independent of previous security prices. The RWT renders technical analysis useless as a means of earning abnormal profits. Essentially, the RWT states that the price of a security today is independent of yesterday's price. In other words, investors cannot use past prices to predict future prices; hence, successive price changes are random. Semi-strong efficiency shows a security's price to be fully inclusive of historical information and all publically available information. The use of a company's financial statements or announcements, for example, cannot be used to forecast future security prices as they would already reflect such information. The third form of market efficiency is referred to as the strong-form efficiency, which describes a security's price to be fully inclusive of historic, public and all private information or insider information (Fama, 1970).

If the EMH and the RWT holds then investors cannot outperform the market either by security selection or by timing the market. However, both the EMH and the RWT cannot explain the existence of calendar anomalies. These anomalies dispute both the EMH and the RWT by displaying seasonal patterns in a security's price, at certain times of the calendar year (Coutts *et al.*, 2000). Persistence of these seasonal patterns over time challenges the EMH even further, because in an efficient market, any seasonal effects should dissipate once brought to light (Doyle

& Chen, 2009). In the following sections, three well documented calendar anomalies will be discussed in detail i.e. the day-of-the-week, January, and pre-holiday effects. Other anomalies that exist but are not included in this paper include, for example, the long term reversal effect (see Debondt and Thaler 1985); momentum, size and value effects.

2.2 THE DAY-OF-THE-WEEK EFFECT

The-day-of-the-week effect or weekend effect is described by its unusually large positive returns on Fridays relative to Mondays. The most obvious cause of this effect is the impact of weekend news on Monday's return. Negative returns on Mondays could be due to the release of bad news and information over the weekend (Lakonishok & Maberly, 1990). The returns on Monday represent a three-calendar-day investment, which starts from the close on Friday to the close on Monday. Given a three-day return, the mean and variance could reasonably be assumed to be higher compared to any other weekday. A plausible and widely accepted explanation, however, is yet to surface. If such a pattern can be reliably recognised, investors could use this information to decide between appropriate investment strategies or portfolio selection strategies. For example, investors could buy on a Monday (low prices) and sell stocks on a Friday (higher prices). French (1980) reports negative returns on Mondays and Fama (1965) observed variances of daily returns and finds Monday's variance to be 20% higher than any other day.

Gibbons and Hess (1981) reveal a strong day-of-the-week effect when looking at the S&P 500 with equally weighted portfolios constructed from The Center for Research in Security Prices (CRSP) and on the Treasury Bill market. Over the period July 1962 to December 1978, the average annual return on a Monday is -33.5% for the S&P 500 and -26.8% for the equally weighted portfolios. Even when observing other asset classes (Treasury Bill market), Monday returns are still lower on average. When market inefficiency is eliminated (using mean-adjusted returns), stock returns still display significant day-of-the-week effects. Dubois and Louvet (1996) examine the day-of-the-week effect across different markets at different stages in development. Nine different countries are reviewed over the period 1969–1992 using a standard and moving average approach on time series data. Results indicate that the effect persists in some European countries, yet it is no longer significant in the US in recent times. Gibbons and Hess (1981) and Dubois and Louvet (1996) represent studies that are outdated. Their results should therefore be looked at with caution as their findings could significantly change when tested on more recent times, with increasingly efficient markets.

Berument and Kiymaz (2001) observe the S&P 500 market index during January 1973 and October 1997. Using an Ordinary Least Squares (OLS) regression, the authors find Wednesday and Friday returns to be significantly different to all other days. When a sample from January 1973 to October 1987 is observed, Monday and Wednesday returns are found to be significantly different to all other days. If the period October 1987 to October 1997 is observed, significance is found on Monday, Tuesday and Wednesday (also see Ajayi, Mehdian and Perry, 2004). The current study will reinforce the work done by Berument and Kiymaz (2001) by applying a regression model and also by including a relatively new methodology, which focuses on higher statistical moments.

Chinzara and Slyper (2013) focus on South Africa and choose the All Share index and four sector indices for the observation of day seasonality. These are namely: Industrials, General Retailers, Mining, and Financials. From 30 January 1995 to 31 December 2010, the authors use a simple OLS regression and find a significantly positive effect on Mondays for the All Share index and the Industrials index. A significant negative Friday effect is also found in the Retails sector. When risk factors are considered, results remain similar. After allowing for risk factors to vary across the days of the week, anomalies exist in the JSE daily returns. This study will employ an identical regression model (which excludes risk) to test whether these effects exist in any of the nine economic sectors of the JSE when dividends are included (which are not considered in Chinzara and Slyper, 2013)

Basher and Sardorsky (2006) inspect 21 emerging markets over the period December 1992 to October 2003. The study employs both conditional and unconditional risk analysis together with five different models using daily closing prices. Each model produces different day-of-the-week effects in each country. However, these effects are rampant in the Philippines, Taiwan and Pakistan. Four out of five models also signal positive effects in Malaysia, Turkey and Thailand. Most emerging markets were found to be free of day seasonality, yet some exhibited strong day-of-the-week effects even after conditional market risk was taken into account. Monday effects are also found to exist in South Africa (JSE All Share Index). Plimsoll *et al.* (2013) follow a similar methodology to Basher and Sardorsky (2006) but focus on the JSE's Top 40 and the ALSI (All Share Index) and TOPI (Top Index Price Today) as comparators, respectively. The day-of-the-week effect is found to be non-existent for the ALSI and TOPI but does exist on a firm-specific level (10 firms are found to show significant effects). This study will attempt to confirm or reject findings from Basher and Sardorsky (2006) and Plimsoll *et al.* (2013) by looking at nine of the JSE sector indices as opposed to the ALSI. By doing this, it can be determined if a seasonal effect exists in particular sectors as opposed to the whole market, and whether or not certain sectors drive the existence of any calendar anomaly.

Sutheebanjard and Premchaiswadi (2010) use daily data from the Stock Exchange of Thailand (SET) from 4 January 2005 to 31 March 2009. Applying Evolution Strategies, results indicate an established effect in Thailand (the percentage of error is highest on a Monday and lowest on a Friday). The findings of this article need to be interpreted with great vigilance due to the unique characteristics of Thailand and its stock market in particular (see Aggarwal, Rao & Hiraki, 1990). Jaffe and Westerfield (1985) research the stock market indices of Japan, Australia, the US and UK, and Canada. These countries are of particular interest to the authors since they made up 87% of the world's market value of exchange listed securities at the time. Using daily returns, weekend effects are found in each of the five countries observed. Japanese and Australian stock markets displayed the lowest mean returns on Tuesdays, which is in contradiction to previous literature found in the US. Their study is of particular importance due to its comparison of developed and emerging markets (see Barone, 1990; Tinic, Barone-Adesi & West, 1987). The findings of their study strengthen the need for the discovery of effects in emerging markets.

Doyle and Chen (2009) test the weekday effect in 13 closing price indices in the US from 1993 to 2007. Results show no Monday or weekend effect when analysing for fixed seasonality effects amongst days of the week, and with the combination of indices. There is, however, a significant weekday effect implying market inefficiency. Steeley (2001) questions the significance of the weekend effect in the UK. Daily returns on the FTSE 100 index are used from 3 April 1991 to 19 May 1998. Day-of-the-week effects are found to have dissipated during the 1990s in the UK equity market. Both Doyle and Chen (2009) and Steeley (2001) highlight the usefulness of identifying seasonality or lack thereof. If one can identify an anomaly with certainty, a strategy can be created to extract any profits available. If no seasonality is detected, markets may "suffice" in being efficient, and investors can assume their decisions are based solely on behavioural biases and not any type of market discrepancies. For this reason, a study exposing different types of anomalies on one particular market over a single time period is needed and warranted.

Many studies reveal a significant day-of-the-week effect that is not purely restricted to a Monday and a Friday. Bayar and Kan (2002) look at the following nineteen countries for a day-of-the-week effect: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the UK, and the US. The sample chosen ranges between 20 July 1993 and 1 July 1998 and a regression model (identical to the one used in this study) is employed, which makes use of dummy variables. The observed daily return patterns differ for local and dollar terms. For local currency terms, higher returns are observed for fourteen countries on Tuesday and then on Wednesday while lower returns are observed towards the end of the week on Thursday and then Friday. In dollar terms higher return patterns are highlighted for twelve countries on Wednesday and then Tuesday, and low return trends on Thursday and then Friday. The study by Bayar and Kan (2002) is extremely useful because the authors highlight the existence of day effects on every day of the week. The authors state Monday, Tuesday, Wednesday, Thursday and Friday effects in various countries. Similarly, Agrawal and Tandon (1994) also use an OLS regression to observe day-of-the-week effects in eighteen countries: Australia, Belgium, Brazil, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Singapore, Sweden, Switzerland, the UK, and the US. Like Bayar and Kan (2002), the authors identify Monday, Tuesday, Wednesday, Thursday and Friday effects in numerous countries. Strong Friday effects are found in most countries followed by a strong Wednesday effect. Both Bayar and Kan (2002) and Agrawal and Tandon (1994) did not include South Africa in their studies. This study will address this shortcoming and provide evidence of the day-of-the-week effect on the JSE.

Balaban (1995) analysed the Turkish stock market from January 1988 to August 1994 and found that the highest returns and lowest standard deviations are observed on Fridays followed by Wednesdays. He also notes that day-of-the-week effects change in magnitude and direction across years. Dubois and Louvet (1996) find positive returns on Wednesdays and negative returns on Mondays and Tuesdays for eleven indices in nine countries from 1969 to 1992. Aggarwal and Rivoli (1989) find strong weekend effect when looking at Hong Kong, Singapore, Malaysia and the Philippines from 1 September 1976 to June 30 1988. The authors also observe a strong Tuesday effect, which they attribute to the +13 hour time difference between New York and these emerging markets (also see Barone 1990). All of the above studies highlight the need to find day-of-the-week effects that are not restricted to Mondays and Fridays for a weekend effect. This study will observe if there is any day seasonality and will also focus on South Africa, which has been excluded in the studies mentioned above.

2.3 THE PRE-HOLIDAY EFFECT

The pre-holiday or holiday effect is amongst the most puzzling calendar anomalies. Characterised by abnormally high returns prior to holidays, this anomaly brings a certain amount of curiosity. Days just prior to holidays are often shown to have lower liquidity which means less cash. Therefore, towards holidays people sell stocks hence they have more cash before a holiday. Investors typically lessen their shareholdings prior to a holiday due to their perceived negative beliefs about new information. Investors tend to sell shares before a holiday hence share prices drop before a holiday. A possible trading strategy is now to buy shares before the holiday when everyone else is selling (thus buying at a low price) and sell it after the holiday when everyone else is buying. When everyone else is buying the price of the stock will go up, which makes it a better time to sell. Marret and Worthington (2009) describe holiday effects to be the cause of investor psychology, implying that investors tend to buy shares before holidays due to “high spirits” and “holiday euphoria”.

Lakonishok and Smidt (1988) find, when looking at the Dow Jones Industrial Average (DJIA), pre-holiday returns are 23 times greater than regular daily returns and this increase accounts for about 50 percent of the total price increase on the DJIA. Cadsby and Ratner (1992) assess daily closing prices of eleven stock market indices from ten different countries. Pre-holiday effects are determined using arithmetic means which are calculated and compared for each index. 5 out of 10 countries displayed a significant holiday effect (United States, Canada, Japan, Hong Kong and Australia). Their study puts the spotlight on the importance of seasonality outside the US. They underline the benefits of finding a pre-holiday effect in different countries as each country has unique characteristics and practices (also see Kim, 1988). This study will attempt to enhance the current body of literature by exposing such seasonality in South Africa.

Vergin and McGinnis (1999) scrutinise the widespread curiosity of the pre-holiday effect. The authors look at small and large corporations over the period 1987–1996 on the S&P 500 and New York Stock Exchange (NYSE). Pre-holiday returns were found to be significantly smaller than previously observed sample periods, using similar methodological approaches. Also, the holiday effect seems to have vanished for large corporations but continues for small corporations. This effect in small corporations is still however, rather weak, due to its lack of usefulness after transaction costs are taken into account. The overall conclusion lends support to an efficient market. Bhana (1994) reviews share returns of companies listed on the JSE during the period 1975–1990. Once again, mean and variances were calculated for two sub-periods: trading days prior to holidays, and all other trading days. The mean of the 144 pre-holiday returns was 0.2620%, which is 5 times larger than the mean of the 3888 other day returns (0.0547%). Overall, one-fifth of the total market return of the sample period is a result of the nine trading days prior to public holidays. Bhana (1994) suggests that this effect is so profound that market participants can effectively create investment strategies designed to exploit such calendar anomalies. Results also suggest that the utilisation of certain investment strategies designed to take advantage of such price behaviour could be beneficial if transaction costs are trivial. Vergin and McGinnis (1991) and Bhana (1994) both have relatively outdated sample periods. This study will employ the most recent sample period and will also include the effects of dividends which have not been given much attention.

Chong, Hudson, Keasey and Littler (2005) look into the dissipation of pre-holiday effects in the US, UK and Hong Kong. The S&P 500, Financial Times Industrial Ordinary Index (FT30) and the Hang Seng Index are used from January 1973 until July 2003. Dividing trading days into days prior to the holiday and all the days after, means and variances along with their *t*-statistic for the difference in means were reported. Strong support for the pre-holiday effect is found in Hong Kong and the UK, with marginal significance in the US. The question of the relative dissipation of this effect found its strength in the US until the late 1990s, which then experienced a temporary reversal. Further research is suggested by Chong *et al.* (2005), specifically, to determine whether or not the pre-holiday effect persists in other markets outside the scope of their study. This study will tackle this issue by looking at South Africa and determining if the pre-holiday effect is in fact as significant as it is found to be in Bhana (1994).

Kim and Park (1994), after considering previous literature, pay particular attention to three major stock market indices; the NYSE, American Stock Exchange (AMEX) and NASDAQ. The study looks specifically at mean returns of ordinary days, pre-holidays and post-holidays. Abnormally high mean returns are found to be significant for trading days before regular holidays. The study is then extended to include the testing of the UK and Japanese markets, and finds that holiday effects exist outside the US (see also Wilson & Jones, 1993; Mills & Coutts, 1995; Arshad & Coutts, 1997). Brockman and Michayluk (1998) turn the focus to the popularity of the holiday effect on the same US stock exchanges as in Kim and Park (1994). The authors find that pre-holiday returns were significantly higher than non-holiday returns. Relating to a post-1987 period, results indicate the persistence of the holiday effect under each of the three stock exchanges, in the full sample period and for all size-based and price-based portfolios. Both studies focus primarily on the US and even though some attention is given to the UK and Japanese markets, they lack validity in other emerging markets.

Other markets around the world show highly significant pre-holiday effects. Meneu and Pardo (2004) identify a significant pre-holiday effect in Spain from 1990 to 2000, while Cao, Premachandra, Bhabra and Tang (2009) document pre-holiday effects in the New Zealand stock market and this effect is believed to be increasing. Marret and Worthington (2009) interrogate the Australian stock market. Twelve different stock indices are observed from 9 September 1996 to 10 November 2006, obtained from Global Financial Data (2006). Pre-holiday returns over the sample period are five times greater than all other days at the market level (0.11295% compared to 0.0236%). When the sub-market level is introduced, results indicate pre-holiday effects in the retail industry only, which could be the primary source of the strong holiday seasonality on the market level. However, these results should be looked at with caution as the construction of indices greatly affected their results. The strong holiday effect found is mainly due to the retail industry, and excluding this particular index would dramatically affect their findings.

Dodd and Gakhovich (2011) analyse 14 emerging Central and Eastern European markets namely: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, Slovenia and the Ukraine. The authors use a dummy variable regression from 1991 to 2010 and show that the pre-holiday is slowly decreasing. Significance is only found in six out of 12 countries and it is suggested that most countries observed are displaying improved market efficiencies. Fajardo and Pereira (2008) also find no holiday effects when looking at the Sao Paulo Stock Exchange (BOVESPA) index from January 1995 to December 2007. Both Dodd and Gakhovich (2011) and Fajardo and Pereira (2008) show the importance of a significantly declining pre-holiday effect around the world. The current study will add to literature by investigating whether the pre-holiday effect is as insignificant as it was found to be in these recent studies.

Alagidede (2013) investigates the pre-holiday effect in African stock markets and limits this investigation to 2006. Seven countries are observed: Egypt, Kenya, Morocco, Nigeria, South Africa, Tunisia and Zimbabwe. Only South Africa displays a significant pre-holiday effect. The author concludes that investors in South Africa show a “good mood” around holidays which indicates large optimism regarding future prospects. Alagidede (2013) contend the need for further research into the persistence of calendar anomalies in Africa. This study will confirm whether or not the pre-holiday effect is as significant as those found in Alagidede (2013), especially when dividends are included.

2.4 THE JANUARY EFFECT

The January effect can be described by unusually high returns in the month of January as compared to the remaining eleven months. The January effect was first brought to light almost 70 years ago. Wachtel (1942) looks at the Dow-Jones Industrial average from 1927 to 1942 and finds seasonality to be present in security prices. This is the first detection of the turn-of-the-year effect and since then numerous studies have surfaced. Rozeff and Kinney (1976) reintroduced this anomaly and this sparked widespread curiosity. They go on to show that seasonality on the NYSE is present when returns are tested on a month-to-month basis, in other words, the month of January displayed higher mean returns than those found in any other month.

