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# The day-of-the-week: effect on South African REITs

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BUQS7027-FY2020 Research Report

# The Day-of-the-week Effect on South African REITs




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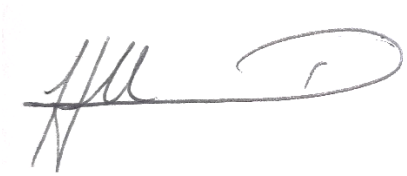
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# Declaration

I declare that this Research Report is my own, unaided work. It is submitted in partial fulfilment of the degree of Master of Science in the field of Property Development and Management at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination in any other university.

Signature of Candidate:



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# List of Abbreviations

| Abbreviation | Description |
|---|---|
| AMEX | American Stock Exchange |
| CAs | Calendar Anomalies |
| CGT | Capital Gains Tax |
| CRSP | Centre for Research in Security Prices |
| EMH | Efficient Market Hypothesis |
| ERPA | European Public Real Estate Association |
| FTSE | Financial Times Stock Exchange Group |
| GBP | Great Brittan Pound |
| IPO | Initial Public Offering |
| JSE | Johannesburg Stock Exchange |
| LTV | Loan to Value |
| OLS | Ordinary Least Squares |
| NAREIT | National Association of Real Estate Investment Trusts |
| NSE | Nigerian Stock Exchange |
| NYSE | New York Stock Exchange |
| PLSs | Property Loan Stocks |
| PUTs | Property Unit Trusts |
| REITs | Real Estate Investment Trusts |
| SA | South Africa |
| US | United States |

# 1. Chapter 1: Introduction

## 1.1 Background to the Study

Calendar anomalies are described as theoretical patterns of abnormal returns of listed stock at certain dates or periods during a calendar year (Jadevicius & Lee, 2016). This suggests that there is an element of predictability in achieving above average returns as an investor using publicly available information. These anomalies have attracted much attention in the past, and have become well documented across many markets beginning with Bachelier (1900) which is regarded as the first research to have identified that calendar related inconsistencies existed (Davis & Etheridge, 2006). Bachelier "examined whether the process [of] generating stock returns operates continuously or only during active trading, i.e. Monday to Friday" (Jadevicius & Lee, 2016, page 59). This has led to many more studies regarding calendar anomalies, see inter alia, Clark (1973), French (1980), French & Roll (1986), Thaler (2012), Davis & Etheridge (2006) & Jadevicius & Lee, (2016), Kinatede, Weber, & Wagner (2019), Aman, Natchimuthu, & Lavanya (2019), and Khan & Rabbani, (2019). As we will discuss later, many of these studies have had contradictory and mixed results.

Fama, *et al.,* (1969) suggested that markets are information efficient and thus follow the Efficient Market Hypothesis (EMH). The EMH principle is based on a random walk process and is thus contradictory to the theory of calendar anomalies where a trader could implement a strategy based on known calendar anomalies and achieve above average returns. According to Lekovic (2018), the EMH exists in three forms. Firstly, the weak form EMH which offers that current share prices reflect all historical data and that no form of technical analysis (forecasting the probability that a share price will move in a certain direction based on historical price "patterns") can assist an investor in outperforming the market. The second form, the semi-strong EMH suggests that neither technical nor fundamental analysis can aid an investor in achieving abnormal returns because all public information is incorporated into the current price of a share. However, it must be noted that information not available to the public can assist in making abnormal returns. Lastly, the strong form EMH submits that all information (public and not public) is part of a share's price, and no type of information can give an investor the competitive edge. Fama (1970) empirically proved that future prices could not be predicted based on past information as price movements and returns on shares from their sample followed a random walk process with their autocorrelations being close to 0.

Calendar anomalies and the EMH have been studied in many equity markets (French, 1980; Davis & Etheridge, 2006; & Jadevicius & Lee, 2016, Kinatede, Weber, & Wagner, 2019, Aman, Natchimuthu, & Lavanya, 2019, and Khan & Rabbani, 2019) and gradually moved into the research of other listed markets and assets over time. Markets such as the real estate sector (through Real Estate Investment Trusts or REITs) (Redman, Manakyan, & Liano, 1997), government bonds (Mikutowski, Karathanaspoulos, & Zaremba, 2019), commodity markets (Qadan, Aharon, & Eichel, 2019) and even cryptocurrency (Plastun, Drofa, & Klyushnik, 2019) have been included in such research papers but not yet to the extent of studies in equity markets. The most frequently studied types of calendar anomalies include the day-of-the-week effect, the weekend-effect, turn of the month effect, holiday effect, and January effect (Olson, Chou, & Mossam, 2007).

The day-of-the-week is the term applied when a specific day of the week produces abnormal stock returns compared to other days of the week Fakhry (2016). The January effect refers to a calendar anomaly whereby the prices of share returns are higher in January than in other months of the year Harjula (2019). The turn-of-the-month effect refers to the temporary increase in share prices in the last few days and first few days of each month of the year Kotlebova (2019), and the Holiday effect, which is one of the most widely researched calendar anomalies, is the term applied to observed patterns around holidays and more specifically, the increased returns on the few days leading up to major holidays Chancharat, *et al.*, (2018).

In 1960, US Congress gave the approval for the formation of investment vehicles called REITs (Zhu, 2018) whereby these listed trusts would allow investors to gain exposure to illiquid commercial real estate assets whilst gaining them the advantage of the listed stock market liquidity (Zhu, 2018). Fundamentally, REITs are legally mandated to distribute the majority of their earnings (differing depending legal framework of the country in which it is listed) and in turn do not have to pay income tax (Boshoff & Bredell, 2013). The income tax burden would therefore be borne by the shareholder. Since their inception, REITs have become widely regarded as essential types of real estate investments (Das, Freybote, & Marcato, 2015) and they are found to be interesting for several factors including their dual nature. The dual nature of REITs refers to how they are real estate investment firms that own and operate assets that are usually limited to real estate, *and* their shares are publicly traded on stock exchanges (Zhu, 2018).