One explanation for this effect is the tax-loss selling hypothesis (see Chen & Singal, 2004; Gultekin & Gultekin, 1983; Jones, Pearce & Wilson, 1987; Reinganum, 1983). This hypothesis suggests that investors try to obtain short-term capital losses for income tax purposes by selling securities at the end of the calendar year. A depression in stock prices prior to the end of the year becomes evident due to this "selling pressure", which in turn leads to increases in prices during the first week of the subsequent year (Schwert, 1983). Another explanation is the window-dressing hypothesis, which is when investors sell their poorly performing stocks before the year end and then reverse the process at the beginning of the following calendar year.

There have been a number of January effect investigations outside the United States. Significant January effects are found to be present in Canada, Holland and South Africa (Berges *et al.*, 1984; Brown, Keim, Kleidon & Marsh, 1983; Van den Bergh & Wessels, 1984; Gultekin & Gultekin, 1983; Robins *et al.*, 1999). Claessens, Dasgupta and Glen (1995) investigate the behaviour of stock returns in twenty emerging markets (Argentina, Brazil, Chile, Colombia, Greece, India, Indonesia, Jordan, Korea, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Portugal, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe). Using a Kruskal-Wallis test, the authors find significant month effects in most countries, and these patterns are not restricted to the month of Janury. Brazil, for example, reveals an April effect while the Phillipines show signs of a June, August and September effect. December seasonality is present in Jordan and Pakistan only, while January effects are found in Korea, Mexico and Turkey. Lucey and Whelan (2004) investigate the monthly and semi-monthly behaviour of the Irish equity market from 1934 to 2000. A strong January effect is found to exist as well as an April effect and half-year seasonality (also see Bhabra, Dhillon and Ramirez (1999) for a November effect). Both Claessens *et al*. (1995) and Lucey and Whelan (2004) highlight the importance of focusing on all months of the year to detect seasonal effects rather than just January. Since these studies did not take South Africa into account, this study will address this issue by analysing whether any monthly effects exist on the JSE, using two methodologies. This will add to the existing literature done on emerging markets and will also provide evidence of calendar effects on the most recent sample period.

Auret and Cline (2011) investigate the January effect on the JSE from 1988 to 2006. Annual portfolios are constructed and monthly excess returns are calculated over two separate sample periods: January 1988 to December 1995; and January 1996 to December 2006. They find no support for the January effect. Keim (1983) discovered that when looking at NYSE and American Stock Exchange (AMEX) firms, daily abnormal return distributions are larger in January (greater means) relative to the rest of the year. It was also found that over 50% of this larger return in January is attributed to large abnormal returns in the first week of the year, specifically the first trading day. Rogalski and Tinic (1986) turned their attention to an equally weighted index of all NYSE and AMEX securities (an equally weighted market portfolio). Results indicated that the returns of the market index as well as the risk premium of the stock market are much higher in January than in any other month of the year. The January, equally weighted average daily return is almost four times larger than the next greatest return, which was in November. These studies open an area for further research. There are differing views as to the existence of the January effect on the JSE when compared to developed markets, creating the need for a study bridging the gap between South Africa and developed markets.

Not all markets or market sectors display the January effect. The January effect is the core investigation with respect to three market indexes on the US equity market from 1964 to 1998 (Mehdian & Perry, 2002). The first sample period occurring between 1964 and 1987, indicates that a January effect is pervasive in all three stock market indexes. Post-1987 (after the stock market crash), show positive January returns are exhibited but are found to be statistically insignificant. The authors conclude that the January effect can no longer be regarded as a well-documented anomaly in the US stock market (Mehdian & Perry, 2002). Their study is of particular importance because it is in violation of the thousands of articles dedicated to the US market supporting the existence of the January effect. It creates the need to reject or support such effects in other markets around the world where it has been found to be significant, an application leading to greater efficiency on a global level.

Moosa (2007) observed US stock prices for month seasonality from 1970 to 2005. Using a similar approach in this study (dummy variable OLS regression), the author finds that the January effect exists but is replaced by a negative July effect when a more recent sample period is considered, that being 1990–2005. Moosa (2007) concludes that the July effect has replaced the January effect over the latest sample period. Jacobsen and Zhang (2012) obtain a 317-year index of monthly UK prices compiled by Global Financial Data starting from 1693 (which covers the entire trading history of the UK equity market). The authors highlight the potential problems of data snooping, noise and selection bias, which makes studying long-time series highly beneficial. Only two robust seasonal effects persist; a negative July effect and a negative October effect. A strong December effect dominates the market prior to 1850, which disappears as the January effect begins to take centre stage. However, January returns are found to be lower than other months for the first 150 years. Both Moosa (2007) and Jacobsen and Zhang (2012) find a negative July effect in the US and UK, respectively. This study will observe whether the July seasonality is as robust in South Africa by testing for different month effects and not limiting the study to just the Janaury effect.

Darrat, Li, Lui and Su (2011) critique the returns on 34 MSCI country indices and the MSCI World Index from January 1988 to December 2010. Using a dummy variable regression model, the authors investigate whether the stock returns on each month is significantly different from zero. There is a positive effect for both April and December for almost all countries, while September shows negative significance in the majority of markets. The results further suggest that a negative monthly effect exists for June, August, and September across most global markets in the sample. Once again, South Africa has been excluded from the list of emerging markets analysed in Darrat *et al*. (2011) and warrants the need for the current study.This study will also employ the same model used in their study as well as a non-parametric test to confirm results from the standard approach used by practioners.

2.5 MULTIPLE CALENDAR EFFECTS

Ziemba (1991) explores a number of market irregularities on the Tokyo Stock Exchange (TSE). Monthly, turn-of-the-month and year, holiday and Golden Week effects are of particular interest during the period 1949 to 1988. Results indicate relative concurrence with previous US literature during the sample period. The turn-of-the-year effect is found to be similar to the US with the exception of it being longer in December and in January. The holiday effect shows strong pre-holidays returns and negative returns following a holiday. The Golden Week effect, which is unique to Japan and falls during, early May, is similar to the holiday effect, since strong seasonality is observed. The small firm January effect is also evident with the additional June effect for small stocks. The overall conclusion points to a lack of market efficiency.

Chatterjee and Manaim (1997) examined multiple market anomalies over the period 1987 to 1992. A multivariate regression model (MVRM) is used to test for the presence of the January, size and weekend effects, since it allows the simultaneous testing of these effects. Results found indicate that a January effect is present, specifically for small firms, and there is no significant weekend effect over the sample period. The authors were amongst the first to look at multiple anomalies in one study. Holden *et al.* (2005) also emphasise the need to look at various anomalies in one study. Using daily returns of the Thailand stock market, the day-of-the-week, month-of-the-year, pre-holiday, and within-month effects are observed. Particular attention is given to the period before, during and after the "Asian crisis". Results indicate that many of the calendar effects are insignificant. The implications of Chatterjee and Manaim (1997) and Holden *et al.* (2005)'s studies include the testing of multiple calendar anomalies in other markets, and – more specifically – emerging markets. The investigation of multiple anomaly tests in one study in South Africa is extremely limited, therefore, verifying the need for this study.

Coutts and Sheikh (2002) question the weekend, January and pre-holiday effects on the JSE, specifically the All Gold Index over an eleven-year sample period. The authors construct summary statistics and OLS regressions over three sub-samples of equal length. Even though the weekend effect shows negative returns on a Monday for two of the three sub-sample periods, the overall conclusion pointed to an insignificant weekend effect. Mean returns are positive for January and no seasonality exists in the remaining months of the year. Mean returns for the second sub-sample of January is positive but insignificant. Pre-holiday mean returns are 77 times larger than the mean returns of other days. In the third sub-sample period, mean returns for all other days are negative in comparison to positive mean returns for pre-holidays. In summary, there is no persistent pre-holiday effect (see also Coutts *et al*. 2000). The study concludes with the absence of any seasonality on the JSE from January 1987 to May 1997. The use of the All Gold index is a major drawback of their study, as this index in isolation cannot represent the entire JSE stock market.

The authors stress the need to confirm the results of their study as it challenges calendar anomalies found in previous literature. Also, the methodology used in their study is the basic approach used by many authors. This creates the need for a study that confirms the results of their study using a different methodology, which again strengthens the purposes of this study.

Darrat, Li and Chung (2013) provide a good summation of calendar anomalies on the JSE for a large sample period. The authors observe daily stock returns from January 1973 to September 2012. A methodology utilising dummy variable regressions is employed as well as the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) approach to model variance. No January effect is found to exist and the day-of-the-week and beginning-of-the-month effects are found to disappear post-2008 (after the global financial crisis). The authors conclude that there is an increase in market efficiency after 2008. This study will attempt to confirm or reject findings from Darrat *et al.* (2013) through two methodologies. However, instead of a beginning-of-the-month effect, this study will test for the more popular pre-holiday effect. This study has very serious implications when coupled with Darrat *et al.* (2013). If results are found to be similar, then there would be newly found evidence giving strong support to an increase in market efficiency in South Africa and would also highlight the dissipation of calendar anomalies.

Chan *et al.* (1996) decide to test seasonality on four different stock exchanges: The Kuala Lumpur Stock Exchange (KLSE), The Stock Exchange of Bombay (SEB), The Stock Exchange of Singapore (SES) and The Stock Exchange of Thailand (SET). An OLS analysis is constructed to test for seasonality, specifically: the day-of-the-week effect; the month-of-the-year effect; and holiday effects. Day-of-the-week effects are prevalent on all four stock markets, while the month-of-the-year effects exist only on the KLSE and SES. Chinese New Year effects are displayed on the SES and KLSE, with the effect more profound among small capitalisation stocks on the SET. Islamic New Year effects are found on the KLSE and weak holiday effects found on the BSE. The outcome of the study points toward important cultural and seasonal patterns within different countries. Once again, similar a methodological approach is used in this study. However, emerging markets are highlighted and the approach creates the need for additional tests using different approaches to verify and contrast the author's conclusions.

Lean, Smyth and Wong (2007) focus on day-of-the-week and January effects from January 1988 to December 2002 for: the Hang Seng Index for Hong Kong; Jakarta Composite Index for Indonesia; Kuala Lumpur Composite Index for Malaysia; Nikkei Index for Japan; Straits Times

Index for Singapore; Taiwan Stock Exchange Index for Taiwan; and the SET Index for Thailand. The authors employ a non-parametric stochastic dominance (SD) test. Weekday and monthly seasonality exists in some Asian markets but the January effect is no longer evident as it once was. The current study will also employ a non-parametric K-S test as this has never been done before with respect to monthly seasonality. Additionally, this study will confirm or reject findings from Lean *et al*. (2007) in a South African context. However, this study will also attempt to find holiday seasonality, which Lean *et al*. (2007) do not address.

2.6 SKEWNESS AND KURTOSIS

Fama (1970) is amongst the first to question the normality of individual and portfolio returns. Standard deviation or variance, which is the traditional measure of risk, cannot fully explain the actual risk or the distribution of stock market returns. Skewness looks at the asymmetry of the probability density function of returns around its mean. Positive skewness displays a long tail to the right indicating that more of the values lie to the left of the mean, while a long left tail with values that lie more to the right of the mean, indicates negative skewness. It is important to understand skewness as it allows one to estimate whether certain data points will be more or less than the mean (Mbululu & Chipeta, 2012)**.** Kurtosis looks at the level of peakedness of returns. Kurtosis greater than three is referred to as leptokurtic, displaying fat tails and extreme values. Kurtosis less than three displays thin tails and are called mesokurtic, while negative excess kurtosis are termed platykurtic. The properties of skewness and kurtosis of stock returns are crucial as they affect investor's views and decisions (Tang, 1996). If a particular investor requires right-skewed portfolios, more reward should be given to an investor accepting left or negatively skewed portfolios even with both portfolios having identical standard deviations (Kim & White, 2004). Scott and Horvath (1980) describe a risk-averse investor as preferring positive skew over negative or no skew. They go on to conclude that investors prefer positive skewness and low kurtosis but are willing to accept larger kurtosis with higher returns.

Mangani (2007) observes the JSE and showed that the return distributions in the South African market were found to be highly leptokurtic. Results reject the hypothesis of identically and independently distributed returns and displays excess skewness. The author also stresses the need to use returns instead of share prices when observing stock price behavior on the JSE. This study will attempt to use of total returns and will also test the distributional properties of returns on the JSE and this will help confirm or reject the results found in Mangani (2007).

Mbululu and Chipeta (2012) test the day-of-the-week effect on skewness and kurtosis on the JSE. Nine economic sector indices are viewed over the period 1995 to 2011. No day-of-the-week effects are present for eight out of nine indices. They also conclude that the JSE is weak-form efficient due to the lack of seasonality. Tang (1996) also tests the day-of-the-week effect on skewness and kurtosis on six different international stock markets. Significant effects are found in all markets except the US. It should be noted that his analysis excludes the effects of dividends, and further research into indices across different markets is recommended for the future. Kalidas, Mbululu and Chipeta (2013) analyse daily closing prices for: the JSE All Share Index; Nigerian All Share Index; Moroccan MASI Index; Zambian All Share Index, and the Botswana All Share Index from 2004 to 2012. The authors employ a K-S test and find significant day-of-the-week effects for all countries except South Africa. This study attempts to fill the gap in Mbululu and Chipeta (2012) and Kalidas *et al*. (2013) Firstly, this study will test the day-of-the-week effect on the nine JSE economic sector indices to confirm or reject their findings using the same methodology as well as by including a regression model. Secondly, the January effect and pre-holiday effect will also be investigated, which has never been done using a K-S test in South Africa. Lastly, by looking at total returns, which include the effect of dividends, Tang's (1996) suggestion will be considered.

2.7 CONCLUSION

Despite the vast amount of methodologies applied in the literature reviewed, anomalies seem to exist in almost all the developed and emerging markets. It can be said that these anomalies are a worldwide phenomenon from the literature surveyed. Most studies only focused on broader market indices and not sector indices except a few like Mbululu and Chipeta (2012), for example. When looking at more recent samples however, calendar effects have seem to have disappeared in certain countries hence the need to constantly check for market efficiency. The next chapter sets the framework to determine the existence these calendar anomalies in South Africa.

CHAPTER THREE

3. METHODOLOGY

Section 3.1 of this chapter outlines the data that will be used to answer the objectives of this study set out in Chapter one. Section 3.2 describes the methods used to determine the existence of a day-of-the-week, January or pre-holiday effect in any of the nine chosen JSE industry sectors.

3.1 DATA

Auret and Cline (2011) indicate that future research should focus on the industrial sectors on the JSE. This study investigates the January, pre-holiday, and day-of-the-week effects on nine of the ten JSE economic industrial sector indices spanning 30 June 1995 to 31 December 2012. The selected industry sectors are shown in Table 1.

Table 1: Industry classification codes from the JSE

Sector code	Sector name
J500	Oil and Gas
J510	Basic Materials
J520	Industrials
J530	Consumer Goods
J540	Health Care
J550	Consumer Services
J560	Telecommunications
J580	Financials
J590	Technology

Source adapted from Mbululu and Chipeta, 2012

The Utilities (J570) sector is found to be thinly traded and will thus be excluded from the analysis. The time period used is relevant as most data are only available from June 1995, which is also post-apartheid, avoiding confounding effects. Closing prices will be obtained from Thompson DataStream and dividend yields from the INET BFA (Bureau of Financial Analysis database). The sample chosen is to provide an understanding of the market anomalies on skewness and kurtosis with particular reference to the South African stock market. The nine listed economic stock market sector indices selected can be used to represent the entire JSE since they account for most of the All Share Economic Group Indices.

To test for the day-of-the-week effect, daily returns are used. In order to isolate the day-of-the-week effect from the pre-holiday effect, mean returns both before and after public holidays are eliminated.

To test for the January effect, daily returns for each month and index will be summed up and divided by the number of trading days in that month to obtain a monthly return. Every month will be tested against every other month to detect not only a January effect, but a February effect, March effect and so on for every subsequent month thereafter.

To test for the pre-holiday effect, the following national South African holidays will be observed:

Table 2: List of South African public holidays

National holidays	Date
New Year's Day	1 January
Human Rights Day	21 March
Good Friday	Friday before Easter Sunday
Family Day	Monday after Easter Sunday
Freedom Day	27 April
Workers Day	1 May
Youth Day	16 June
National Women's Day	9 August
Heritage Day	24 September
Day of Reconciliation	16 December
Christmas Day	25 December
Day of Goodwill	26 December

Source adapted from Mbululu and Chipeta, 2012

It should be noted however, that some of these holidays fall on a weekday, in which case the JSE will be closed. Following Bhana (1994), no distinction is made between holidays accompanied by stock market closings and those which are not, simplifying the analysis. Additionally, this study will follow Marret and Worthington (2009), who defined the pre-holiday as the last trading day before a holiday. All remaining trading days will be grouped together as “all other days”.

3.2 DESCRIPTION OF OVERALL RESEARCH DESIGN

Closing prices will be converted to total returns as follows:

Total stock return = $\{[(P_t - P_{t-1}) + D_t / P_{t-1}] \times 100$ ……………………………………………….................. (1)

Where P_t represents the most recent closing value; and P_{t-1} represents the previous closing value for either one of the nine sector indices, and D_t represents dividend payments. Daily returns for each month are summed up and then averaged to get the monthly return. Pre-holiday returns includes the daily return one day prior to a public holiday, while all other days will be the summation of all daily returns excluding pre-holiday returns.

3.2.1. Regression analysis

A. Day-of-the-week effect

Following Chinzara and Slyper (2013) the following regression model can be estimated:

$$Rt = \sum_{j=1}^{5} \sigma_j \ D_{jt} + \varepsilon_t$$

……………………………………………………………………………………. (2)

Where R_t is the return on the index, $D_{1t} \ldots D_{5t}$ represents the dummy variables for Monday through Friday and $\mathcal{E}_t$ is an independently, identically distributed, white noise error term. The coefficients of the dummy variables $\sigma_1 \ldots \sigma_5$ represent both the magnitude and direction, which each individual day exerts on the mean return of the index. Equation (2) is the simplest test for stock market day-of-the-week effects (Basher & Sardorsky, 2006). Statistical significance of any one of these coefficients indicates the presence of a day-of-the-week effect because the specific weekday is high or low enough to be significantly different to the other days of the week.

B. January effect

To test for a January effect the following regression model will be estimated:

$$Rt = \sum_{j=1}^{12} \sigma_j \ D_{jt} + \varepsilon_t$$

…………………………………………………………...………………...… (3)

Where R_t is the return on the index, $D_{1t}…D_{12t}$ represents the dummy variables for January through December and $\mathcal{E}_t$ is an independently, identically distributed, white noise error term. The coefficients of the dummy variables $\sigma_1… \sigma_{12}$ represent both the magnitude and direction, which each individual month exerts on the mean return of the index. Statistical significance of any of the coefficients indicates that a month calendar effect exists.

C. Pre-holiday effect

The pre-holiday effect will be tested using the following regression:

$$Rt = \sum_{j=1}^{1} \sigma_j \ D_{jt} + \varepsilon_t \qquad \text{………………………………………………………………..……………(4)}$$

Where R_t is the return on the index, D_{1t} represents the dummy variable for day prior to a public holiday or zero otherwise and $\mathcal{E}_t$ is an independently and identically distributed and white noise error term. The coefficient of the dummy variables σ_1 represents both the magnitude and direction of pre-holidays on the mean return of the index. Statistical significance of this coefficient indicates a pre-holiday effect.

D. Unit root test

Prior to performing any of the regression analyses, a unit root test will be conducted to determine if the data is stationary. The Augmented Dickey Fuller (ADF) test will be employed in this study. The null hypothesis states that the data is unit root, meaning, the data is not stationary (Campbell, Lo & Mackinlay, 1997). The rejection of this hypothesis implies that the data is stationary, thus a regression can be conducted without differencing the data.

3.2.2. Direct test on skewness and kurtosis

A. Day-of-the-week effect

This study follows Mbululu and Chipeta (2012), hence descriptive statistics are employed for every day of the week for each of the nine indices to determine the normality of the data. These include skewness, kurtosis, standard deviation and mean. Using these statistics, an analysis of the distribution of returns can be observed. This will aid in deciding if either a parametric or non-parametric tests should be used. If results show a non-normal distribution, a non-parametric test will be employed.

Following the method employed by Mbululu and Chipeta (2012) the returns are then standardised, meaning, this includes transforming the standard deviation to one and mean to zero. To achieve this, returns are converted into standard scores by subtracting mean returns from each corresponding daily return and dividing this result by the corresponding standard deviation of each day. For a non-normal distribution, this converts the standard deviation to one and the mean to zero without affecting skewness and kurtosis (Tang, 1996). Statistica is used to conduct a Kolmogorov-Smirnov (K-S) two-sample test, which tests the hypothesis of equal distribution between the standard scores from two different days. This particular non-parametric test is used as it is extremely sensitive to any kind of difference between the mean, variance, skewness or kurtosis of two sample distributions. The null hypothesis is that the mean and variance of the computed standard scores between two days for each index must be equal. A rejection of the null hypothesis in favour of the alternative hypothesis implies that the two samples have different skewness and kurtosis, meaning they differ in higher statistical moments. The two-sample K-S test uses the maximum vertical difference to compare two cumulative distribution functions and is represented as:

$$\text{Max } |F_m (X) - F_n (Y)| \quad \text{……………………} \quad (5)$$

Where Fm(X) is the observed cumulative distribution function of variable X; Fn(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. This study will test for the day-of-the-week effect which will be achieved by conducting 90 K-S tests.

B. January effect

As stated earlier, daily returns for each month and index will be summed up and averaged to get a monthly return. This monthly return will then be standardised by subtracting the mean monthly return from each monthly return and thereafter dividing it by the standard deviation of each monthly return. After standardising the returns, the K-S two-sample test is employed, which tests the hypothesis of equal distribution between the standard scores from two different months. The null hypothesis is that the mean and variance of the computed standard scores between two months for each index must be equal. Each month will be tested against every other month on the selected nine indices creating a total of 594 K-S tests.

C. Pre-holiday effect

Returns are grouped into pre-holiday returns (one day prior to a public holiday) and all other days. The mean return of pre-holidays will be subtracted from each pre-holiday return and thereafter divided by the standard deviation of pre-holiday returns. After the standardisation process is completed, the K-S two-sample test is employed. This test will help ascertain whether a pre-holiday effect exists on any of the nine JSE sector indices based on higher statistical moments. Once again, there is a severe limitation to this approach. For each of the nine tests that will be conducted, the observations for the pre-holiday standard scores are largely underweighted when compared to the ordinary days (174 observations for pre-holidays and 4199 for ordinary days). However, for the sake of consistency, this study will test the pre-holiday effect using the K-S test but results should be looked at with caution. This approach simply highlights an additional method for observing holiday seasonality.

CHAPTER FOUR

4. ANALYSIS OF EMPIRCAL RESULTS: REGRESSION ANALYSIS

Sections 4.1 to 4.3 analyses the mean, standard deviation, skewness and kurtosis for the day-of-the-week, January and pre-holiday effects, respectively. The results from the Augmented Dickey Fuller test will be examined in Section 4.4. Lastly, Sections 4.5- 4.7 describes the results from the regression model for each calendar effect.

4.1 DESCRIPTIVE STATISTICS FOR EACH DAY OF THE WEEK

Table 3: Industry classification codes from the JSE

Sector code	Sector name
J500	Oil and Gas
J510	Basic Materials
J520	Industrials
J530	Consumer Goods
J540	Health Care
J550	Consumer Services
J560	Telecommunications
J580	Financials
J590	Technology

Source adapted from Mbululu and Chipeta, 2012

*Table 3 with industry classifications codes and names are reproduced (see Table 1) here for convenience.

Table 4 shows the average mean returns for each day of the week are all positive. Monday returns in particular, display the highest mean (0.00116) relative to the rest of the week. This result is surprising as one would expect Monday returns to be lower than Friday returns (see for example Gibbons & Hess, 1981; Doyle & Chen, 2009). Overall, Friday has the lowest mean return (0.00005). When looking at the Industrials (J520), Consumer Goods (J530) and Financials (J580) sectors, results indicate that mean returns are negative on a Friday compared to a Monday, once again, contradicting the day-of-the-week effect on the JSE. In particular, J530 and J560 have the highest daily returns, which suggest that the Consumer Goods and Telecom sectors, respectively, are outperforming every other sector index.

The second part of Table 4 displays the standard deviation of each weekday across each industrial sector index. When taking a detailed look into Mbululu and Chipeta (2012), the highest standard deviations found across the various sectors are found in J560 and J590. These results are in concurrence with the outcomes in Table 4, which also indicates that the Telecom (J560) and Technology (J590) sectors are the riskiest. The Telecom (J560) sector displays a clear risk-return relationship by earning the greatest return over all weekdays but subsequently including the greatest risk. Also, the highest standard deviation (0.02228) is found in J590 sector on Wednesdays and the lowest standard deviation (0.01087) is located in Consumer Services (J550) during Fridays (which is also the least risky sector on average).

Skewness and kurtosis are calculated in Statistica. It should be noted that Statistica denotes kurtosis for a normal distribution equal to zero (as opposed to other programs that define kurtosis of a normal distribution equal to three). A normal distribution, therefore, has kurtosis equal to zero. Kurtosis greater than zero indicates the presence of leptokurtosis in the return distribution, whilst kurtosis less than zero indicates a platykurtic distribution in returns.

Table 4: Descriptive statistics: daily returns (30 June 1995 – 31 December 2012)

					Mean					
Day	**J500**	**J510**	**J520**	**J530**	**J540**	**J550**	**J560**	**J580**	**J590**	**Average**
Mon	**0.00135**	**0.00112**	**0.00074**	**0.00144**	**0.00105**	**0.00068**	**0.00206**	**0.00045**	**0.00154**	**0.00116**
Tue	**-0.00005**	**0.00023**	**0.0011**	**0.00101**	**0.00085**	**0.00099**	**0.00145**	**0.00103**	**0.001**	**0.00085**
Wed	**-0.00057**	**0.00031**	**0.00081**	**0.00056**	**0.00092**	**0.00082**	**-0.00015**	**0.00108**	**0.00048**	**0.00047**
Thur	**0.00184**	**0.00085**	**0.00063**	**0.00129**	**0.00039**	**0.00039**	**0.0007**	**0.00034**	**0.00008**	**0.00072**
Fri	**0.00083**	**0.00003**	**-0.0001**	**-0.00018**	**0.00005**	**0.00005**	**0.00005**	**-0.00032**	**0.00007**	**0.00005**
Average	**0.00068**	**0.00051**	**0.00064**	**0.00082**	**0.00065**	**0.00059**	**0.00082**	**0.00052**	**0.00063**	
					Standard Deviation					
Day	**J500**	**J510**	**J520**	**J530**	**J540**	**J550**	**J560**	**J580**	**J590**	**Average**
Mon	**0.01966**	**0.01894**	**0.01326**	**0.01663**	**0.01347**	**0.01207**	**0.02048**	**0.01337**	**0.01879**	**0.0163**
Tue	**0.01852**	**0.01675**	**0.01272**	**0.01775**	**0.01402**	**0.01176**	**0.02225**	**0.01385**	**0.01974**	**0.01637**

Standard Deviation										
Day	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Wed	0.01848	0.01718	0.01275	0.01656	0.01285	0.01185	0.02056	0.01338	0.02228	0.01621
Thur	0.01873	0.01753	0.01248	0.01731	0.0139	0.01254	0.02121	0.0129	0.02113	0.01641
Fri	0.0186	0.01638	0.01148	0.01628	0.01387	0.01087	0.02109	0.01276	0.01861	0.01555
Average	0.0188	0.01736	0.01254	0.01691	0.01362	0.01182	0.02112	0.01325	0.02011	
Kurtosis										
Day	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Mon	5.37961	6.52591	7.23269	5.39835	4.71211	3.73255	2.5848	3.68611	6.94893	5.13345
Tue	5.77083	6.50208	14.25887	10.83042	11.6725	8.5657	16.00763	10.20915	16.12468	11.10465
Wed	2.85342	5.27683	3.83419	2.63595	3.55154	4.20671	4.19242	5.74949	7.41724	4.41309
Thur	3.53568	3.53185	3.31782	2.12903	2.29577	5.07248	2.75887	6.33678	9.25558	4.2482
Fri	3.98808	2.78366	2.60497	2.55252	7.1629	3.53974	5.35997	7.30725	9.6386	4.99308
Average	4.30552	4.92407	6.24971	4.70925	5.87896	5.02343	6.18074	6.65775	9.87701	
Skewness										
Day	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Mon	0.12189	0.18081	-0.86628	0.24966	-0.38652	-0.57041	0.36138	-0.36813	-0.31092	-0.1765
Tue	0.20388	0.49997	-1.08229	0.78795	-0.89319	-0.94857	0.64874	-0.97977	-1.1139	-0.31969
Wed	0.03108	0.19759	0.35992	0.40387	0.33991	-0.17672	0.43507	0.339	-0.39756	0.17024
Thur	0.45949	-0.22191	-0.2014	0.26338	-0.1502	-0.73685	-0.11215	-0.64761	-0.11892	-0.16291
Fri	0.0559	0.28867	-0.30725	-0.25886	0.38096	-0.03007	0.194	0.14167	0.55783	0.11365
Average	0.17445	0.18903	-0.41946	0.2892	-0.14181	-0.49253	0.30541	-0.30297	-0.27669	

Source: Thompson DataStream (2010) and Author’s own estimates

Table 4 also displays the kurtosis values for each index and each day of the week. On average, every weekday and every sector exhibits kurtosis values greater than zero indicating leptokurtosis. As explained earlier, a normal distribution on Statistica has a kurtosis value equal to zero. Results suggests that the returns on the nine economic industrial sectors are non-normally distributed and that the weekday return distributions have fat tails, hence extreme returns are more likely. Tuesday has the most peakedness (11.10465) indicating fat tails and extreme values also confirming the results found in Tang (1996). Surprisingly, Thursday (which has the highest standard deviation) has the lowest kurtosis value (4.24820). When looking at each sector, the Technology sector (J590) stands out with the highest kurtosis value (9.87701). It also has the second highest overall standard deviation. The Oil and Gas sector (J500) has the lowest overall kurtosis value (4.30552) but is still greater than zero, once again, indicating fat tails and extreme values. Tuesdays in particular, display extremely large positive kurtosis values, such that they warrant further investigation. Kurtosis values for Tuesdays are compared with Mbululu and Chipeta (2012) and results reveal that their study also displays high kurtosis values on Tuesdays. Thus, results are in agreement with Mbululu and Chipeta (2012) hence we one can proceed with to K-S tests.

Skewness experienced by each day and each sector is displayed in the fourth part of the table. Skewness looks at the asymmetry of the probability density function of returns around their respective mean. Positive skewness displays a long tail to the right indicating more of the values lying to the left of the mean, while a long left tail with values that lie more to the right of the mean, indicate negative skewness. When applied to investment returns, positive skewness implies frequent small losses and few extreme gains while negative skewness implies frequent small gains and few extreme losses. As discussed above, kurtosis values suggest that the returns on the JSE are non-normally distributed. Since skewness that equals to zero implies normality, results in Table 4 show all returns series having skewness values that are either greater than or less than zero. Monday returns are positively skewed for four sectors namely; Oil and Gas (J500), Basic Materials (J510), Consumer Goods (J530), and Telecommunications (J560). Negative skewness is present for the Industrials (J520), Health Care (J540), Consumer Services (J550), Financials (J580) and Technology (J590) sectors. This suggests that more than half the sectors on Mondays experience frequent small gains and few extreme losses. Since Mondays also display leptokurtosis; few extreme losses are more likely. Overall, J550 represents the most negatively skewed sector, whilst the Telecommunications sector (J560) is the most positively skewed.

4.2 DESCRIPTIVE STATISTICS FOR EACH MONTH OF THE YEAR

From Table 5 there appears to be no sign of a January effect. Mean returns in January are positive (0.01998) but they are not the largest when compared to the rest of the year. In fact, the last three months of the year (October, November and December) have the largest overall mean returns. Additionally, the largest mean return for January came from the Technology sector (J590) and the lowest return from the Industrials sector (J520). Three out of the twelve months had negative returns with September being the worst performer at -0.00251 or -0.25092%. When looking at the different sectors, all nine JSE industrial economic indices had positive returns. January, April, October and November are the only months that experience positive mean returns across all sector indices while May has negative returns for six out of the nine sectors. There is insufficient evidence to confidently confirm the presence of seasonality and it can therefore be concluded that based on monthly mean returns there is no sign of the January effect.

Table 5 also shows that the risk-return relationship found when looking at the months of the year is not evident. January has a greater standard deviation (0.07392) than December (0.06740), yet January is not rewarded for this extra risk as highlighted by the lower overall mean. Some studies (see Reinganum, 1983; Chen & Singal, 2004; Gultekin & Gultekin, 1983; Schwert, 1983) suggest that December returns are lower when compared to January, partly as a result of both the tax-loss-selling hypothesis and the window-dressing hypothesis. If the risk-return relationship holds true, then January should have a higher mean return when compared to December, thereby signifying a January effect. However, due to the inverse relationship found, no such conclusion can be drawn. This therefore strengthens the rejection of the January seasonality phenomenon. August appears to be the riskiest month (0.09383), while March exhibits the lowest overall standard deviation (0.06549). When each sector is scrutinised, it appears that the Technology sector (J590) is the riskiest. The least risky sector is the Industrials sector (J520). Results also suggest that J590, during July is by far the riskiest time with a standard deviation of 17.18820

.