South Africa's National Treasury promulgated the REIT Tax Act on 25 October 2012 which lead to the introduction of REITs on 1 May 2013 to the Johannesburg Stock Exchange (JSE). Previous investment structures known as Property Unit Trusts (PUTs) and Property Loan Stocks (PLSs) were transformed into REITs as previously they were not internationally recognised and thus were not attractive to investors (Kantilal, 2016). Despite the introduction and formation of REITs and global REIT markets, inspired by the benefits of pass through taxation, most research into REITs remains partisan to listed US REITs (see inter alia, Hardin, Liano, & Huang, 2005; Lee & Ou, 2010; Zhu, 2018).

## 1.2 Substantiation of the Problem

Previous studies have noted that some predictability exists in stock markets whereby certain days-of-the-week produce higher returns than others (see inter alia, Fama, 1965b; Godfrey, Granger, & Morgenstern, 1964; Cross, 1973; French, 1980; Davis & Etheridge, 2006; Jadevicius & Lee, 2016; Kinatede, Weber, & Wagner, 2019; Aman, Natchimuthu, & Lavanya, 2019; and Khan & Rabbani, 2019). These observed patterns have also been corroborated by market pundits and have, over the years, been labelled as "calendar anomalies" (French, 1980; Gibbons & Hess, 1981; Jadevicius & Lee, 2016; Kinatede, Weber, & Wagner, 2019). Types of calendar anomalies studied include so-called day-of-the-week effect, turn of the month effect, January effect, and the holiday effect (Olson, Chou, & Mossam, 2007). The Efficient Market Hypothesis (EMH), founded by Fama, *et al.*, (1969) fundamentally contradicts the theory of calendar anomalies as it is based on a random walk process whereby all markets are efficient, and investors are unable to outperform the market because all information has already been taken into consideration. Since the creation of the theories of calendar anomalies and the Efficient Market Hypothesis, the majority of research has been conducted on US equity markets with little research focused on REIT markets, and in particular, international REIT markets (Jadevicius & Lee, 2016).

REITs are investment channels formed by the United States Congress in 1960 to allow investors exposure to illiquid real estate assets whilst benefitting from the liquidity offered by listed equities traded on stock exchanges (Zhu, 2018). As REITs generally produce higher returns than other stocks, they have become very popular as investments (Hardin, Huang, & Liano, 2012). REITS are statutorily regulated, and therefore, each market will be slightly unique and will bring out different dimensions depending on the laws imposed on the market by each host country. In South Africa, REITs were listed in the JSE for the first time in 2013 and its four listed REITs now form one of the largest sectors (in terms of market

capitalisation) on the exchange. In fact, SA REITs have the second largest market capitalization on the FTSE EPRA/NAREIT Emerging Index with a weighting of 9.55% (FTSE Russel, 2017).

REIT shares encompass traits from both equities and underlying asset values (Zhu, 2018). They emulate equities in the short run but correlate closely with the underlying asset in the long run (Hoesli & Oikarinen, 2012). REITs are also held to different statutory regulations than those applied to other companies. For example, in South Africa, a REIT must generate at least 75% of its earnings from direct rental income derived through property owned or indirect income through properties invested in, and it must distribute at least 75% of its taxable income to shareholders in the form of dividends (KPMG, 2013). These external forces also fundamentally affect the behaviour of REIT shares in comparison to equities.

Studies that have been conducted on REITs with regards to the EMH and the day-of-the-week effect have revealed some contradictory results. For instance, Redman, Manakyan, & Liano, (1997) found that Monday produced significantly lower returns than Tuesday through to Friday. Friday and Higgins (2000) and Connors, *et al.*, (2002) and Brounen & Ben-Hamo (2009) found results in line with Redman, Manakyan, & Liano, (1997), whilst Hardin, *et al.*, (2005) found that Monday returns were positive but not statistically significant. Lee and Ou (2010) found that Wednesday had negative returns but positive returns for Tuesday and Friday. Fakhry (2016) emphasised that the EMH is a difficult theory to test, whilst Rossi (2015) concluded his qualitative research on the EMH and calendar anomalies by stating that "there is no unified point of view on the relationship of the EMH to calendar anomalies". Bampinasa, Fountas, & Panagiotidis, (2016) had mixed results on the day-of-the-week effect depending on the data sample that was used, and Ramiah, Lowies, Gabe, Xu, & Mossa, (2017) found that there were no abnormal seasonal anomalies in the Pacific region REIT market.

These contradictory studies seem to be situational rather than widespread and the research feels that this warrants further research into the day-of-the-week effect in REIT markets.

Research into REITs and associated calendar anomalies has grown substantially in the past few years, however, research into REIT calendar anomalies in the South African REIT markets has only just begun. Fundamentally, calendar anomalies analysis requires retrospective data and since REITs were only introduced to South Africa in 2013, sufficient data simply has not been available. This, therefore, is ideal timing to begin research into this

topic area as REITs in South Africa have passed through their infancy and are starting to mature.

The only known research into the South African property sector and the day-of-the-week effect was conducted by Brounen & Ben-Hamo (2009) wherein the research studied the share price movements of global property shares for the top ten most distinguished markets and South Africa. The findings of this research were that nine of the eleven countries that were studied showed significant positive Friday returns for their equally-weighted and value-weighted sample data, whilst Monday showed weak returns for both. This is again in contradiction with the studies discussed above.

## 1.3 Problem Statement

Previous analysis in this topic of calendar anomalies has been mainly based on equity markets with a more recent shift into researching REITs, however, this research has also been primarily based in the United States REIT markets, with few other first-world country REIT markets studied and even fewer emerging REIT markets studied such as South Africa where REITs were introduced into South Africa in 2013, and therefore, this is the opportune point to study calendar anomalies (the day-of-the-week effect specifically) as the data necessary to complete a study of this nature is only now becoming relevant and a trading strategy using this analysis can be developed.

## 1.4 Primary Research Question

The primary research question emanates from the existing contradictory empirical evidence that either supports or is against the Efficient Market Hypothesis (EMH). The research question is as follows:

- Is there a day-of-the-week effect on REIT returns? (Jadevicius & Lee, 2016).

## 1.5 Secondary Research Question

From the primary question, the secondary research questions are identified as:

- What are the theoretical origins of the day-of-the-week effect and the Efficient Market Hypothesis (EMH)?
- Is there a day-of-the-week effect on SA REIT returns?