Table 5: Descriptive statistics: monthly returns (30 June 1995 – 31 December 2012)

	Mean									
Month	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Jan	0.02304	0.01726	0.00643	0.01953	0.00965	0.00911	0.03122	0.01745	0.04617	0.01998
Feb	0.01365	0.00442	0.01299	-0.01973	-0.00216	0.01334	0.00803	0.01041	-0.00671	0.00380
Mar	0.02209	0.01929	0.00897	0.01558	0.02371	0.00595	0.03582	0.00853	-0.02098	0.01322
Apr	0.01551	0.02512	0.02062	0.02804	0.01793	0.01582	0.00779	0.01113	0.01768	0.01774
May	0.01688	-0.00026	-0.00775	0.01971	-0.00067	-0.00875	-0.00684	-0.00853	0.02931	0.00368
Jun	-0.01703	-0.00542	0.00103	0.00938	-0.0019	0.00121	-0.00987	0.00304	-0.0027	-0.00247
Jul	-0.00703	0.01632	0.01568	0.02400	0.01362	0.02819	0.02178	0.02231	-0.00115	0.01486
Aug	0.04058	0.01043	0.00856	0.00434	0.00878	0.00606	-0.00153	-0.01964	0.00780	0.00726
Sep	0.01672	0.00429	0.00696	0.00729	0.00638	-0.00867	-0.01929	0.00142	-0.03768	-0.00251
Oct	0.00884	0.01981	0.02825	0.03826	0.02999	0.04260	0.06532	0.03238	0.04825	0.03486
Nov	0.01262	0.01076	0.01975	0.03186	0.02235	0.01045	0.03753	0.01932	0.03002	0.02163
Dec	0.01339	-0.00242	0.02734	0.01511	0.02492	0.02171	0.02239	0.02356	0.03941	0.02060
Average	0.01327	0.00997	0.01240	0.01611	0.01272	0.01142	0.01603	0.01012	0.01245	
	Standard Deviation									
Month	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Jan	0.06402	0.05705	0.07730	0.08178	0.07533	0.07545	0.07495	0.06414	0.09525	0.07392
Feb	0.08966	0.08140	0.04910	0.04575	0.05121	0.06405	0.08646	0.06560	0.11928	0.07250
Mar	0.05973	0.07362	0.04876	0.08636	0.05844	0.05283	0.08275	0.04810	0.07885	0.06549
Apr	0.09729	0.09573	0.04140	0.05788	0.04335	0.05201	0.06170	0.04447	0.10420	0.06645
May	0.09449	0.07345	0.04575	0.06577	0.06633	0.06642	0.06075	0.05465	0.09817	0.06953
Jun	0.06047	0.06839	0.07709	0.06054	0.07311	0.06556	0.08685	0.06240	0.10001	0.07271
Jul	0.08005	0.08903	0.04943	0.06115	0.06600	0.05596	0.07533	0.05342	0.17188	0.07803
Aug	0.07421	0.06836	0.08853	0.07137	0.07934	0.10438	0.11037	0.12357	0.12433	0.09383
Sep	0.07804	0.08247	0.06266	0.09069	0.05434	0.06797	0.10481	0.05608	0.10414	0.07791
Oct	0.07629	0.08524	0.06247	0.05526	0.07032	0.06901	0.10407	0.07801	0.10223	0.07810
Nov	0.06151	0.06538	0.06131	0.05450	0.05329	0.07754	0.11561	0.04637	0.09776	0.07036
Dec	0.07025	0.07031	0.06195	0.06821	0.05386	0.04480	0.10954	0.05662	0.07102	0.06740
Average	0.07550	0.07587	0.06048	0.06660	0.06208	0.06633	0.08943	0.06279	0.10559	
	Kurtosis									
Month	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Jan	-0.49406	-0.57236	-0.47581	1.27958	0.34295	1.63716	-0.14251	0.69959	-0.61801	0.18406
Feb	-0.84570	-0.17362	1.87047	-0.33567	2.60608	-0.15442	1.49531	1.91612	-0.20710	0.68572
Mar	-1.25271	-0.36239	-0.37135	0.82393	-0.13898	-0.82372	-0.15266	0.40409	0.51471	-0.15101
Apr	0.05925	3.77301	1.93607	0.70695	0.26106	5.03586	0.30952	1.35095	3.26142	1.85490
May	-0.25467	-0.00799	-0.51600	-0.30459	-0.32897	-0.59355	-0.54666	-0.00497	0.74326	-0.20157
Jun	0.07275	7.67478	3.89248	-0.60644	2.06306	0.21459	-0.65886	-0.60377	0.01332	1.34021
Jul	-0.17757	1.70387	-0.28238	2.82730	-0.26531	-1.44242	3.82931	-0.23965	3.84676	1.08888
Aug	6.24303	2.57169	12.26819	8.60130	10.60214	14.43665	7.54334	14.23825	8.58793	9.45473
Sep	1.82847	0.36141	2.36612	2.09865	0.14762	0.48674	6.88515	1.96710	5.54830	2.40995
Oct	-0.43795	0.37248	-0.60809	-0.41052	0.90241	1.87687	0.83909	2.40279	0.73638	0.63039

Kurtosis										
Month	**J500**	**J510**	**J520**	**J530**	**J540**	**J550**	**J560**	**J580**	**J590**	**Average**
Nov	**3.13233**	**0.37953**	**0.15961**	**0.21057**	**-0.85272**	**-0.43700**	**2.71737**	**-0.16743**	**1.53581**	**0.74201**
Dec	**2.56201**	**0.08565**	**0.98373**	**0.67151**	**-0.72120**	**-0.16594**	**-0.53520**	**0.35246**	**1.28788**	**0.50232**
Average	**0.86960**	**1.31717**	**1.76859**	**1.29688**	**1.21818**	**1.67257**	**1.79860**	**1.85963**	**2.10422**	

Skewness										
Month	**J500**	**J510**	**J520**	**J530**	**J540**	**J550**	**J560**	**J580**	**J590**	**Average**
Jan	**0.50647**	**-0.08064**	**-0.37150**	**0.39742**	**-0.09676**	**-0.88343**	**-0.08703**	**-0.84810**	**-0.30094**	**-0.19606**
Feb	**-0.40142**	**0.35720**	**-0.62421**	**-0.08374**	**-1.10984**	**-0.06166**	**0.21726**	**0.80798**	**0.23652**	**-0.07354**
Mar	**-0.03577**	**-0.27285**	**0.63306**	**0.66322**	**0.15549**	**0.10931**	**0.00927**	**0.09796**	**-0.87086**	**0.05432**
Apr	**0.53332**	**1.50606**	**0.79051**	**0.21275**	**0.31553**	**-1.66554**	**0.57345**	**0.56575**	**-1.15257**	**0.18658**
May	**-0.04458**	**0.15883**	**-0.19884**	**0.63975**	**-0.06322**	**0.16815**	**-0.56765**	**0.56292**	**0.53450**	**0.13221**
Jun	**0.34875**	**-2.40092**	**-1.47525**	**0.07588**	**-1.11276**	**-0.91427**	**-0.12317**	**-0.08418**	**0.382434**	**-0.58928**
Jul	**-0.75178**	**-0.44775**	**-0.39880**	**-0.77129**	**-0.46581**	**0.39654**	**-1.33725**	**0.28973**	**-1.61145**	**-0.56643**
Aug	**-2.04919**	**-0.83710**	**-3.19258**	**-2.63489**	**-2.87172**	**-3.63258**	**-2.49779**	**-3.61684**	**-2.72994**	**-2.67363**
Sep	**-0.99341**	**-0.62057**	**-1.12211**	**-1.50642**	**-0.48619**	**-0.23382**	**-2.22925**	**-0.99835**	**-2.06660**	**-1.13964**
Oct	**-0.43940**	**-0.93540**	**-0.29791**	**0.30406**	**-0.17772**	**-1.01959**	**1.07066**	**0.37332**	**-0.69696**	**-0.20210**
Nov	**0.97873**	**0.67156**	**-0.01664**	**0.23340**	**0.13874**	**-0.31042**	**-0.82485**	**0.23988**	**-0.47104**	**0.07104**
Dec	**1.20670**	**-0.69597**	**-0.92180**	**-0.04608**	**0.05011**	**-0.73525**	**0.17028**	**0.02778**	**0.74173**	**-0.02250**
Average	**-0.09513**	**-0.29980**	**-0.59967**	**-0.20966**	**-0.47701**	**-0.73188**	**-0.46884**	**-0.21518**	**-0.66710**	

Source: Thompson DataStream (2010) and Author's own estimates

Part three of Table 5 reveals leptokurtosis to be present in all months with the exception of March and May. Ten out of twelve months have a higher chance of extreme values occurring in these months (fat tails). In view of the kurtosis results, the month of August is particularly noticeable. August displays an exceptionally large kurtosis relative to any other month of the year. To investigate why this has occurred, the author conducted a deeper investigation into the month of August (in unreported results). These results suggest that the Asian crisis in August 1998 had severely affected the overall kurtosis of that month. The Asian crisis engulfed the international market when the Thai baht collapsed and significantly increased volatility during this period (Ellis & Lewis, 2001; Polasek & Ren, 2001). The analysis in Table 5 includes the Asian crisis since eliminating this month does not change the overall kurtosis value from positive to either zero or negative, hence results remain accurate. Overall, March and May are the only two months that display negative kurtosis (platykurtic), which is indicative of thinner tails, meaning extreme values are less likely to occur.

Table 5 also displays the skewness for each month, each of the indices, together with their resultant averages. Negative skewness is experienced in January, February, June, July, August, September, October and December indicating frequent small gains with occasional large losses. March, April, May and November exhibit positive skewness, which means regular small losses with few large gains. Overall, January is negatively skewed for all sectors except the Oil and Gas (J500) and Consumer Goods (J530) sectors. January, which is also leptokurtic, can be seen as having a higher chance of experiencing large occasional losses than a normal distribution. December, is also negatively skewed (on average) with leptokurtosis and has a greater chance of experiencing extreme losses. Since returns display non-normal characteristics, a non-parametric test will be the best suited for the identification of any seasonality effects.

4.3 DESCRIPTIVE STATISTICS FOR PRE-HOLIDAY AND ORDINARY DAY RETURNS

Table 6 represents the mean returns for pre-holidays versus ordinary (or all other day) returns no pre-holiday effect can be identified. The mean for the pre-holiday returns is 0.00061 and the mean return for all other days is equal to 0.00074. This is unexpected due to the hundreds of studies that identify significantly higher returns on days just before a holiday (see for example: Kim & Park, 2004; Marret & Worthington, 2009, Cadsby & Ratner, 1992; Lakonishok & Smidt, 1988). Across all nine sectors, only Basic Materials (J510) and Consumer Services (J550) display pre-holiday returns that are greater than ordinary days. All other sectors display surprising results highlighting no higher mean return before public holidays compared to all other days in South Africa.

The standard deviation (on average) is found to be lower for the one day prior to a public holiday. Even with each sector viewed individually, they all display a lower standard deviation when compared to ordinary days. Overall, results show ordinary days to be riskier than pre-holidays and investors are rewarded with higher returns for this additional risk.

At this stage, no pre-holiday effect is evident in South Africa because returns on average, after being adjusted for dividends, are not higher than all other trading days on average. The only sectors with a pre-holiday effect based solely on their mean return are the Basic Materials (J510) and the Consumer Services (J550) sectors.

Pre-holiday returns are also found to be leptokurtic and on average, display positive skewness,. This means that there is a higher chance of extreme gains occurring than small losses. There are five indices that display positive skewness and are also leptokurtic, namely: the Oil and Gas (J500), Health Care (J540), Consumer Services (J550), Financials (J580) and Technology (J590) sectors. These indices have a higher chance of experiencing large gains than small losses. The remaining four indices which include Basic Materials (J510), Industrials (J520), Consumer Goods (J530), and Telecommunications (J560) all have negative skewness and are leptokurtic. These indices therefore experience large losses more frequently when looking at returns just before a holiday.

Table 6: Descriptive statistics: pre-holiday and ordinary day returns (30 June 1995 – 31 December 2012)

	Mean									
	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Pre-Holiday	0.00051	0.00123	0.00054	-0.00027	0.00055	0.0012	0.0009	0.00042	0.00037	0.00061
All other days	0.00080	0.00059	0.00068	0.00094	0.00074	0.00064	0.00096	0.00064	0.00065	0.00074
	Standard Deviation									
	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Pre-Holiday	0.01795	0.01604	0.01081	0.01595	0.01246	0.01084	0.02062	0.01225	0.02002	0.01522
All other days	0.01891	0.01746	0.01261	0.01716	0.01363	0.01182	0.02114	0.01334	0.0202	0.01625
	Kurtosis									
	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Pre-Holiday	4.79141	1.99928	3.60997	3.28036	3.77279	5.03818	2.8443	5.12271	10.34541	4.53382
All other days	4.16909	4.95448	6.46178	5.13308	5.98839	5.01717	6.74888	6.59848	9.71705	6.0876
	Skewness									
	J500	J510	J520	J530	J540	J550	J560	J580	J590	Average
Pre-Holiday	0.96797	-0.01926	-0.00202	-0.15356	0.62512	0.41717	-0.146	0.66054	1.513	0.42922
All other days	0.17419	0.16511	-0.39874	0.40442	-0.1464	-0.50598	0.33694	-0.28719	-0.2903	-0.06088

Source: Thompson DataStream (2010) and Author's own estimates

The ordinary days have a higher kurtosis value than pre-holiday returns on average. Also, ordinary days display negative skewness implying that on average, they have a greater chance of experiencing extreme losses. This is a very unusual result as the mean returns for ordinary days are higher on average. Additionally, there are now five indices that display negative skewness. These are the Industrial (J520), Health Care (J540), Consumer Services (J550), Financials (J580) and Technology (J590) indices. Results are similar to Alagidede (2013) who finds the South African stock market to be negatively skewed and leptokurtic.

4.4 UNIT ROOT TEST

Table 7 displays the *t*-stat for daily, monthly, pre-holiday and ordinary day returns for each sector index. Prior to performing the test, a graph representing the data revealed that data has a trend and an intercept and therefore when running the unit root test, both a trend and an intercept were included. Results from the unit root test are all significant at the 1% level indicating that the data is stationary in level. The next section will look at an OLS regression model to test for the day-of-the-week, January and pre-holiday effects.

Table 7: Augmented Dickey Fuller test

	Daily returns	Monthly returns	Pre-holiday returns	Ordinary day returns
J500	-59.78657[a]	-14.72671[a]	-13.03747[a]	-60.68869[a]
J510	-59.02787[a]	-14.01441[a]	-12.81803[a]	-60.12149[a]
J520	-59.68283[a]	-13.22226[a]	-14.42092[a]	-60.66015[a]
J530	-62.26127[a]	-15.98109[a]	-13.08373[a]	-63.19300[a]
J540	-60.09990[a]	-13.57149[a]	-12.70102[a]	-39.95494[a]
J550	-57.36679[a]	-12.36127[a]	-12.67033[a]	-58.14531[a]
J560	-60.31768[a]	-13.48454[a]	-12.48364[a]	-61.23491[a]
J580	-57.01147[a]	-14.37039[a]	-14.10808[a]	-58.01709[a]
J590	-40.73704[a]	-13.00628[a]	-12.20832[a]	-41.49499[a]

Source: Thompson DataStream (2010) and Author's own estimates
[a] significant at 1% level
[b] significant at 5% level
[c] significant at 10% level

4.5 THE DAY-OF-THE-WEEK EFFECT

Table 8 describes the regression results from equation (2). Nineteen out of a possible 45 are significant at either the 1%, 5% or 10% levels. Monday has a significant day-of-the-week effect in 8 out of 9 sectors. Monday returns are positive and significant at the 1% level for Telecommunications (J560) and significant at the 5% level for Oil and Gas (J500), Consumer Goods (J530), Health Care (J540) and Technology (J590) sectors. Monday is also positive at the 10% level for the Basic Materials (J510), Industrials (J520) and Consumer Services (J550) sectors. These results are in concurrence with Chinzara and Slyper (2013) who find a significant Monday effect on the All Share and Industrials sector in South Africa over the period 1 January 1995 to 31 December 2010. Unlike Chinzara and Slyper (2013), however, this study does not find a significant negative return on Fridays but other significant results are found on all other days. Finding a Monday effect is also supported by earlier studies such as Gibbons and Hess (1981), although they find negative Monday returns on the S&P 500 and the value-weighted and equal-weighted portfolios constructed by the Center for Research in Security Prices (CRSP) (also see Berument and Kiymaz, 2001 and Ajayi *et al*., 2004)

Table 8: Regression analysis for the day-of-the-week effect

	J500	J510	J520	J530	J540	J550	J560	J580	J590
Mon	0.00135[b]	0.00112[c]	0.00074[c]	0.00144[b]	0.00105[b]	0.00068[c]	0.00206[a]	0.00045	0.00155[b]
Tue	-0.00005	0.00023	0.00110[b]	0.00101	0.00085[c]	0.00099[b]	0.00145[b]	0.00103[b]	0.00100
Wed	-0.00057	0.00031	0.00081[c]	0.00056	0.00092[c]	0.00082[b]	-0.00015	0.00108[b]	0.00048
Thur	0.00184[a]	0.00085	0.00063	0.00129[b]	0.00039	0.00039	0.00070	0.00034	0.00008
Fri	0.00083	0.00003	-0.00010	-0.00018	0.00005	0.00005	0.00005	-0.00032	0.00007

Source: Thompson DataStream (2010) and Author's own estimates
[a] significant at 1% level
[b] significant at 5% level
[c] significant at 10% level

Significant positive returns are found on a Tuesday in the Industrials (J520), Consumer Services (J550), Telecommunications (J560) and Financial (J580) sectors at the 5% level, as well as in the Health Care (J540) sector at the 10% level. These results are similar to those found in Basher and Sardorsky (2006). Basher and Sardorsky (2006) used one model that is identical to the regression model used in this study and the authors find significant Tuesday effects in Pakistan and the Philippines from December 1992 to October 2003. However, Basher and Sardorsky (2006) reveal these Tuesday's returns to be significantly negative, while this study finds a positive Tuesday effect. Similarly, Balaban (1995) finds a negative Tuesday mean return for the Istanbul

Stock Exchange. The differences in these findings could be attributed to the use of stock market indices and also the use of dividends.

Wednesday displays significant positive returns at the 5% level for the Consumer Services (J550) and Financial (J580) sectors, and at the 10% level for the Industrials (J520) and Health Care (J540) sectors. These findings are consistent with Berument and Kiymaz (2001) who find significant positive returns during Wednesdays using an OLS regression on the S&P 500 from 1973 to 1997. Bayar and Kan (2002) support results found in this study by analysing stock market indices from 19 international countries using a binary dummy variable regression from 20 July 1993 to 1 July 1998. Local currency Wednesday returns are found to be large and significantly positive in eleven countries. When dollar returns are observed, Wednesday is also significantly positive in eleven countries. Agrawal and Tandon (1994) find positive Wednesday effects in 13 out of 18 countries observed and these results are also supported by Dubois and Louvet (1996) who find positive Wednesday returns for eleven indices in nine countries from 1969 to 1992.

Thursday returns displays less seasonality with positive significance in the Oil and Gas sector (at the 1% level) and in Consumer Goods sector (at the 5% level). Basher and Sardorsky (2006) also find significantly positive returns on Thursdays in Turkey.

Friday displays no day effects which is unexpected. The findings contradict Agrawal and Tandon (1994), Balaban (1995) and Barone (1990) who provide evidence for positive mean returns on Fridays.

Overall, these nineteen significantly positive results suggest that market participants should short these indices on their respective days to earn abnormal profits, assuming transaction costs are negligible (Chinzara & Slyper, 2013).

4.6 THE JANUARY EFFECT

Table 9 reveals month effects in all except the Basic Materials (J510) sector. There is a January effect present in the Technology (J590) sector and this effect is significantly positive at the 10% level. The existence of a January effect supports earlier studies done by Rozeff and Kinney (1976), Gultekin and Gultekin (1983 and Robins *et al.* (1999). Rogalski and Tinic (1986) and Berges *et al*. (1984) also find a significant January effect in American and Canadian stock returns, respectively.

However, since 8 out of 9 sectors do not display any seasonal effect in the first month of the year it can be concluded that overall, the returns on the JSE do not display the January effect. Auret and Cline (2011) also find no January effect on the JSE from 1988 to 2006.

October displays the most seasonality with 7 out of 9 sectors displaying significance at the 1%, 5% or 10% levels. October returns are significantly positive at the 1% level for the Consumer Services (J550) and Telecommunications (J560) sector, and at the 5% level for the Consumer Goods (J530), Health Care (J540) and Financial (J580) sector. October returns also display month seasonality in the Industrial (J520) and Technology (J590) sectors at the 10% level. Alagidede (2013) reports a significantly positive October effect (at the 1% level) in Nigeria using an OLS regression model. When the All Share Index (in South Africa) is observed, no October seasonality is found. This difference in results could be attributed to the inclusion of dividends, which could have amplified October returns thereby creating a significant seasonal effect. Additionally, unlike Alagidede (2013), this study addresses a more recent sample period. Results contrast Jacobsen and Zhang (2012) who observed the UK stock market over a 317-year period. The authors find that a robust October effect exists; however, this effect is negative.

December shows significant positive returns in the Industrial (J520) and Health Care (J540) sectors, at the 10% level. Claessens *et al*. (1995) also find significant December effects in Pakistan and Jordan. Positive July returns are found to be significant at the 10% level in Consumer Services (J550) while all other sectors show no July effect. The December seasonality in the Industrial (J520) and Health Care (J540) sectors and July seasonality in the Consumer Services (J550) is reinforced by Brown *et al.* (1983) who find significant December and July effects in Australia. However, results in this study challenge Moosa (2007) who uses a dummy variable OLS regression and finds a significantly negative July effect from 1990 to 2005

.

Table 9: Regression analysis for the January effect

	J500	J510	J520	J530	J540	J550	J560	J580	J590
Jan	0.02304	0.01726	0.00643	0.01953	0.00965	0.00911	0.03122	0.01745	0.04617[c]
Feb	0.01365	0.00442	0.01299	-0.01973	-0.00216	0.01334	0.00803	0.01041	-0.00671
Mar	0.02209	0.01929	0.00897	0.01558	0.02371	0.00595	0.03582	0.00853	-0.02099
Apr	0.01551	0.02512	0.02062	0.02804[c]	0.01793	0.01582	0.00779	0.01113	0.01768
May	0.01688	-0.00026	-0.00775	0.01971	-0.00067	-0.00875	-0.00685	-0.00853	0.02931
Jun	-0.01703	-0.00542	0.00103	0.00938	-0.00190	0.00121	-0.00987	0.00304	-0.00270
Jul	-0.00703	0.01632	0.01568	0.02400	0.01362	0.02819[c]	0.02178	0.02231	-0.00115
Aug	0.04058[b]	0.01043	0.00856	0.00434	0.00878	0.00606	-0.00153	-0.01964	0.00780
Sep	0.01672	0.00429	0.00696	0.00729	0.00638	-0.00867	-0.01929	0.00143	-0.03768
Oct	0.00884	0.01981	0.02825[c]	0.03826[b]	0.02999[b]	0.04260[a]	0.06532[a]	0.03238[b]	0.04825[c]
Nov	0.01262	0.01076	0.01975	0.03186[b]	0.02235	0.01045	0.03753[c]	0.01932	0.03002
Dec	0.01339	-0.00242	0.02734[c]	0.01511	0.02492[c]	0.02171	0.02239	0.02356	0.03941

Source: Thompson DataStream (2010) and Author's own estimates
[a] significant at 1% level
[b] significant at 5% level
[c] significant at 10% level

The Consumer Goods (J530) sector reveals April seasonality and this effect is significant at the 10% level. Lucey and Whelan (2004) find evidence of an April effect in the Irish equity market from 1934–2000. Like Bhabra *et al*. (1999) this study also finds a November effect. Significant positive returns in November are found in the Consumer Goods (J530) sector (at the 5% level) and Telecommunications (J560) sector (at the 10% level). Additionally, August displays positive monthly seasonality in the Oil and Gas (J500) sector at the 5% level. Since all fifteen significant results are positive, it would make economic sense for market participants to short these indices on their respective months to earn abnormal profits, provided transaction costs are trivial.

4.7 THE PRE-HOLIDAY EFFECT

In view of Table 10, no pre-holiday effect exists in any of the nine economic sectors of the JSE. Results are inconsistent with Bhana (1994) who finds a significant pre-holiday effect in share returns of companies listed on the JSE during the period 1975–1990. Results in this study differ with Alagidede (2013) who also finds a pre-holiday effect on the All Share Index in South Africa. Both studies have an outdated sample period (up to and including 2012). This study suggests that the JSE is becoming increasingly efficient due to the lack of seasonality found. Also, when dividends are included, the pre-holiday mean returns are not significantly higher relative to all other trading days.

Table 10: Regression analysis for the pre-holiday effect

	J500	J510	J520	J530	J540	J550	J560	J580	J590
Pre-holiday	**0.00051**	**0.00123**	**0.00054**	**-0.00027**	**0.00055**	**0.00120**	**0.00091**	**0.00042**	**0.00037**

Source: Thompson DataStream (2010) and Author's own estimates
[a] significant at 1% level
[b] significant at 5% level
[c] significant at 10% level

The results in Table 10 represent significant departures from the empirical literature on other markets. Lakonishok and Smidt (1988) find significant pre-holiday effects when looking at the Dow Jones Industrial Average (DJIA). Cadsby and Ratner (1992) find pre-holiday effects in the United States, Canada, Japan, Hong Kong and Australia. Kim and Park (1994) find significantly higher returns for trading days before regular holidays for the NYSE, AMEX and NASDAQ. The authors also find pre-holiday effects in the UK and Japanese markets (see also Wilson & Jones, 1993; Mills & Coutts, 1995; and Arshad & Coutts, 1997). Marret and Worthington (2009) also find strong holiday seasonality in the Australian stock market from 1996 to 2006.

Finding no significant pre-holiday effect is supported by Vergin and McGinnis (1999) who investigate small and large corporations on the S&P 500 and NYSE from 1987 to 1996. The authors conclude that the pre-holiday effect only persists for small corporations. Results also concur with Dodd and Gakhovich (2011) who, using an OLS regression, find no significant pre-holiday effect in Bulgaria, Croatia, Czech Republic, Latvia, Poland, Romania, Serbia, Slovakia, Slovenia and the Ukraine.

Thus far, the traditional approach to finding seasonality has been applied. In the next section, calendar effects on higher statistical moments will be observed, which will include a relatively new methodology (the K-S test).

4.8 CONCLUSION

This section assessed calendar anomalies by using the standard approach used in literature, namely: the dummy variable regression model. Various day and month effects were highlighted but pre-holiday effects were found to have dissipated. Overall no weekend effect is found and the January effect is also non-existent.

CHAPTER FIVE

5. DIRECT TEST ON SKEWNESS AND KURTOSIS RESULTS

This chapter employs the second methodology, which is a relatively new technique used for testing calendar anomalies. The K-S test is a non-parametric test that pays particular attention to higher statistical moments (skewness and kurtosis). This chapter is structured as follows: Sections 5.1- 5.3 show the results from the non-parametric two-sample Kolmogorov-Smirnov test for each of the nine indices for the day-of-the-week effect, the January effect and the pre-holiday effect, respectively. The final Section 5.4 describes how one can create a trading strategy to extract profits from calendar effects based on higher statistical moments.

5.1 THE DAY-OF-THE-WEEK EFFECT ON SKEWNESS AND KURTOSIS

Earlier it was concluded that returns of the nine industrial economic sector indices of the JSE are non-normally distributed by displaying skewness and kurtosis values which do not equal a normal distribution. These findings are unsurprising and warrant the need to test for any calendar effects through the use of a non-parametric test. This study employs the Kolmogorov-Smirnov (K-S) two-sample test to identify any seasonality on the JSE. Returns are standardised by transforming the mean to zero and standard deviation to one, thereby leaving the skewness and kurtosis untouched. The K-S two-sample test analyses the hypothesis of equal distribution between the standard scores from two different days and is extremely sensitive to higher statistical moments (skewness and kurtosis). The null hypothesis states that the computed standard scores between two days for each index are equal. The rejection of null hypothesis in favour of the alternative hypothesis implies that the two days have different skewness and kurtosis and that they differ in higher statistical moments. To determine the presence of any day seasonality, the mean returns for one weekday (for a particular index) must be significantly different from any other weekday at the 10% level or lower. Ten combinations of weekdays are constructed over each sector, which means 90 tests will be conducted. For each combination, the maximum difference is recorded as well as the significance of the p-values. The actual p-values are not given but this does not affect the interpretation of results in any way.

Table 11 records the results for the two-sample K-S test for the day-of-week effect on the nine JSE sectors. Positive Monday returns for the Health Care (J540) sector are significantly different from positive Wednesday returns at the 5% significance level with maximum difference equal to

0.06702. It can safely be said that the Health Care sector has a significant seasonality effect mainly due to its mean, skewness and kurtosis between Monday returns and Wednesday returns. This significant difference between Monday and Wednesday is highlighted again in the Technology (J590) sector but at a weaker significance. Once again, positive Monday returns are significantly different from positive Wednesday returns at the 10% significance level with a maximum difference equal to 0.02544. This is somewhat enlightening as both weekday returns are positive. This suggests that if a trading strategy is to be created then stocks in these should be bought on the day with smaller returns and sold on the day with higher returns. Section 5.4 will help disentangle the complexity of forming trading strategies when calendar anomalies are found on higher statistical moments.

Table 11: Two-sample Kolmogorov-Smirnov test for the day-of-the-week effect

Category	J500	J510	J520	J530	J540	J550	J560	J580	J590
Mon-Tue	0.02223 p > .10	0.04536 p > .10	0.02725 p > .10	0.02250 p > .10	0.03062 p > .10	0.04052 p > .10	0.03301 p > .10	0.03207 p > .10	0.02471 p > .10
Mon-Wed	0.03491 p > .10	0.05624 p > .10	0.05548 p > .10	0.04819 p > .10	0.06702[c] p < .05	0.03048 p > .10	0.02890 p > .10	0.03457 p > .10	0.02544[b] p < .10
Mon-Thur	0.02864 p > .10	0.03337 p > .10	0.03345 p > .10	0.04138 p > .10	0.02927 p > .10	0.01420 p > .10	0.02201 p > .10	0.01849 p > .10	0.02470 p > .10
Mon-Fri	0.02895 p > .10	0.05736 p > .10	0.02738 p > .10	0.02959 p > .10	0.03187 p > .10	0.03690 p > .10	0.03410 p > .10	0.02294 p > .10	0.02142 p > .10
Tue-Wed	0.04072 p > .10	0.02794 p > .10	0.02631 p > .10	0.04344 p > .10	0.03068 p > .10	0.02323 p > .10	0.03248 p > .10	0.01643 p > .10	0.04351 p > .10
Tues-Thur	0.01693 p > .10	0.03869 p > .10	0.03869 p > .10	0.04232 p > .10	0.03144 p > .10	0.03628 p > .10	0.03628 p > .10	0.03265 p > .10	0.03990 p > .10
Tues-Fri	0.02298 p > .10	0.01572 p > .10	0.02781 p > .10	0.03869 p > .10	0.02056 p > .10	0.02660 p > .10	0.03628 p > .10	0.01935 p > .10	0.03023 p > .10
Wed-Thur	0.02451 p > .10	0.02481 p > .10	0.01739 p > .10	0.01698 p > .10	0.01477 p > .10	0.02125 p > .10	0.01662 p > .10	0.02220 p > .10	0.02055 p > .10
Wed-Fri	0.02650 p > .10	0.02441 p > .10	0.01863 p > .10	0.01467 p > .10	0.02871 p > .10	0.01606 p > .10	0.01737 p > .10	0.02091 p > .10	0.03174 p > .10
Thur-Fri	0.01814 p > .10	0.04474 p > .10	0.02418 p > .10	0.01572 p > .10	0.03386 p > .10	0.03628 p > .10	0.02056 p > .10	0.02418 p > .10	0.01572 p > .10

Source: Thompson DataStream (2010) and Author's own estimates
Upper row shows the K-S statistic.
Lower row shows the Probability > K-S statistic
[a] significant at 1% level
[b] significant at 5% level
[c] significant at 10% level

This study reinforces the study by Doyle and Chen (2009) who test for the daily seasonality on closing price indices in: the US (NYSE composite and NASDAQ composite); Japan (NIKKIE225); the UK (FTSE100); Germany (DAX30); France (CAC40); and Hong Kong (Hang Seng composite) during 1997 and 2007. The authors find no weekend effect in all indices except for AMEX and DAX. They do, however, identify the existence of a significant general weekday effect and also state that markets are inefficient. The current study also identifies a weekday effect with Monday having a significantly higher return than Wednesday (based on skewness and kurtosis) for both Health Care (J540) and Technology (J590) sectors. If this effect is focused on in isolation then there is new evidence against the EMH in South Africa. Two conclusions can be made at this point. Firstly, seasonality does indeed exist and pushes returns for some of the days of the week (i.e. Mondays) to be higher than other weekdays (i.e. Wednesdays) and this effect is not restricted to a Friday relative to a Monday for the weekend effect. Secondly, if only the day-of-the-week effect had been looked at then the continued existence of relatively stable seasonality effects would have been missed (by narrowing the test down to Friday and Monday tests). By analysing 10 different pairs in this study, a general weekday test is performed and allows the rejection of a weekend effect to be consistent with previous research but creates new-found evidence for a weekday effect between Monday and Wednesday. The two significant results that were found to occur between Monday and Wednesday still only exist in two out of nine sectors. Therefore, there may be a weekday effect present but overall there appears to be no seasonality (88 out of 90 tests are insignificant).

There appears to be no evidence suggesting that a day-of-the-week effect exists on the nine JSE sector indices. Monday mean returns are on average larger than Friday returns indicating no weekend effect and this is confirmed by the results from the K-S tests. All sectors (including Health Care-J540 and Technology-J590) show no weekend effect, therefore rendering trading strategies aimed at exploiting this calendar effect useless. Given that nine indices have been analysed, the researcher can conclude that finding two significant results out of 90 makes the result inconclusive. Therefore, mean returns for the nine economic sectors follow a random walk and describe the JSE as weak-form efficient. Thus far, results are in concurrence with Mbululu and Chipeta (2012) who look at the nine JSE sectors for a day-of-the-week effect. Mbululu and Chipeta (2012) find the Basic Materials (J510) sector to have a significant (at the 10% level) day-of-the-week effect. However, the results show no day seasonality overall and the authors conclude that the JSE shows no sign of a day-of-the-week effect on skewness and kurtosis. Mbululu and Chipeta (2012) also find the JSE to be weak-form efficient and support the findings of this study. However, unlike Mbululu and Chipeta (2012), this study finds other day seasonality (Monday and Wednesday for J540 and J590) and suggests that the inclusion of dividends significantly affected the results obtained. When dividends are included then Monday mean returns are always greater than Friday returns. This suggests that the use of total returns largely affects the identification of the day-of-the-week effect and should be a factor to consider when trading strategies are devised.