- Can abnormal returns be achieved by applying a trading strategy based on the day-of-the week effect on South African REITs?

## 1.6 Research Aim

The aim of this research is to establish if there is a day-of-the-week effect on Real Estate Investment Trust returns.

## 1.7 Research Objective

From the aim the following research objectives are identified:

- To determine the theoretical origins of the day-of-the-week effect and the Efficient Market Hypothesis.
- To ascertain if there is a day-of-the-week effect on SA REIT returns
- To determine if a trading strategy can be developed using this research to achieve abnormal investment returns from South African REITs.

## 1.8 Hypothesis

There is a day-of-the-week effect on the returns incurred by South African REIT shares.

## 1.9 Limitations

The following limitations have been identified in this study:

- Limited time: Ideally the research would research all types of calendar anomalies on South African REITs to gain a better understanding of these effects and the possible trading strategies that could be developed around them, however, the time allowed to conduct this study will not allow for this to be possible. The study on all types of calendar anomalies on South African REITs could be conducted by an individual/company/government sector that has less of a time constraint.
- Limited access to resources: The researcher for this paper has limited access to resources and thus the research cannot be performed for other emerging economies in addition to that of South Africa. Perhaps a PhD student who would have access to more resources could look at this study in other emerging countries.
- Limited scope: Future research in this field in more underdeveloped economies. This is important research and whilst these results are inferred on South Africa, more

research into different types of calendar anomalies in other emerging economies is possible.

## 1.10 Assumptions

The following assumptions have been made in this study:

- Data that has been sourced from the JSE and the REIT share index, which is crucial to undertake the statistical analysis required for this research, is assumed to be accurate and unaltered.
- Literature review sources obtained from the research are assumed to be factual and trustworthy.
- Statistical models obtained from previous research are assumed to be correct. It is outside of the scope of this research to develop a new statistical method to analyse REIT returns.
- REIT return differences are assumed to vary by country as the stock exchanges which the REITs are listed on, have different regulations that are applied to said REITs.

# 2. Chapter 2: Literature Review

## 2.1 Introduction to the Literature Review

Previous studies have noted that some predictability exists in stock markets whereby certain days-of-the-week produce higher returns than others (see inter alia, Fama, 1965b; Godfrey, Granger, & Morgenstern, 1964; Cross, 1973; French, 1980; Davis & Etheridge, 2006; Jadevicius & Lee, 2016; Kinatede, Weber, & Wagner, 2019; Aman, Natchimuthu, & Lavanya, 2019; and Khan & Rabbani, 2019). These observed patterns have also been corroborated by market pundits and have, over the years, been labelled as "calendar anomalies" (Jadevicius & Lee, 2016; Kinatede, Weber, & Wagner, 2019). Types of calendar anomalies studied include the so-called day-of-the-week effect, turn-of-the-month effect, January effect (also known as month-of-the-year effect), and the holiday effect (Olson, Chou, & Mossam, 2007).

The day-of-the-week suggests that returns across each day of the week are not identical (Fakhry, 2016). The January effect refers to a calendar anomaly whereby returns for each month are not identical and the returns are higher in January compared to other months (Harjula, 2019). The turn-of-the-month effect is an anomaly where identified increases in share prices in the last few days and first few days of each month occur (Kotlebova, 2019), and lastly, the Holiday effect, which is one of the most widely researched calendar anomalies, is the term applied noted increases in returns on the few days leading up to major holidays (Chancharat, *et al.*, 2018).

Whilst there have been day-of-the-week effect studies conducted on equity markets, there have been far fewer days-of-the-week studies conducted in the listed real estate field. The studies that have been conducted in the real estate field have traditionally focused on the US listed Real Estate Investment Trusts (REITs) as they are the most advanced in the world (see inter alia, Hardin, Liano, & Huang, 2005; Lee & Ou, 2010). This has been followed by some more recent studies focusing on European and global REIT calendar anomalies (see inter alia, Jadevicius & Lee, 2016; Jawa & Kumar, 2017; du Toit, Hall, & Pradhan, 2018; and Chong & Hou, 2020).

REITs are investment channels formed by the United States Congress in 1960 to allow investors exposure to illiquid real estate assets whilst benefitting from the liquidity offered by listed equities traded on stock exchanges (Zhu, 2018). As REITs generally produce higher

returns than other stocks, they have become very popular as investments (Hardin, Huang, & Liano, 2012). Each REIT market will be idiosyncratic because of the differing statutory regulations that apply to each country's market. In South Africa, REITs were listed in the JSE for the first time in 2013 and its four listed REITs now form one of the largest sectors (in terms of market capitalisation) on the exchange. In fact, South African REITs have the second largest market capitalization on the FTSE EPRA/NAREIT Emerging Index with a weighting of 9.55% (FTSE Russel, 2017).

As far as the author is aware, there have been no studies examining the day-of-the-week effect in South African REITs for the last decade, and therefore the purpose of this study will be to empirically ascertain whether South African REIT share prices experience the day of the week effect or not.

The objectives that this literature review will address are:

- What are the theoretical origins of the day-of-the-week effect and the Efficient Market Hypothesis (EMH)?

The literature review is structured as follows:

- Introduction
- Methodology of the literature review
- Theoretical Framework
    - Equity Markets
    - REITs and the day-of-the-week effect
- History of REITs
- South African REITs
- Key findings of the literature review

## 2.2 Methodology of Literature Review

Firstly, research began by systematically searching available literature on the subject. A list of 12 possible keywords was listed to conduct a Google Scholar search. These 12 keywords/phrases are as follows:

- Calendar Anomalies
- The Monday Effect
- The Efficient Market Hypothesis

- Random Walk Theory
- REITs and Calendar Anomalies
- REITs and the Efficient Market Hypothesis
- REITs and the Monday Effect
- REITs and the Day-of-the-week Effect
- South African REITs
- South African REITs and Calendar Anomalies
- South African REITs and the Day-of-the-week Effect
- South African REITs and the Efficient Market Hypothesis

Only a Google Scholar search was conducted as it was assumed that any searches on this platform would pick up a significant amount of the research published with these keywords or phrases.

The papers that were eventually selected during the search were selected based on the accuracy and credibility of the authors, the credibility of the information, and the authority of the research. The results were also filtered to retrieve the most recent research papers.

After summarising the papers, the research wanted to ascertain if there exists a Monday Effect or Day-of-the-Week Effect on the share prices of South African REITs, Finally, after counsel with the allocated research supervisor, the final topic was reached.

## 2.3 Theoretical Framework

Many papers that have studied the Efficient Market Hypothesis and the contradictory theory of Calendar Anomalies. The following two sub-sections will examine both theories by looking at their origins, evolutions, and how they have been applied to modern literature in both equity and REIT markets.

Following on from the EMH and calendar anomaly theoretical framework, this paper will dissect the origins of REIT markets as an asset class as well as look at REITs in a South African context.

### 2.3.1 Equity Markets

Jadevicius & Lee (2016) suggest that Bachelier (1900) was the first to identify the existence of calendar irregularities relating to the stock market. Bachelier's (1900) research investigated whether stocks achieved gains on a continuous basis or only during trading

operating hours i.e. Monday to Friday. Bachelier (1900) noted that if stocks achieved returns continuously yet they were only traded from Monday to Friday, then by the process of inference, the distribution of returns will be different for each calendar day. However, if returns are generated during trading operating days (i.e. Monday to Friday) only then the distribution of the returns will be equal for each calendar day. French (1980) suggested that if the rationale is that information flows constantly, and returns are achieved constantly, then it is reasonable to expect that returns on Mondays should be three times greater than the returns of any other day of the week. This rationale was consistent with the findings by Fama (1956b) and Cross (1973) and Gibbons and Hess (1981) who found that returns on treasury bills and common stock were inconsistent across the days of the week.

Fama, (1970), using the efficient markets model which later become known as the Efficient Market Hypothesis (EMH), empirically proved that future prices of shares could not be predicted based on publicly available historical information as price movements and returns on shares from their sample followed a random walk process with their autocorrelations being close to 0 (Jadevicius & Lee, 2016). However, whilst it is regarded as a relatively simple hypothesis and has been widely accepted by academic financial economists, it has garnered noticeable controversy (Cho, Linton, & Whang, 2007; Shiller, 2014) especially because it undermines the idea that investors can identify mispriced stocks (Rossi, 2015).

Rossi (2015) acknowledged that the EMH is the notion that current prices of stocks fully reflect the publicly available information of the company and that there is simply no way in which to gain abnormal returns by using this information. However, he identified the growing evidence against the EMH particularly because it erodes the idea that investors can identify mispriced stocks. Ultimately, Rossi (2015), in his literature analysis of the relationship between calendar anomalies and the EMH, concluded that there was no unanimous view on the relationship between calendar anomalies and the EMH.

Fakhry (2016) examined whether the price of a share is determined by the available information about the company or the market participant's perception of the available information on the company. The paper noted that, in theory, the EMH dictates that the price of any asset depends on the information, while behavioural finance theory dictates that the price depends on the reaction of the market participants to the information. The research concluded that the EMH is a difficult theory to test and that the empirical evidence that is available is mixed, yet it can be a useful yardstick for institutional regulators and central banks.

Applications of these two theories to equity markets have been conducted by the likes of Jawa & Kumar, (2017), du Toit, Hall, & Pradhan, (2018), and Chong & Hou, (2020) where their papers have empirically shown that return predictability exists and, therefore, the EMH is false. This research is discussed in detail below.

Jawa & Kumar (2017) investigated whether calendar effects violate the weak form of efficiency and highlight the role of past patterns and seasonality in estimating future prices. The research recognised the EMH as a fundamental cornerstone of modern investment theory but identified that the existence of anomalies jeopardised the notion of efficiency of information flow in stock market prices. The study revealed a significant Wednesday effect as well as a significant December effect in the Indian stock market for the period of January 1995 to December 2015. The research concluded that the results suggested that the Indian stock markets do not show informational efficiency (even in the weak form) and that this is a consistent trait in emerging markets.

du Toit, Hall, & Pradhan (2018) looked to determine if amending data sets and methodologies would uncover day-of-the-week effects in South African stock market indices. The research proved that, contrary to the original studies, the day-of-the-week effect is present in both volatility and return equations when amending data set dates and methodologies. They observed that the highest and lowest returns occurred on Monday and Friday respectively, while volatility is observed on all five days from Monday to Friday.

Chong & Hou, (2020) examined whether Valentine's Day influenced stock market returns as it is theoretically a stimulus of investor behaviour. Unlike prior research, this study distinguishes itself by firstly, studying only a single celebration which is not a public holiday in any country, and secondly, it incorporated the ARMA-GARCH model using different samples from 1 Jan 1990 to 1 March 2019 as opposed to most other studies which used Ordinary Least Squares (OLS) method. The study found that the stock returns are higher on days when Valentine's day is approaching than on other days, however, in countries where the event is not highly celebrated, such as German and Japan, the effect is lower. This proves "the Valentine Effect" in the stock market and contradicts the Efficient Market Hypothesis.

Cho, Linton, & Whang (2007) identified four possible theories for the differences in return distribution across the days of the week. This first of which is related to data snooping. Cho, Linton, & Whang (2007) criticised the statistical methods, used in research by Sullivan, Timmerman, & White, (1998) and Hansen, Lunde, & Nason, (2005), which were biased

towards calendar effects. The second theory discusses the market microstructure, whereby dividends, taxes, and market settlements produced inconsistencies in returns. The third theory examines the flow of weekly information. Cho, Linton, & Whang (2007) identified that most negative news was delayed and only usually released to the open market on a Friday, while other news was generally released between a Tuesday and a Thursday in the UK stock market. Finally, the fourth theory investigated individual traders' strategies. The research suggested that many short-sellers sell on a Friday, whilst long-traders usually divest on Mondays (Jadevicius & Lee, 2016).

There is an abundance of research into calendar anomalies and the Efficient Market Hypothesis in equity markets which has led to contradictory views on the subject (see inter alia, Davis and Etheridge, 2006; Cho, Linton, & Whang, 2007; Narayan, Mishra, & Narayan, 2014; Fakhry, 2016; du Toit, Hall & Pradhan, 2018).