This study supports by Plimsoll *et al.* (2013) who investigated the JSE's All-Share Index (ALSI) and Top 40 Index (TOPI) from 26 July 2006 to 27 July 2012. Plimsoll *et al.* (2013) conclude that the day-of-the-week effect does not exist on the index level, which is in line with this study but find that this seasonality does exist at a firm-specific level. Kalidas *et al*. (2013) observe the JSE All Share Index from 2004 to 2012 and conclude that the day-of-the-week effect does not exist on the South African stock market but does exist in other African countries. The authors employ the K-S test and find significant results in Zambia, Botswana, Nigeria and Morocco. This result reinforces the conclusion in this study in that a day-of-the-week effect is found to be non-existent.

Results report no day-of-the-week effect and are in direct opposition to the hundreds of studies that identify this effect as a well-known calendar anomaly. Basher and Sardorsky (2006) find a significant Monday effect in South Africa using the JSE ALSI using conditional and unconditional risk dummy variable regression models. Gibbons and Hess (1981) find a strong weekend effect when looking at the S&P 500 with equally weighted portfolios constructed from the CRSP and on the Treasury Bill market from 1962 to 1978 (also see Agrawal & Tandon, 1994; Balaban, 1995; Barone, 1990). Dubois and Louvet (1996) also identify the day-of-the-week effect in some European countries but confirm the lack of significance in the US. Overall, this study is in line with most studies done in South Africa but violates seasonality effects found in other markets (both developing and developed).

5.2 THE JANUARY EFFECT ON SKEWNESS AND KURTOSIS

Table 12 shows the results for the two-sample K-S test that attempts to identify a January effect based on higher statistical moments. The skewness and kurtosis values described earlier for each month displayed monthly mean returns to be non-normally distributed. The returns are then standardised by taking each monthly return and subtracting the mean monthly return and thereafter dividing the answer by the standard deviation of the monthly returns, thereby providing a standard score for each month.

Table 12: Two-sample Kolmogorov-Smirnov test for the January effect

CATEGORY	J500	J510	J520	J530	J540	J550	J560	J580	J590
JAN-FEB	0,11765 p >.10	0,17647 p >.10	0,23529 p >.10	0,17647 p >.10	0,11765 p >.10	0,11765 p >.10	0,35294 p >.10	0,23529 p >.10	0,11765 p >.10
JAN-MAR	0,17647 p >.10	0,17647 p >.10	0,17647 p >.10	0,17647 p >.10	0,11765 p >.10	0,17647 p >.10	0,29412 p >.10	0,17647 p >.10	0,05882 p >.10
JAN-APR	0,17647 p >.10	0,17647 p >.10	0,29412 p >.10	0,11765 p >.10	0,11765 p >.10	0,17647 p >.10	0,29412 p >.10	0,29412 p >.10	0,11765 p >.10
JAN-MAY	0,11765 p >.10	0,17647 p >.10	0,17647 p >.10	0,23529 p >.10	0,11765 p >.10	0,11765 p >.10	0,29412 p >.10	0,23529 p >.10	0,11765 p >.10
JAN-JUN	0,11765 p >.10	0,17647 p >.10	0,17647 p >.10	0,17647 p >.10	0,11765 p >.10	0,11765 p >.10	0,17647 p >.10	0,17647 p >.10	0,11765 p >.10
JAN-JUL	0,12092 p >.10	0,15359 p >.10	0,10784 p >.10	0,06863 p >.10	0,11765 p >.10	0,20915 p >.10	0,20588 p >.10	0,20261 p >.10	0,18627 p >.10
JAN-AUG	0,12092 p >.10	0,15359 p >.10	0,23856 p >.10	0,17647 p >.10	0,13399 p >.10	0,24510 p >.10	0,12092 p >.10	0,29739 p >.10	0,23529 p >.10
JAN-SEP	0,11765 p >.10	0,06863 p >.10	0,12418 p >.10	0,12092 p >.10	0.10784 p >.10	0,13725 p >.10	0,15033 p >.10	0,13399 p >.10	0,17647 p >.10
JAN-OCT	0,11765 p >.10	0,12418 p >.10	0,16340 p >.10	0,27124 p >.10	0.12092 p >.10	0,07843 p >.10	0,31699 p >.10	0,13399 p >.10	0,19935 p >.10
JAN-NOV	0,25163 p >.10	0,15359 p >.10	0,19281 p >.10	0,21569 p >.10	0,10784 p >.10	0,15359 p >.10	0,31699 p >.10	0,18954 p >.10	0,18627 p >.10
JAN-DEC	0,12092 p >.10	0,15359 p >.10	0,18301 p >.10	0,21242 p >.10	0.13725 p >.10	0,10458 p >.10	0,26144 p >.10	0,18954 p >.10	0,13072 p >.10
FEB-MAR	0,17647 p >.10	0,05882 p >.10	0,23529 p >.10	0,17647 p >.10	0,17647 p >.10	0,11765 p >.10	0,23529 p >.10	0,05882 p >.10	0,11765 p >.10
FEB-APR	0,17647 p >.10	0,17647 p >.10	0,17647 p >.10	0,11765 p >.10	0,17647 p >.10	0,17647 p >.10	0,17647 p >.10	0,23529 p >.10	0,11765 p >.10
FEB-MAY	0,17647 p >.10	0,11765 p >.10	0,17647 p >.10	0,17647 p >.10	0.17647 p >.10	0,11765 p >.10	0,11765 p >.10	0,17647 p >.10	0,11765 p >.10
FEB-JUN	0,23529 p >.10	0,11765 p >.10	0,11765 p >.10	0,17647 p >.10	0,11765 p >.10	0,17647 p >.10	0,17647 p >.10	0,11765 p >.10	0,11765 p >.10
FEB-JUL	0,18954 p >.10	0,06863 p >.10	0,20261 p >.10	0,09150 p >.10	0,13072 p >.10	0,20588 p >.10	0,10131 p >.10	0,20588 p >.10	0,13072 p >.10
FEB-AUG	0,24510 p >.10	0,07843 p >.10	0,19608 p >.10	0,17974 p >.10	0,24183 p >.10	0,29412 p >.10	0,17647 p >.10	0,17647 p >.10	0,12745 p >.10
FEB-SEP	0,24510 p >.10	0,13399 p >.10	0,20261 p >.10	0,17647 p >.10	0,15686 p >.10	0,13399 p >.10	0,06536 p >.10	0,09477 p >.10	0,11765 p >.10
FEB-OCT	0,18954 p >.10	0,12418 p >.10	0,14706 p >.10	0,26144 p >.10	0,15359 p >.10	0,12745 p >.10	0,32026 p >.10	0,15033 p >.10	0,11765 p >.10
FEB-NOV	0,30065 p >.10	0,09477 p >.10	0,20588 p >.10	0,19608 p >.10	0,21242 p >.10	0,12745 p >.10	0,12745 p >.10	0,09804 p >.10	0,12745 p >.10
FEB-DEC	0,24510 p >.10	0,11765 p >.10	0,10131 p >.10	0,12418 p >.10	0,20915 p >.10	0,11111 p >.10	0,20915 p >.10	0,09477 p >.10	0,13399 p >.10
MAR-APR	0,17647 p >.10	0,23529 p >.10	0,17647 p >.10	0,11765 p >.10	0,11765 p >.10	0,17647 p >.10	0,11765 p >.10	0,23529 p >.10	0,17647 p >.10
MAR-MAY	0,17647 p >.10	0,17647 p >.10	0,11765 p >.10	0,11765 p >.10	0,05882 p >.10	0,11765 p >.10	0,11765 p >.10	0,23529 p >.10	0,11765 p >.10
MAR-JUN	0,17647 p >.10	0,23529 p >.10	0,11765 p >.10	0,11765 p >.10	0,11765 p >.10	0,11765 p >.10	0,11765 p >.10	0,17647 p >.10	0,17647 p >.10
MAR-JUL	0,12745 p >.10	0,18627 p >.10	0,11111 p >.10	0,07843 p >.10	0,11111 p >.10	0,19935 p >.10	0,13399 p >.10	0,15686 p >.10	0,18627 p >.10
MAR-AUG	0,17647 p >.10	0,18627 p >.10	0,23529 p >.10	0,11765 p >.10	0,13399 p >.10	0,18627 p >.10	0,18301 p >.10	0,17974 p >.10	0,23529 p >.10
MAR-SEP	0,18301 p >.10	0,13072 p >.10	0,12418 p >.10	0,11765 p >.10	0,07843 p >.10	0,13725 p >.10	0,12745 p >.10	0,09477 p >.10	0,13072 p >.10
MAR-OCT	0,12745 p >.10	0,24183 p >.10	0,16667 p >.10	0,15033 p >.10	0,07190 p >.10	0,12092 p >.10	0,16013 p >.10	0,15686 p >.10	0,19935 p >.10
MAR-NOV	0,18301 p >.10	0,13072 p >.10	0,08170 p >.10	0,13725 p >.10	0,09804 p >.10	0,11765 p >.10	0,18627 p >.10	0,10131 p >.10	0,18627 p >.10
MAR-DEC	0,18301 p >.10	0,13072 p >.10	0,12418 p >.10	0,12418 p >.10	0,13725 p >.10	0,11765 p >.10	0,10458 p >.10	0,15359 p >.10	0,19281 p >.10
APR-MAY	0,05882 p >.10	0,11765 p >.10	0,11765 p >.10	0,23529 p >.10	0,05882 p >.10	0,23529 p >.10	0,17647 p >.10	0,29412 p >.10	0,17647 p >.10
APR-JUN	0,11765 p >.10	0,11765 p >.10	0,11765 p >.10	0,17647 p >.10	0,11765 p >.10	0,23529 p >.10	0,23529 p >.10	0,23529 p >.10	0,23529 p >.10
APR-JUL	0,12418 p >.10	0,06209 p >.10	0,10784 p >.10	0,09150 p >.10	0,11111 p >.10	0,27451 p >.10	0,11765 p >.10	0,16013 p >.10	0,13399 p >.10
APR-AUG	0,12418 p >.10	0,05882 p >.10	0,11765 p >.10	0,11765 p >.10	0,13399 p >.10	0,27451 p >.10	0,17647 p >.10	0.29412[b] p <0.5	0,17647 p >.10

CATEGORY	J500	J510	J520	J530	J540	J550	J560	J580	J590
APR-SEP	0,12745	0,05882	0,08497	0,11765	0,09804	0,16340	0,12092	0,12745	0,11765
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
APR-OCT	0,06863	0,11111	0,10784	0,20588	0.12092	0,16340	0,21569	0,12745	0,25817
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
APR-NOV	0,13072	0,10784	0,10458	0,15033	0,15359	0,21895	0,07190	0,16013	0,14706
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
APR-DEC	0,17974	0,11111	0,10458	0,10131	0,14052	0,16340	0,10458	0,16013	0,21569
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
MAY-JUN	0,05882	0,17647	0,11765	0,11765	0,05882	0,17647	0,11765	0,11765	0,11765
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
MAY-JUL	0,12418	0,13072	0,14379	0,12092	0,13399	0,26144	0,18627	0,08497	0,12745
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
MAY-AUG	0,17647	0,13072	0,19608	0,17647	0,24510	0,23529	0,29739	0,23856	0,17974
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
MAY-SEP	0,12745	0,13399	0,14379	0,17647	0,13725	0,12418	0,18627	0,06863	0,07190
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
MAY-OCT	0,12092	0,18301	0,10784	0,12092	0,13399	0,12092	0,26144	0,12418	0,14052
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
MAY-NOV	0,13725	0,14379	0,19281	0,12092	0,09477	0,15359	0,18627	0,13399	0,12745
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
MAY-DEC	0,17974	0,09477	0,11765	0,12418	0,13725	0,17647	0,20261	0,07843	0,13399
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUN-JUL	0,11765	0,21242	0,20588	0,13072	0,16340	0,25817	0,12418	0,14379	0,12745
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUN-AUG	0,11765	0,21242	0,17647	0,17974	0,19281	0,30392	0,23856	0,23529	0,17974
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUN-SEP	0,11111	0,16340	0,15033	0,17647	0,13725	0,25490	0,12745	0,12092	0,11765
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUN-OCT	0,11765	0,16340	0,16340	0,15359	0,13399	0,19935	0,25817	0,14379	0,19935
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUN-NOV	0,13725	0,32026	0,26144	0,12092	0,15686	0,14379	0,19935	0,13725	0,11111
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUN-DEC	0,12092	0,21242	0,10458	0,12418	0,16340	0,10458	0,20261	0,08824	0,13399
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUL-AUG	0,22222	0,11111	0,22222	0,16667	0,16667	0.33333[b]	0,16667	0,22222	0,11111
	p >.10	p >.10	p >.10	p >.10	p >.10	p < 0.25	p >.10	p >.10	p >.10
JUL-SEP	0,22222	0,16667	0,11111	0,11111	0,11111	0,16667	0,11111	0,11111	0,11111
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUL-OCT	0,16667	0,11111	0,11111	0,27778	0,16667	0,22222	0,33333	0,16667	0,33333
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUL-NOV	0,27778	0,22222	0,11111	0,22222	0,16667	0,16667	0,11111	0,05556	0,27778
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
JUL-DEC	0,16667	0,16667	0,11111	0,22222	0,16667	0,16667	0,22222	0,11111	0,27778
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
AUG-SEP	0,11111	0,16667	0,27778	0,11111	0,22222	0,27778	0,16667	0,27778	0,16667
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
AUG-OCT	0,16667	0,16667	0,22222	0,33333	0,33333	0,22222	0,33333	0,33333	0,27778
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
AUG-NOV	0,27778	0,16667	0,33333	0,27778	0,38889	0,33333	0,27778	0,33333	0,22222
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
AUG-DEC	0,27778	0,16667	0,27778	0,27778	0,33333	0,33333	0,27778	0,27778	0,27778
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
SEP-OCT	0,16667	0,11111	0,11111	0,27778	0,11111	0,11111	0,33333	0,11111	0,33333
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
SEP-NOV	0,16667	0,22222	0,11111	0,27778	0,16667	0,16667	0,16667	0,11111	0,22222
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
SEP-DEC	0,22222	0,16667	0,11111	0,16667	0,16667	0,11111	0,22222	0,16667	0,16667
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
OCT-NOV	0,22222	0,22222	0,16667	0,16667	0,16667	0,11111	0,11111	0,16667	0,22222
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
OCT-DEC	0,16667	0,16667	0,11111	0,11111	0,16667	0,11111	0,16667	0,11111	0,22222
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10
NOV-DEC	0,16667	0,11111	0,11111	0,16667	0,11111	0,11111	0,16667	0,05556	0,22222
	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10	p >.10

Source: Thompson DataStream (2010) and Author's own estimates
Upper row shows the K-S statistic.
Lower row shows the Probability > K-S statistic
[a] significant at 1% level
[b] significant at 5% level
[c] significant at 10% level

Sixty-five pairs of months are constructed from 12 months, allowing for the testing of each month against all other 11 months. The researcher developed 594 tests to determine whether a January effect exists and if any other monthly seasonality is present. The time period chosen is from 31 June 1995 to 31 December 2012, which therefore includes 17 observations for the months, up to, and including January to June and another 18 observations for the months, up to, and including July to December. The number of observations may be a severe limitation to the K-S test that generally requires a large sample and/or observations. When the day-of-the-week effect was considered earlier in this study, each day had 800+ observations and since the January effect has only 17 and/or 18 observations per test, results should be analyzed with care. As indicated in Table 12, many of the K-S statistics have similar values, which could be due to returns being placed on the same scale (after being standardised) or alternatively due to the extremely small number of observations. Despite these disadvantages, the interpretation is appropriate to identify monthly seasonality on higher statistical moments.

Table 12 shows 2 out of 594 K-S tests to be statistically significant. April is significantly different (at the 5% level) from August in the Financials (J580) sector, while July is significantly different to August in the Consumer Services (J550) sector. All other combinations are found to be insignificant and there is no evidence of a January effect across all nine sector indices on the JSE. Overall, results indicate that there are no seasonal patterns in monthly returns based on higher statistical moments on any of the nine JSE sector indices. This also confirms the rejection of any trading rule strategies trying to exploit seasonality in monthly stock returns.

Li and Liu (2010) observe four market and 16 industry indices of the New Zealand stock exchange from 1997 to 2009. August is found to have significantly negative returns in eight industry sectors and two market indices. This study identifies April to be statistically different from August mainly due to its mean, skewness and kurtosis and this effect is significant at the 5% level in the Financial (J580) sector (with a maximum difference equal to 0.29412). August returns are significantly negative, while April returns are significantly positive and this effect is only found in J580. Results are similar to Claessens *et al*. (1995) who establish a significant August effect in Argentina, Jordan, Malaysia and the Philippines with a sample period ending in 1992. Additionally, the authors identify an April effect in Brazil (see also Lucey & Whelan, 2004). Agrawal and Tandon (1994) employ a non-parametric Kruskal Wallis test and find significant

August effects in Canada, Italy, Mexico, Sweden and the UK. April effects are also significant in Belgium, Brazil, Denmark, France, New Zealand, the UK and the Dow Jones Industrial Average. July is also significantly different to August at the 5% level in the Consumer Services (J550) sector and with a maximum difference of 0.33333. This August effect however, is only evident in two out of a possible 22 combinations (11 pairs in Financial-J580 and 11 pairs in Consumer Services-J550). These results are in contrast to Alagidede (2013) who find only a February effect in South Africa. The author classifies an August effect in Nigeria and a July effect in Zimbabwe. Alagidede (2013) and results in the current study give no evidence of a significant January effect in South Africa.