### 2.3.2 REITs and the day-of-the-week effect

In regard to the origins and evolution of the EMH and calendar anomalies, there is no difference between equity markets and REIT markets as the theories are fundamentally the same, however, the applications and research done into the respective markets are where the difference lies. Firstly, there are fundamentally fewer studies concerning the days-of-the-week effect in REITs compared to equity markets as REITs were only formed for the first time in 1960 (Zhu, 2018). Secondly, the geographical nature of the studies has been heavily weighted towards the United States. Of the research that has examined REITs and days-of-the-week effect, more papers exist that focus on the US market than any other market (Jadevicius and Lee, 2016), however, it seems research into US REITs on calendar anomalies and the EMH has slowed to a halt whereby no new research on these topics applied to US REITs has been conducted since Lee and Ou (2010).

Past applications of the EMH and calendar anomalies include Redman, Manakyan, & Liano (1997), Friday and Higgins (2000), Connors, *et al.* (2002), Hardin, *et al.* (2005), and Lee and Ou (2010) as discussed below.

Redman, Manakyan, & Liano, (1997) studied four calendar anomalies; the day-of-the-week effect, the January effect, the turn-of-the-month effect, and the pre-holiday effect using daily returns from a portfolio of REIT shares listed on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX) and the Centre for Research in Security Prices (CRSP)

tapes for the period 1986 to 1993. The research applied the Kruskal-Wallis test and found that returns on Monday were significant and lower than returns on Tuesday through to Friday.

January (Turn-of-the-Year) effect which was originally documented in studies by Branch (1977), Dyl (1977), Keim (1983), Reinganum (1983), and Roll (1983). The January effect is an intriguing anomaly in that it has not been traded away despites the fact that it has been well-known public information for 40 years. Keim (1983) who studied the empirical relationship between abnormal returns and market value of the NYSE and AMEX, found that January's daily share price showed that abnormal return distributions had larger means than those of the other eleven months. Furthermore, Keim (1983) showed that on average, large firms earn larger risk-adjusted retuns than smaller firms, and that more than 50 percent of the January premium return occurs in the first trading week of the year, and particularly the first trading day. Reinganum (1983) supported the findings of Keim and found that small firms bring in abnormally large returns in January, especially in the first few days of trading. This is also consistent with findings by Branch (1977) and Dyl (1977) who found that companies tend to increase the selling of poor performing assets towards the end of the year which leads to significant increases in trading volumes, however, Reinganum (1983) stated that the tax loss selling cannot explain the full January seasonal effect.

The Half-month (Turn-of-the-Month) effect was originally studied by Ariel (1987) on the US equity market who found that the mean return for share prices is positive only for the days immediately before and during the first half of calendar months. Ariel suggested that the cause of this effect may be attributed to the shift in the mean of the distributions of returns to days in the last half of the calendar month from days in the beginning half of the month. Agrawal & Tandon (1994) examined five seasonal patterns in equity markets of eighteen contries, and found that fourteen of the eighteen countries gave strong evidence of the existence of the turn-of-the-month effect. The evidence included large positive returns over the four days around the middle of the month and also on the last day of each month.

Holiday Effect causes higher-than-normal returns to be observed around holidays, mainly in the pre-holiday period. Two possible reasons for the holiday effect are presented in Fabozzi, Ma, & Briley (1994) namely higher pre-holiday returns are the result of positive holiday sentiment or simply the effect may be part of other seasonalities that have already been documented. Chong, Hudson, Keasey, & Littler (2005) supported the findings stated above, however, the intent of the study was to find if the effect had declined in the US, UK and

Hong Kong. The study found that the holiday-effect had declined in magnitude in all three countires, but only significantly in the US.

Friday and Higgins (2000) identified a negative Monday effect with positive and significant Wednesday, Thursday, and Friday returns when analysing daily empirical data of an equally-weighted portfolio of publicly traded REITs and two sub-categories of REITs, namely; Equity REITs and mortgage REITs. The time frame for this data was for the period of 1970 to 1995 and the evidence is in line with Redman, Manakyan, & Liano, (1997).

Connors, *et al.,* (2002) studied the daily total returns average of REITs portfolios with value-weighted and equally-weighted indices data collected from the CRSP for the period 1994 to 1999. The research then applied the Ordinary Least Squares regression method and found that Friday returns were positive and significant for the entire sample REIT portfolios. This evidence is in line with Redman, Manakyan, & Liano, (1997) and Friday and Higgins (2000).

Hardin, *et al.,* (2005) used the same methodology as Redman, Manakyan, & Liano, (1997) and applied it to daily value-weighted (with daily rebalancing) and equally-weighted REIT returns data from the CRSP for the period of 1994 to 2002 to examine calendar anomalies in US REITs. In the case of the value-weighted analysis, the research found that returns on Monday were positive but not statistically significant. This is in contradiction to the studies by Redman, Manakyan, & Liano, (1997), Friday and Higgins (2000) and Connors, *et al.,* (2002). For the equally-weighted data set, it was found that returns for Friday were higher and significant when compared to Monday.

Lee and Ou (2010) researched the day-of-the-week effect on the daily closing prices of Mortgage REITs in the US. The data was collected for the period of 2001 to 2007 from the National Association of REITs (NAREIT). The result, after applying the GARCH methodology, was that Mortgage REITs have abnormal negative returns for Wednesday but have abnormal positive returns for Tuesday and Friday.

More recently, studies on REITs outside of the US REIT markets have increased as the number of markets that offer REITs has now increased, including many emerging markets (see inter alia, Jadevicius & Lee, 2016; Jawa & Kumar, 2017; Zhu, 2018; du Toit, Hall, & Pradhan, 2018; and Chong & Hou, 2020). These studies are dissected below.

Brounen & Ben-Hamo (2009) studied the share price movements of global property shares for the top ten most distinguished markets and South Africa. By applying the OLS

methodology to index data for the period 1987 to 2007 (and including sub-period analysis), the research found that for the equally-weighted index data, nine out of eleven countries encountered significant positive Friday returns. This was similar to the conclusion reached when applying the OLS method to the value-weighted index data.

Jadevicius and Lee (2016) studied the day-of-the-week effect on UK REITs by applying the same methodology as Redman, Manakyan, & Liano, (1997) to daily closing share price value (in GBP) data from the ERPA/NAREIT UK index and its two sub-indices FTSE ERPA/NAREIT UK REITs and non-REITs. The research found that whilst there is evidence to support that return anomalies and inefficiencies do exist in UK REITs, the anomalies are too modest for investors to gain superior returns by employing this strategy alone, but they did concede that the outcome of this paper would be able to effectively assist in a trading strategy.

Bampinasa, Fountas, & Panagiotidis, (2016) analysed the seasonality of 12 countries using a rolling regression and full sample regression methods on daily data for the period 1990 to 2010. The evidence gathered from the full sample regression is in line with previous literature and proves the existence of days-of-the-week effects, however, the rolling regression method results cast doubt on the existence of the day-of-the-week effect. The research concluded that "daily seasonality of the European Real Estate sector is subject to data mining and sample selection bias".

Ramiah, Lowies, Gabe, Xu, & Mossa, (2017) Studied the Monday and January effects for regarding daily and monthly data for selected Pacific region countries and in addition to this, the authors also examined the returns of REITs "around the global financial crisis and under different market conditions". The research empirically proved that there are no abnormal seasonal anomalies in selected Pacific region REITs and found that there was "a negative reaction to the global financial crises and a resilient real estate investment trust market during a bullish market".

As with the research in equity markets, research conducted with regards to the day-of-the-week effect is abundant and somewhat contradictory.

## 2.4 History of REITs

On September 14, 1960, US Congress, as part of an alteration to their Cigar Excise Tax Extension, gave the approval for the formation of an innovative investment vehicle called a

Real Estate Investment Trust (REIT) (NAREIT, 2020). These REITs would allow investors to gain exposure to the benefits of commercial real estate assets (income generation, capital appreciation, and tax breaks) whilst overcoming one of its major flaws: illiquidity (Zhu, 2018, NAREIT, 2020). Traditionally, only a few investors had access to investment in these commercial assets as there are high barriers to entry, however, with the introduction of REITs, investors were able to pool their capital together, similar to the concept of mutual funds, to purchase/develop and earn a return from these commercial assets.

Two main types of REITs are Equity REITs and Mortgage REITs. Equity REITs make use of leverage to own large amounts of assets. In addition to owning the asset, they will also manage the asset. Equity REITs, therefore, make returns on the capital appreciation of the assets, the rental income that the assets generate, and management fees. Mortgage REITs do not directly own the assets but rather the underlying debt (i.e. the mortgage) that is linked to the asset. Mortgage REITs, therefore, make returns on the interest of the capital lent to another company to build/buy the real estate asset (Ashworth, 2020). In very rare cases, Hybrid REITs exist. These Hybrid REITs, are as the name suggests; a mix of both Equity and Mortgage REIT investment strategies with their revenue including rental income and interest on mortgage loans (Mbhokota, 2020). There are various types of REIT subsectors that focus on investment in a specific type of real estate asset. The following are some of the subsectors:

- Retail REITs
- Office REITs
- Residential REITs
- Industrial REITs
- Healthcare REITs

Fundamentally, REITs are legally mandated to distribute the majority of their earnings (differing depending legal framework of the country in which it is listed) and in turn do not have to pay income tax (Adams, Brau, & Holmes, 2007). The income tax burden would therefore be borne by the shareholder. Since their inception, REITs have become widely regarded as essential types of real estate investments (Das, Freybote & Marcato, 2015) and they are found to be so interesting for a number of factors including their dual nature. Each REIT market will be idiosyncratic because of the differing statutory regulations that apply to each country's market. REITs have dual natures because essentially, they are real estate investment firms who own and operate assets that are usually limited to real estate, and their shares are publicly traded on stock exchanges (Zhu, 2018). Hoesli & Oikarinen (2012) and

Case, Yang & Yildirim (2012) identified that in terms of long-run behaviour, REITs tend to behave more like stock related to a company that owns and operates real estate assets than general stocks.

REITs share similar traits with Unit Trusts and common shares traded on a stock exchange. For instance, REITs are classified in the same professionally administered category as Unit Trusts (Naidoo, 2014) and, they both issue shares to raise funds from public investors or by way of private placements for private investors if the trusts are not listed on a stock exchange.

## 2.5 REITs in South Africa

REITs were listed on the Johannesburg Stock Exchange (JSE) for the first time on the 1st of May 2013 following the promulgation of the REIT Tax Act by the National Treasury on the 25th of October 2012. As a result, previous investments structures known as Property Unit Trusts (PUTs) and Property Loan Stocks (PLSs) which had been listed on the JSE since the 1960s but which were not internationally recognised and, therefore, were not attractive to international investors, were transformed into REITs and made attractive to international investors by aligning their tax structures to understood standards (KPMG, 2013; Boshoff & Bredell, 2013; Kantilal, 2016, Kola, 2016).

In fact, Ntuli and Akinsomi (2016) empirically showed the attractiveness of South African REITs to investors locally and abroad. The research highlighted a positive correlation between SA REITs and other listed companies, meaning SA REITs can be included as part of a portfolio to enhance its diversification. Further to this, the research showed that REITs acted as a "return-enhancer" to other investments such as bonds and shares. When compared to listed real estate companies, REITs proved to have a lower risk factor and offer and higher return while offering a stronger correlation to other portfolio assets. This shows that it is potentially a better diversification asset than a listed real estate share (Ntuli and Akinsomi, 2016).

In line with the standards as set out by the JSE (KPMG, 2013) in order for a REIT to be listed on the exchange, a REIT must:

- Have a net asset value ownership of R300million or more;
- To generate at least 75% of its earnings from direct rental income derived through property owned or indirect income through properties invested in;

- To distribute at least 75% of its taxable income to shareholders in the form of dividends;
- To keep its loan to value ratio (LTV) below 60% of the gross value of its assets;
- To not engage in investments that are not deemed to be within the ordinary course of the business; and,
- A committee must be created and mandated to monitor the risk.

REITs in South Africa are exempt from Capital Gains Tax (CGT). From a shareholder perspective, however, CGT is applicable upon disposal of their investment. In addition to this, the shareholder would need to pay tax on dividends received in line with SARS regulations (SARS, 2020).