Overall, 592 out of 594 tests are insignificant and there appears to be no January effect on the nine sectors of the JSE. This result is consistent with Auret and Cline (2011) who investigate the January effect on the FTSE/JSE All Share Index for two periods: from January 1988 to December 1995, and January 1996 to December 2006. The January effect is found to be non-existent and this concurs with results of this study (see also Page & Palmer, 1991). Mehdian and Perry (2002) assess the US market from 1964 until 1998 and conclude that the January effect can no longer be regarded as a well-documented anomaly.

Finding no monthly seasonality, and specifically a January effect, is in conflict with previous global evidence that has been documented for decades especially in international markets. There have been a number of tests conducted outside the United States. Depending on the tax year end, significant January effects, or June effects in the case of Australia, are found to be present in Canada, Australia, Holland and South Africa (Berges *et al.*, 1984; Brown *et al.*, 1983; Gultekin & Gultekin, 1983; Robins *et al.*, 1999; Van den Bergh & Wessels, 1984). Taken as a whole, the nine industrial economic sectors show no evidence of a January effect.

5.3 THE PRE-HOLIDAY EFFECT ON SKEWNESS AND KURTOSIS

Table 13: Two-sample Kolmogorov-Smirnov test for the Pre-holiday effect

Pre-holiday vs. ordinary	J500	J510	J520	J530	J540	J550	J560	J580	J590
K-S statistic	0.03968	0.04679	0.04779	0.04175	0.02306	0.04795	0.05291	0.04111	0.02138
P-value > K-S statistic	p > .10	p > .10	p > .10	p > .10	p > .10	p > .10	p > .10	p > .10	p > .10

Source: Thompson DataStream (2010) and Author's own estimates

The skewness and kurtosis values described earlier for pre-holiday and all other day returns displayed a non-normal distribution. The returns are then standardised by taking each pre-holiday holiday return and subtracting the mean return from it and thereafter dividing the answer by the standard deviation of the pre-holiday returns, providing a standard score for the group. Pre-holiday standard scores are tested against all other day standard scores to find a difference on higher statistical moments, which is done for each index. In earlier results, pre-holiday returns were found to be greater than all other days for only two sectors, namely: Basic Materials (J510) and Consumer Services (J550).

Table 13 shows all nine tests to be insignificant and imply that returns a day before a public holiday are not significantly different to all the remaining days of the year. Results are inconsistent with Bhana (1994) and Alagidede (2013) who find significant pre-holiday effects in South Africa. This difference in results could be attributed to the updated sample period used in this study. As seen earlier, there is very little evidence to support other calendar effects in South Africa and the increase in efficiency is most likely large enough to eliminate the pre-holiday effect as well. Vergin and McGinnis (1999) find that the holiday seasonality has dissipated over time for large corporations but still persists for small corporations. Fajardo and Pereira (2008) highlight a non-existent pre-holiday effect in the Sao Paulo stock exchange. However, this insignificant pre-holiday effect is contrary to Cao *et al*. (2009) and Meneu and Pardo (2004) who find pre-holiday seasonality in New Zealand and Spain, respectively (see also Dodd & Gakhovich, 2011).

Overall, no significant pre-holiday effect exists on the JSE. This unexpected outcome could be the result of the data set used where there were only a few observations for pre-holidays when compared to ordinary days. This result also has serious implications for traders wanting to earn arbitrage profits. Since a pre-holiday seasonality does not exist on the South African market, investors cannot create trading strategies based on this particular type of seasonality. Also, since no pre-holiday effect is found, the JSE can be described as being weak-form efficient. The next section will describe a possible trading strategy that can be used if any type seasonality is found to exist.

5.4 POSSIBLE TRADING STRATEGIES BASED ON THE DIRECT TEST ON SKEWNESS AND KURTOSIS RESULTS

An interesting working paper by Amaya, Jacobs, Christofferson and Vasquez (2011) investigates the effect of skewness and kurtosis and equity returns. The authors analyse every listed stock in the Trade and Quote (TAQ) database from 4 January 1993 until 30 September 2008. The relationship between realised higher statistical moments (realised skewness, kurtosis, and volatility) of individual stocks and future stock returns are examined. Results indicate that realised skewness and realised kurtosis predict next week's stock returns in the cross-section of returns but realised volatility does not. Realised skewness is found to have a negative relationship with future stock returns therefore portfolios with low skewness outperform those with high skewness. Additionally, realised kurtosis is positively related to future stock returns. Two conclusions are stated in light of their findings. Firstly, a trading strategy that buys stocks with lower realised skewness and sells stocks with higher realised skewness produces a significant positive return. Secondly, a trading strategy that buys stocks with high realised kurtosis and sells stocks with low realised kurtosis produces a significant positive return.

It is due to the complex nature of Amaya *et al.* (2011), that this study cannot simply make reference to/or directly apply any of their findings to the results obtained in the previous section. Also, given that there are no anomalies present overall, this study will not attempt to exploit seasonal trading strategies. However, this study can analyse the results keeping in mind the trading strategies mentioned in Amaya *et al.* (2011) and assuming transaction costs are zero. Earlier results revealed a significant weekday effect between Monday and Wednesday in the Health Care (J540) and Technology (J590) sectors, respectively. For the purposes of maintaining accuracy, each effect will be viewed separately. Monday is found to be significantly different from Wednesday in the Health Care sector (J540). Monday has a kurtosis value of 4.71211 and skewness of -0.38652, while Wednesday has kurtosis of 3.55154 and skewness of 0.33991. According to Amaya *et al.* (2011) a successful trading strategy should buy stocks with lower skewness and higher kurtosis. According to the significant weekday effect between Monday and Wednesday in J540, stocks (in this case the index) should be bought on a Monday (has lower skewness and higher kurtosis than Wednesday) and sold on a Wednesday to achieve a significant positive return. When looking at the other significant weekday effect between Monday and Wednesday in the Technology (J590) sector a different approach needs to be taken if a successful trading strategy is to be implemented. In the Technology (J590) sector, Monday has a kurtosis value of 6.94893 and skewness equal to -0.31092, while Wednesday has kurtosis of 7.41724 and skewness equal to -0.39756. It is now suggested that stocks are bought on a Wednesday (has higher kurtosis and lower skewness) and sold on a Monday. One major conclusion can be made at this point. If a significant effect is found to exist between two weekdays indicating a calendar effect, the next step is to go back to the original skewness and kurtosis and find the day that has the higher kurtosis value and lower skewness (indicating the day the index should be bought). The reverse is true for the other significant day, indicating the day the index should be sold.

For the January effect, the same concept would apply. However, the only significant effect found is between April and August in the Financials (J580) sector, and between July and August in the Consumer Services (J550) sector. For the first monthly effect, April is significantly different from August based on higher statistical moments in J580. April has kurtosis of 1.35095 and skewness of 0.56575, while August has kurtosis of 14.23825 and skewness of -3.61684. Drawing from Amaya *et al.* (2011), a successful trading strategy would include buying the index in August (has higher kurtosis and lower skewness than April) and selling it in the April of the following year. For the Consumer Services (J550) sector, July has kurtosis of -1.44242 and skewness equal to 0.39654, while August has kurtosis of 14.43665 and skewness equal to -3.63258. Therefore, the same trading strategy would be applied as J580 due to April having higher skewness and lower kurtosis than August.

In conclusion, this section does not attempt to “break through” the calendar anomaly phenomenon and the corresponding trading strategies that follow. This section simply gives a better understanding of what it actually means to find seasonality effects based on higher statistical moments and suggests possible methods moving forward when a trading strategy is considered.

5.5 CONCLUSION

This chapter investigated the day-of the-week, January and pre-holiday effects on the nine industrial economic sectors of the JSE. The K-S test is employed, which is a relatively new methodology for assessing stock price patterns. Results are not as significant as was found in

Chapter 4. Overall, there appears to be no sign of any calendar effect on any of the nine indices when looking at differences in skewness and kurtosis.

CHAPTER SIX

6. DISCUSSION OF OVERALL RESULTS

This chapter focuses on combining the results from the parametric and non-parametric tests. Finding common ground with regard to both methodologies will indicate a robust calendar effect. Each calendar will be discussed using both parametric and non-parametric tests. Lastly, calendar effects will be collectively reviewed and compared to existing literature.

6.1 THE DAY-OF-THE-WEEK EFFECT

Regression results reveal a significant Monday effect for all except the Financial (J580) sector and this effect is positive. For eight out of nine sectors, the JSE displays positive returns on a Monday. Tuesday returns are also found to be positive and significant for the Industrial (J520), Health Care (J540), Consumer Services (J550), Telecommunication (J560) and Financial (J580) sectors. Wednesday displays similar seasonality to Tuesday with positive returns for J520, J540, J550 and J580. Lastly, Thursday displays a positive calendar effect for the Oil and Gas (J500) and Consumer Goods (J530) sectors.

Using the non-parametric K-S two-sample test, only two combinations of weekdays are significant. Monday is found to be significantly different from Wednesday for Health Care (J540) and Technology (J590) sectors mainly due to its mean, skewness and kurtosis.

Observing both methodologies concurrently, a Monday and a Wednesday effect is realised for the Health Care (J540) sector using a regression analysis and Mondays are also found to be significantly different from Wednesdays for J540 using a K-S test. This is the only common result found and suggests that there is a significant Monday effect with Wednesday for J540. However, most results are inconsistent and the overall observation points to an increase in market efficiency for the JSE. A plausible explanation for this could be an easier flow of information in the South African stock market. Market participants may be more skilled and possess greater expertise when it comes to stock trading.

6.2 THE JANUARY EFFECT

The regression results from Section 4 revealed very weak monthly seasonality on the South African stock market. The only January effect was in the Technology (J590) sector, while April and July effects exist in the Consumer Goods (J530) and Consumer Services (J550) sectors respectively. An August effect is exposed in the Oil and Gas (J500) sector while October uncovered the most seasonality with significance in all sectors with the exception of Oil and Gas (J500) and Basic Materials (J510). November effects were highlighted in the Consumer Goods (J530) and Telecommunication (J560) sectors. December effects were found to exist in the Industrial (J520) and Health Care (J540) sectors.

When the K-S test is analysed, only two test results are significant. August is significantly different from April (for Financials-J580) and July (for Consumer Services-J550) and this difference is based on their higher statistical moments.

Consulting both methodologies, only July displays some seasonal effects in Consumer Services (J550). There is no January effect present in both tests and overall there appears to be very strong evidence against monthly seasonality on the JSE. One reason for this lack of seasonality could be due to the fact that the South African market has become more efficient and the January effect is no longer as strong as it once was.

6.3 THE PRE-HOLIDAY EFFECT

When holiday seasonality is observed using the regression and non-parametric test, no significant effect is found in either methodology. This result suggests that the pre-holiday effect does not exist on the JSE and is consistent regardless of which test is used. The nine industrial economic sectors of the JSE show no significant returns preceding a public holiday when compared to the rest of the year. Additionally, whether returns are assumed to be normally or non-normally distributed, results still reveal no significant pre-holiday effect.

For the K-S test, the lack of a pre-holiday effect can be attributed to the fact that very few pre-holiday observations were compared to a large amount of ordinary days. This poses a great weakness and suggests that the unfair comparison could lead to the result of no seasonality. However, since the regression model did not pick up any seasonality either, it can be concluded that there is no pre-holiday effect in the South African stock market.

6.4 CALENDAR EFFECTS ON THE JSE

When consulting each calendar effect using both methodologies, it is particularly evident that calendar effects do not exist on the South African stock market. This has serious implications for investors seeking to make profits by exploiting seasonal effects. This result also suggests that the JSE is weak-form efficient.

This study is in line with Coutts and Sheikh (2002) who investigated the weekend, pre-holiday and January effect on the JSE, focusing on the All Gold Index from 1987 to 1997. Using OLS regressions, no significant weekend effect is found. The January effect and pre-holiday effect also displays insignificant results. However, when pre-holiday returns are observed, the returns that precede a public holiday exceed other trading days by 77 times. This is in contrast to pre-holiday mean returns that are found in Chapter 4. One reason for this could be the inclusion of dividends. Once dividends are taken into account, the overall mean returns for pre-holidays are actually lower than other days. The second reason is the time period observed. This study looks at a much more recent sample period and may be indicative of greater efficiency. Coutts and Sheikh (2002) focused on the All Gold Index as an accurate representative of the South African stock market and this is a major drawback of their study. However, the nine economic sectors of the JSE used in this study reveal the same outcome and the results suggest that the JSE is weak-form efficient and that calendar effects on this particular market do not exist. Additionally, Coutts and Sheikh (2002) analysed these calendar effects using the standard approach (OLS regression), which does not give any attention to higher statistical moments. This study declares that calendar effects do not exist on the JSE using a regression and a non-parametric test.

This study also aligns closely with a recent study by Darrat *et al*. (2013). Seasonal anomalies on the JSE are observed from 1973 to 2012. The authors tested for the day-of-the-week, beginning-of-the-month, and month-of-the-year effects. Post-2008 shows insignificant effects and suggests that most of the anomalies that were present in earlier literature may have been filtered out. Darrat *et al*. (2013) conclude that the JSE became more efficient in the aftermath of the recent global financial crisis. The results in this study agree with the overall conclusion of Darrat *et al*. (2013) and suggest that any attempt to exploit seasonal anomalies on the South African stock market would prove to be ineffective due to the increase in market efficiency.

Other international markets also display a similar decrease in calendar effects. Chatterjee and Manaim (1997) scrutinise the January, size, and weekend effect. From 1987 to 1992 the NYSE, American Stock Exchange (ASE) and Over-the-Counter (OTC) markets are observed using a Multivariate Regression Model (MVRM). A January effect exists for small firms but there is no evidence supporting the presence of any pervasive weekend effect. This study reaffirms these results and endorses the insignificance of calendar effects on the South African market. It also confirms that these calendar effects have disappeared regardless of which methodological approach is employed.

This study links closely with Lean *et al*. (2007) who inspect the weekday and monthly seasonality while focusing on higher statistical moments. The authors employ the non-parametric stochastic dominance (SD) test over the period 1998 to 2002. The indices under inspection are: the Hang Seng Index for Hong Kong; Jakarta Composite Index for Indonesia; Kuala Lumpur Composite Index for Malaysia; Nikkei Index for Japan; Straits Times Index for Singapore; Taiwan Stock Exchange for Taiwan; and the SET Index for Thailand (also see Holden *et al*., 2005). The SD test, which focuses on higher statistical moments, reveals the weekday effect does exist in the Asian countries observed but the January effect does not (except for Singapore). The current study confirms results found in Lean *et al*. (2007) in that the January effect is non-existent, but differs with respect to the day-of-the-week effect.

On the other hand, a great deal of literature finds calendar anomalies to be significant. Ziemba (1991) investigates the monthly, turn-of-the-month, first-half-of-the-month, turn-of-the-year, holiday, and Golden Week effects on the Tokyo Stock Exchange from 1949 to 1988. Seasonality effects are found to be similar to the US and suggest a lack of market efficiency. Once again, the sample period is a major drawback of the study. Ziemba (1991) focuses on a time period that has thousands of articles dedicated to proving the inefficiencies of markets around the world. If a more recent sample is considered, a very different picture could be shown. The current study uses the most recent data and proposes that markets are indeed weak-form efficient when looking at returns that are not too backdated. Chan *et al.* (1996), using OLS regressions, analyses the following: the Kuala Lumpur Stock Exchange (KLSE); the Stock Exchange of Bombay (SEB); the Stock Exchange of Singapore (SES); and the Stock Exchange of Thailand (SET). Day-of-the-week effects are prevalent on all four stock markets, while the month-of-the-year effects exist only on the KLSE and SES. Islamic New Year effects are found on the KLSE and weak holiday effects found on the BSE. Chinese New Year effects are displayed on the SES and KLSE, with the effect more profound among small capitalisation stocks on the SET. Their study uses the typical methodological approach and also suggests that these effects are specific to these stock exchanges due to cultural and seasonal patterns. This study tackles calendar effects and suggests that its non-existence is due to the unique characteristics of the South African stock market, especially in more recent years.

Overall, results in this study suggest that the JSE exhibits no sign of the day-of-the-week, January and pre-holiday effect and this conclusion is the same regardless of which methodology is employed. Using the most recent data, results suggest that the South African stock market is weak-form efficient due to the lack of seasonality found.

CHAPTER SEVEN

7. CONCLUSION AND AREAS FOR FUTURE RESEARCH

This study investigated the day-of-the-week, January and pre-holiday effects on the nine industrial economic sectors of the JSE including; the Oil and Gas (J500), Basic Materials (J510), Industrials (J520), Consumer Goods (J530), Health Care (J540), Consumer Services (J550), Telecom (J560), Financials (J580) and the Technology (J590) sectors. From 31 June 1995 to 31 December 2012, each calendar effect is observed using two methodologies. Daily price and dividend data are obtained from DataStream and INET BFA Database. Closing prices and dividend yields are converted to total returns and are separated into each day for the day-of-the-week effect. For the January effect, the daily returns for the particular month together with the index in question are summed up to obtain an average monthly return. The pre-holiday effect is separated into pre-holiday returns (the day just before a public holiday) and ordinary days (all other trading days). The first methodology follows Chinzara and Slyper (2013) through the use of a dummy variable regression model for each calendar effect. The second methodology is the Kolmogorov-Smirnov (K-S) test. Firstly for the K-S test, the mean, standard deviation, skewness and kurtosis is calculated and analysed for each calendar effect. Secondly, total returns are converted to standard scores by converting the mean to zero and standard deviation to one. Lastly, Statistica is used to run the K-S test to find any difference between two groups, which is based solely on their skewness and kurtosis (higher statistical moments).