South Africa is the only African country that has REITs included in global indices like the FTSE EPRA/NAREIT Index and the S&P Global Index (Akinsomi, Pahad, Nape, & Margolis, 2015) with Ntuli and Akinsomi (2016) noting that in its first year of trading, South African REITs outperformed countries in Asia and Europe (including the UK). In terms of asset allocation, the South African listed property sector has roughly 60-65% of its asset value invested in 25 nations (Van Niekerk, 2017). The JSE's four listed REITS now makeup one of the biggest sectors on the JSE in terms of market capitalisation and, further to this, South African REITs make up 9.55% of the weighted value of the FTSE EPRA/NAREIT Emerging Index (FTSE Russel, 2017).

## 2.6 Key Findings of the Literature Review

The key findings can be summarised as follows:

- Calendar anomalies were first identified by Bachelier (1900) in the early 20$^{th}$ century. There are many types of calendar anomalies that have been identified and studied. These include but are not limited to; day-of-the week effect, the weekend effect, turn of the month effect, the January effect, and the holiday effect.
- Calendar anomalies are described as theoretical patterns of abnormal returns of listed stock at certain dates or periods of time during a calendar year (Jadevicius & Lee, 2016)
- The EMH was first proposed by Fama, *et al.*, (1969) where all markets were described as "efficient". There are three forms of EMH. Firstly, the weak form, secondly, the semi-strong form, and lastly, the strong form. The theory behind the

Efficient Market Hypothesis is a random walk process whereby the price of a share is determined by the publicly available information and therefore, it always trades at its fairest value.

- Historically, there exists more studies on day-of-the-week effect in the equity markets and less in REITs as the equity market has existed for a longer period whereas REITs were first introduced in 1960 in the United States of America. This is, however, changing (Jadevicius & Lee, 2016). With regards to day-of-the-week studies on REITs, more research has been conducted on the US markets (as it is by far the largest in the world), with fewer studies focusing on international REIT markets and even less focusing on emerging markets.
- Studies that have been conducted on REITs with regards to the EMH and the day-of-the-week effect have revealed some contradictory results. For example, Redman, Manakyan, & Liano, (1997), Friday and Higgins (2000) and Connors, *et al.,* (2002) found that Monday had negative returns, Brounen & Ben-Hamo (2009) found that Friday had positive returns (in-line with Redman, Manakyan, & Liano, (1997), Friday and Higgins (2000) and Connors, *et al.*, (2002)), while Hardin, *et al.,* (2005) found that Monday returns were positive but not statistically significant. Lee and Ou (2010) found that Wednesday had negative returns but positive returns for Tuesday and Friday. Fakhry (2016) emphasised that the EMH is a difficult theory to test, Rossi (2015) concluded his qualitative research on the EMH and calendar anomalies by stating that "there is no unified point of view on the relationship of the EMH to calendar anomalies". Bampinasa, Fountas, & Panagiotidis, (2016) had mixed results on the day-of-the-week effect depending on the data sample that was used, and Ramiah, Lowies, Gabe, Xu, & Mossa, (2017) found that there were no abnormal seasonal anomalies in the Pacific region REIT market.
- REITs were first introduced in 1960 by US Congress which allowed investors to gain exposure to illiquid commercial real estate investors whilst gaining them the advantage of listed stock market liquidity (Zhu, 2018).
- South Africa's National Treasury promulgated the REIT Tax Act on 25 October 2012 which lead to the introduction of REITs on 1 May 2013 to the Johannesburg Stock Exchange (JSE). Previous investment structures known as Property Unit Trusts (PUTs) and Property Loan Stocks (PLSs) were transformed into REITs as they were not internationally recognised and therefore were not attractive to investors (Kantilal, 2016).

- As far as the researcher is aware, the last study that was conducted around day-of-the-week effect in SA Property shares was by Brounen & Ben-Hamo (2009) wherein the research studied the share price movements of global property shares for the top ten most distinguished markets and South Africa. This was before REITs were introduced in South Africa. More recently, Kinatede, Weber, & Wagner (2019), have studied calendar anomalies in equity markets for BRICS member countries and found that South Africa is affected by calendar anomalies after holidays.

# 3. Chapter 3: Research Design

## 3.1 Research Philosophy and Approach

The design of the research was guided by the research onion as proposed by Saunders et al (2009). The research onion is a diagram indicating the stages (beginning with the outer most layer and working inwards) of the development of a research proposal. The layers of the onion are as follows (listed from outer most layer to inner most layer): Research philosophy, research approaches, research strategies, time horizons, and data collection methods as shown in the figure below.

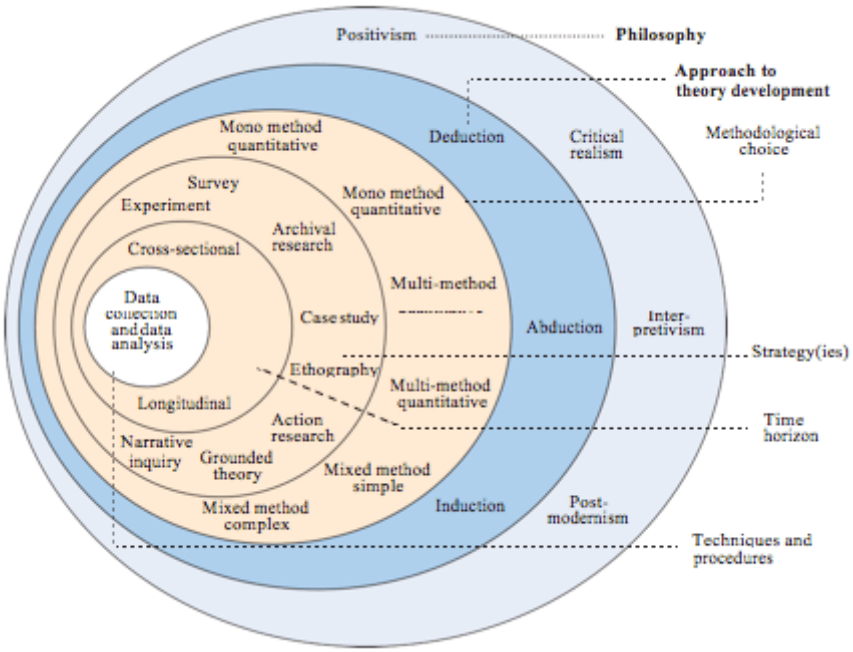



*Figure 1: Saunders et al (2009) Research onion*

The research philosophy is positivism. The research philosophy of this paper is deemed to be positivism because it applies statistical models or methods of natural sciences to a body of real-world data. In other words, this paper is empirical quantitative research.