Using the regression model, the day-of-the-week effect shows some significance with 19 out of a possible 45 tests being significant at either the 1%, 5% or 10% levels. The January effect also displays weak evidence of persistence with only 15 out of 108 tests being significant at either the 1%, 2.5%, 5% or 10% levels. The pre-holiday shows no significant results and suggests that calendar effects that are assumed to be normally distributed do not exist on the JSE. Employing the K-S test, the day-of-the-week effect and January effect, each display only two significant results. The pre-holiday effect shows no significance in either methodology. These non-parametric test results are extremely important, since they do not consider whether the sample is normal or not. By analysing these anomalies as a whole using both methodologies, it can be said the South African stock market does not present any robust anomalies studied which suggests that the JSE is weak-form efficient.

This poses considerable implications for investors trying to create trading strategies aimed at exploiting seasonal effects. Section 5.4 describes how a trader can create abnormal profits when two groups of days or months are found to be significantly different from each other based on higher statistical moments. By consulting the number of insignificant results obtained for each calendar effect under each methodology, the JSE is found to be free of calendar effects.

This study suggests further research is necessary not only to confirm the results of this study but also to investigate the JSE and its underlying micro-processes. Further research should be undertaken to investigate whether or not a January effect exists within small firms. Therefore, a deeper look into individual companies should be taken for each calendar anomaly since no seasonal effects are found on an index level. One can also consider another approach for the pre-holiday effect when looking at the unfair comparison of pre-holiday returns and ordinary day returns.

The lack of seasonality in this study could be due to increased trading by institutional investors, allowing the processing of information to be made at a faster rate. The failure to identify seasonality suggests that prices follow a random walk. Since the detection of calendar effects provide profit opportunities and violates the basic foundation of market efficiency, the absence of such effects suggests that JSE may be moving towards weak form efficiency.

8. LIST OF REFERENCES

Agenor, P.R. (2003). Benefits and costs of international financial intergration: Theory and facts. *The World Economy, 26(8),* 1089–1118.

Aggarwal, R., & Rivoli, P. (1989). Seasonal and day of the week effects in four emerging stock markets. *Financial Review, 24(1),* 541–550.

Aggarwal, R., Rao, R. P., & Hiraki, T. (1990). Regularities in Tokyo Stock Exchange security returns: P/ E, size, and seasonal influences. *Journal of Financial Research*, *13(3),* 249–263.

Agrawal, A., & Tandon, K. (1994). Anomalies or illusions? Evidence from stock markets in eighteen countries. *Journal of International Money and Finance, 13(1),* 83–106.

Ajayi, R. A., & Mehdian, S. (1994). Rational investors' reaction to uncertainty: Evidence from the world's major markets. *Journal of Business Finance and Accounting, 21(4),* 533–545.

Ajayi, R. A, Mehdian, S., & Perry, M. (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.

Alagidede, P. (2013). Month of the year and Pre-holiday effects in African stock markets. *SAJEMS NS, 16(1),* 64–74.

Amaya, D., Jacobs, K., Christoffersen, P., & Vasquez, A. (2011). Do realized skewness and kurtosis predict the cross-section of equity returns? *Working paper, University of Houston*.

Andrianaivo, M., & Yartey, C. A. (2009). Understanding the growth of African financial markets. *IMF Working Paper,* 1–40.

Arshad, Z., & Coutts, J. (1997). Security price anomalies in the London international stock exchange: A 60 year perspective. *Applied Financial Economics, 7(5),* 455–464.

Auret, C., & Cline, R. (2011). Do the value, size and January effects exist on the JSE? *Investment Analysts Journal, 74(1),* 29–37.

Balaban, E. (1995). Day-of-the-week effects: New evidence from an emerging stock market. *Applied Economic Letters, 2(1),* 139–143.

Barone, E. (1990). The Italian stock market: Efficiency and calender anomalies. *Journal of Banking and Finance, 14(2–3),* 485–510.

Basher, S. A., & Sardorsky, P. (2006). Day-of-the-week effects in emerging stock markets. *Applied Economics Letters, 13(1),* 621–628.

Bayar, A., & Kan, O. B. (2002). Day-of-the-week effects: Recent evidence from nineteen stock markets. *Central Bank Review, 2(1),* 77–90.

Berges, A., McConnell, J. J., & Schlarbaum, G. G. (1984). The turn-of-the-year in Canada. *The Journal of Finance, 39(1),* 185–192.

Berument, H., & Kiymaz, H. (2001). The day of the week effect on stock market volatility. *Journal of Economics and Finance, 25(2),* 181–193.

Bhabra, H. S., Dhillion, U. S., & Ramirez, G. G. (1999). A November effect? Revisting the tax-loss selling hypothesis. *Financial Management, 28(4),* 5–15.

Bhana, N. (1994). Public holidays share price behaviour on the Johannesburg Stock Exchange. *Investments Analysts Journal, 39(1),* 45–49.

Brockman, P., & Michayluk, D. (1998). The persistent holiday effect: Additional evidence. *Applied Economics Letters, 5(1),* 205–209.

Brown, K. C., Harlow, W. V., & Tinic, S. M. (1988). Risk aversion, uncertain information, and market efficiency. *Journal of Financial Economics, 22(1),* 355–385.

Brown, P., Keim, D. B., Kleidon, A. W., & Marsh, T. A. (1983). Stock return seasonalities and the tax-loss selling hypothesis. *Journal of Financial Economics, 12(1),* 105–127.

Cadsby, C. B., & Ratner, M. (1992). Turn-of-month and pre-holiday effects on stock returns: Some international evidence. *Journal of Banking and Finance, 16(1),* 497–509.

Campbell, J. Y., Lo, A. W., & Mackinlay, A. C. (1997). The Econometrics of Financial Markets. *Second Edition,Princeton University Press*.

Cao, X., Premachandra, I., Bhabra, G., & Tang, Y. (2009). Firm Size and the pre-holiday effect in New Zealand. *International Research Journal of Finance and Economics, 32(1),* 171–187.

Chan, M., Khanthavit, A., & Thomas, H. (1996). Seasonality and cultural influences on four Asian stock markets. *Asia Pacific Journal of Management, 13(2),* 1–24.

Chatterjee, A., & Maniam, B. (1997). Market anomalies revisited. *Journal of Applied Business Research, 13(4),* 47–56.

Chen, H., & Singal, V. (2004). All things considered, taxes drive the January effect. *The Journal of Financial Research, 27(3),* 351–372.

Cheung, K. C., & Coutts, J. A. (1999). The January effect and monthly seasonality in the Hang Seng index: 1985–97. *Applied Economics Letters, 6(2),* 121–123.

Chinzara, Z., & Slyper, S. (2013). Volatility and anomalies in the Johannesburg Securities Exchange daily returns. *Financial Markets Journal, 17(1),* 25–41.

Chong, R., Hudson, R., Keasey, K., & Littler, K. (2005). Pre-holiday effects: International evidence on the decline and reversal of a stock market anomaly. *Journal of International Money and Finance, 24(1),* 1226–1236.

Claessens, S., Dasgupta, S., & Glen, J. (1995). Return behaviour in emerging stock markets. *World Bank Economic Review, 9(1)*, 131–151.

Coutts, A. J., Kaplanidis, C., & Roberts, J. (2000). Security price anomalies in an emerging market: The case of the Athens Stock Exchange. *Applied Financial Economics, 10(1)*, 561–571.

Coutts, J. A., & Sheikh, M. A. (2002). The anomalies that arent there: the weekend, January and pre-holiday effects on the all gold index on the Johannesburg Stock Exchange 1987–1997. *Applied Financial Economics, 12*, 863–871.

Darrat, A. F., Li, B., Chung, R. (2013). Seasonal Anomalies: A closer look at the Johannesburg Stock Exchange. *Contemporary Management Research, 9(2),* 155-168

Darrat, A. F., Li, B., Liu, B., & Su, J. J. (2011). A fresh look at seasonal anomalies: An international perspective. *International Journal of Business and Economics, 10(2),* 93–116.

Debondt, W. F. M., Thaler, R. H. (1985). Does the stock market overreact? *Journal of Finance, 40(1),* 793-808

Denman, R. (2012). What role for South Africa? Retrieved from *http://www.siteselection.com/ssinternational/2012/dec/africa.cfm*.

Diarra, C. S., Gurria, A., & Mayaki, I. (2011). Economic diversification in Africa. A review of selected countries. Retrieved from *http://www.un.org/africa/osaa/reports/economic_diversification_africa_2011Jan.pdf*.

Dodd, O., & Gakhovich, A. (2011). The holiday effect in Central and Eastern European financial markets. *Investment Management and Financial Innovations*, *8(4)*, 29–35.

Doyle, J. R., & Chen, C. H. (2009). The wandering weekday effect in major stock markets. *Journal of Banking and Finance, 33(1),* 1388–1399.

Dubois, M., & Louvet, P. (1996). The day-of-the-week effect: The international evidence. *Journal of Banking and Finance, 20(1)*, 1463–1484.

Ellis, L., & Lewis, E. (2001–2003). The response of financial markets in Australia and New Zealand to news about the Asian crisis. *Working Paper*, *Reserve Bank of Australia*.

Fajardo, J., & Pereira, R. (2008). Seasonal effects on the Bovespa Index. *Brazilian Business Review, 5(3),* 233–241.

Fama, E. F. (1965). The behaviour of stock-market prices. *The Journal of Business, 38(1),* 34–105.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance, 25(2),* 383–417.

French, K. R. (1980). Stock returns and the weekend effect. *Journal of Financial Economics, 8(1)*, 55–69.

Gibbons, M. R., & Hess, P. (1981). Day of the week effects and asset returns. *The Journal of Business, 54(4)*, 579–596.

Gultekin, M. N., & Gultekin, N. B. (1983). Stock market seasonality. *Journal of Financial Economics, 12(1)*, 469–481.

Holden, K., Thompson, J., & Ruangrit, Y. (2005). The Asian crisis and calendar effects on stock returns in Thailand. *European Journal of Operational Research, 163(1)*, 242–252.

Jacobsen, B., & Cherry, Z. Y. (2012). Are monthly seasonals real? A three century persepctive. *Working paper Massey University*.

Jaffe, J., & Westerfield, R. (1985). The week-end effect in common stock returns: The international evidence. *The Journal of Finance, 40(2)*, 433–454.

Jones, C. P., Pearce, D. K., & Wilson, J. W. (1987). Can tax-loss selling explain the January effect? A note. *The Journal of Finance, 42(2)*, 453–461.

Kalidas, S., Mbululu, D., & Chipeta, C. (2013). Changing patterns in the day-of-the-week effects in African stock markets. *International Business and Economics Research Journal, 12(10)*, 1157–1173.

Keim, D. B. (1983). Size-related anomalies and stock return seasonality. *Journal of Financial Economics, 12(1)*, 13–32.

Kim, C.-W. K., & Park, J. (1994). Holiday effects and stock returns: Further evidence. *The Journal of Financial and Quanitative Analysis, 29(1)*, 145–157.

Kim, S. (1988). Capitalizing on the weekend effect. *Journal of Portfolio Management, 14(1)*, 59–63.

Kim, T.-H., & White, H. (2004). On more robust estimation of skewness and kurtosis. *Finance Research Letters, 1(1)*, 56–73.

Lakonishok, J., & Maberly, E. (1990).The weekend effect: Trading patterns of individual and institutional investors. *The Journal of Finance,45(1)*, 231–245

Lakonishok, J., & Smidt, S. (1988). Are seasonal anomalies real? A ninety-year perspective. *A Review of Financial Studies, 1(4)*, 403–425

Lean, H. H., Smyth, R., & Wong, W.-K. (2007). Revisiting calendar anomalies in Asian stock markets using a stochastic dominance approach. *Journal of Multinational Financial Management, 17 (1)*, 125–141.

Li, B., & Liu, B. (2010). Monthly seasonality in the New Zealand Stock Market. *International Journal of Business Management and Economic Research, 1(1)*, 9–14.

Lucey, B. M., & Whelan, S. (2004). Monthly and semi-annual seasonality in the Irish equity market: 1934–2000. *Applied Financial Economics, 14(3)*, 203–208.

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *The Journal of Economic Perspectives, 17(1)*, 59–82.

Mangani, R. (2007). Distributional properties of JSE prices and returns. *Investment Analysts Journal, 66(1)*, 57–72.

Marrett, G. J., & Worthington, A. C. (2009). An empirical note on the holiday effect in the Australian stock market. *Applied Economic Letters, 16(1)*, 1769–1772.

Mbululu, D., & Chipeta, C. (2012). Day-of-the-week effect: Evidence from the nine economic sectors of the JSE. *Investment Analysts Journal, 75(1)*, 55–65.

Mehdian, S., & Perry, M. J. (2002). Anomalies in the US equity markets: a re-examination of the January effect. *Applied Financial Economics, 12(2)*, 141–145.

Meneu, V., & Pardo, A. (2004). Pre-holiday effect, large trades and small investor behaviour. *Journal of Empirical Finance, 11(1)*, 231–246.

Miller, E. (1988). Why a weekend effect? *Journal of Portfolio Management, 14(1)*, 43–48.

Mills, T., & Coutts, J. (1995). Calender effects in the London Stock Exchange FTSE indices. *The European Journal of Finance, 1(1)*, 79–93.

Moosa, I. (2007). The vanishing January effect. *International Research Journal of Finance and Economics, 7(1)*, 92–103.

Page, M., & Palmer, F. (1991). The relationship between excess returns, firm size and earnings on the Johannesburg Stock Exchange. *South African Journal of Business Management, 22(3)*, 63–73.

Plimsoll, J., Saban, B., Spheris, A., & Rajaratnam, K. (2013). The day of the week effect: An analysis of the Johannesburg Stock Exchange Top 40 firms. *International Business and Economics Research Journal, 12(3)*, 319–330.

Polasek, W., & Ren, L. (2001). Volatility analysis during the Asia crisis: A multivariate GARCH-M model for stock returns in the US, Germany and Japan. *Applied Stochastic Models in Business and Industry, 17(1)*, 93–108.

Reinganum, M. R. (1983). The anomalous stock market behaviour of small firms in January. *Journal of Financial Economics, 12(1)*, 89–104.

Robins, E., Sandler, M., & Durand, F. (1999). Inter-relationships between the January effect, market capitalisation and value investment strategies on the JSE. *Investment Analysts Journal, 50(1)*, 53–64.

Rogalski, R. J., & Tinic, S. M. (1986). The January size effect: Anomaly or risk mismeasurement. *Financial Analysts Journal, 42(6),* 63–70.

Rozeff, M. S., & Kinney, J. W. (1976). Capital market seasonality: The case of stock returns. *Journal of Financial Economics, 3(1),* 379–402.

Schwert, W. G. (1983). Size and stock returns, and other empirical regularities. *Journal of Financial Economics, 12(1),* 3–12.

Scott, R. C., & Horvath, P. A. (1980). On the direction of preference for moments of higher order than the variance. *The Journal of Finance, 35(4),* 915–919.

Senbet, L., & Otchere, I. (2008). African stock markets. *In Africa Finance for the 21st Century. High Level Seminar Organised by the IMF Institute in Collaboration with the Joint Africa Institute*.

Steeley, J. M. (2001). A note on information seasonality and the disappearance of the weekend effect in the UK stock market. *Journal of Banking and Finance, 25(1),* 1941–1956.

Subramoney, S. (2010). Africa has the advantage – it now needs to win the game. Retrived from *http://www.nepad.org/nepad/news/1502/africa-has-advantage-it-now-needs-win-game*.

Sutheebanjard, P., & Premchaiswadi, W. (2010). Analysis of calender effects: Day-of-the-week effect on the Stock Exchange of Thailand (SET). *International Journal of Trade, 1(1),* 57–62.

Tang, G. Y. (1996). Day-of-the-week effect on skewness and kurtosis: A direct test and portfolio effect. *The European Journal of Finance, 2(1),* 333–351.

Tinic, S. M., Barone-Adesi, G., & West, R. R. (1987). Seasonality in Canadian stock prices: A test of the "Tax loss selling" hypothesis. *Journal of Financial and Quantitative Analysis, 22(1),* 51–72.

Van den Bergh, W., & Wessels, R. (1985). Stock market seasonality and taxes: An examination of tax-loss selling hypothesis. *Journal of Business Finance and Accounting (UK), 12(4),* 515–530.

Vergin, R. C., & McGinnis, J. (1999). Revisiting the holiday effect: Is it on holiday? *Applied Financial Economics, 9(1),* 477–482.

Wachtel, S. B. (1942). Certain observations on seasonal movements in stock prices. *The Journal of Business of the University of Chicago, 15(2),* 184–193.

Wilson, J., & Jones, C. (1993). Comparison of seasonal anomalies across major equity markets: A note. *Financial Review, 28(1),* 107–115.

Ziemba, W. T. (1991). Japanese security market regularities: Monthly, turn-of-the-month and year, holiday and Golden Week effects. *Japan and the World Economy, 3(2),* 119–146.