This research is not based on post-positivism or post-modernism as it does not simply reject the tenets of positivism. The study conducted is independent of the researcher and aims to generate a testable hypothesis and arrive at an objective finding.

Interpretivism philosophy could have been used in some research in this area by possibly using two types of methods (quantitative and qualitative) however, only one method (quantitative analysis) will be used in this research. In addition, the research philosophy is not

one of interpretivism because is not based on perceptions around the Monday effect on South African REITs, but rather on hard facts. The research will follow a rigid framework and the outcome will be objectively determined. Contrary to this, in interpretivism research, the knowledge acquired is seen as socially constructed.

## 3.2 Methodology

The research of this paper will be conducted by way of a literature review to identify the gaps in the research, followed by a quantitative analysis of daily share price data gathered from specific indices.

To conduct the quantitative analysis a theory about the Monday effect on South African REITs was developed, then, a testable hypothesis has been formulated to arrive at a conclusion about the theory. In order to arrive at this conclusion, data collection needs to be conducted and the data needs to be analysed. Following the analysis, the finding will either confirm or disprove the testable hypothesis. The findings of this research will be kept objective.

This research will meet the basic criteria for scientific research being replicability, precision, flexibility, and logical. The research is replicable as other research could apply this methodology and data to the other emerging markets in Sub-Saharan Africa as mentioned in the limitations section.

## 3.3 Research Methods

The research that will be conducted will be quantitative in nature as one of the main objectives for this paper is to quantify if there is a Monday calendar anomaly in the share price of REITs listed in South Africa using daily closing figures (in South African Rands) published by the JSE. To meet this objective, qualitative research will not be required. In addition, the quantitative method was selected to avoid the personal bias of the analysis and the overall outcome.

Although it is appreciated that qualitative research may look deeper into the complexities of the subject of said research, the quantity of factors to consider would make the study too complex and time-consuming. It may also lead to a bias of the researcher. Furthermore, this research is neither mixed nor qualitative as it will not be using surveys, interviews, observation, or focus groups (these are the sources of qualitative data).

## 3.4 Research Tools

### 3.4.1 Descriptive Statistics

Descriptive statistics highlight certain characteristics which occur in each data set and are most commonly ascertained through measures of central tendency, dispersion, normality, and correlation and covariance. These measures are important to analyse because they show us the most common patterns that lie within each data set.

#### 3.4.1.1 Central Tendency

Measures of central tendency (mean, median, and mode) are the most recognised types of descriptive statistics and illustrate the centre position of a distribution of a data set. The mean, also known as the average, is calculated by adding all the figures in a data set and dividing that sum by the number of figures in the set. Median is the figure situated in the middle of the data set (StatiscticsSolutions.com, 2021). For the purposes of this study, we will not be including mode in the descriptive statistics.

#### 3.4.1.2 Dispersion

Measures of dispersion analyse the shape of the data's distribution and how spread out it is. To describe the dispersion of the data, maximum and minimum values, range, and standard deviation of the data needs to be analysed. The range is the maximum value of the data set minus the minimum value of the data set. Standard deviation is a statistic that is calculated as the square root of the variance (the spread of the numbers in a data set) and shows us the dispersion of a data set in relation to the mean value (StatiscticsSolutions.com, 2021).

#### 3.4.1.3 Normality

Normality in descriptive statistics relates to the distribution symmetry of the data around the mean. A normal distribution is a symmetric distribution about the mean and in graphical form will appear as a bell curve. In essence, a normal distribution will show data that occurs more frequently to be closer to the mean than data that occurs less frequently. A normal distribution has a mean of zero and a standard deviation of 1 and is symmetrical in shape (however, not all symmetrical distributions are normal distributions). For a normal distribution, 68% of all of the observations will occur within +/- one standard deviation from the mean, with 95% of all observations within +/- two standard deviations and 99.7% of

observations within +/- three standard deviations (MathIsFun.com, 2019). The hypothesis test for normality is:

- H0: The population/sample is normally distributed
- H1: The population is not normally distributed

Other measures that describe normality in descriptive statistics are skewness, kurtosis, and the Jarque-Bera test statistic. Skewness and kurtosis show how a given data set differs from a normal distribution and the Jarque-Bera test statistic is a goodness of fit test that determines whether or not the sample data have skewness and kurtosis that match a normal distribution. Skewness in isolation measures the degree of symmetry of the data and has three outcomes;

1. Normal skewness: the sample data has a 0 skew and the distribution is symmetric around its mean;
2. Positive skewness: the sample data has a long-right tail, and the data is made up of values that are higher than the sample mean; and,
3. Negative skewness: the sample data has a long-left tail, and the data is made up of values that are lower than the sample mean.

Kurtosis in isolation measures the degree of sharpness or peakness of the data's distribution curve. There are three types of kurtosis:

1. Mesokurtic: the sample data has a normal distribution with a kurtosis of 3;
2. Leptokurtic: the sample data has a positive kurtosis value (the graphical representation will show a peaked curve) with more higher values; and,
3. Platykurtic: the sample data has negative kurtosis (the graphical representation will have a flatted curve) with more lower values.

The Jarque-Bera test is a test conducted to determine if a sample has the skewness and kurtosis of a normal distribution. The test statistic of the test is always a positive number. If the test statistic is far from zero, it suggests that the sample does not have the skewness and kurtosis of a normal distribution (Statology, 2020). To help support the rejection or non-rejection of the null hypothesis of normality, we calculate the p-value in addition to the Jarque-Bera test statistic. The p-value, also known as a probability value, is the test for significance of results in relation to the null hypothesis and it describes how likely it is that they data would have occurred randomly (McLeod, 2019). A p-value on less than or equal to 0.05 (or 5%) is statistically significant and is the evidence against the null hypothesis. The

smaller the calculated p-value, the more evidence you have to reject the null hypothesis and, therefore, accept the alternative hypothesis (Statistics How To, 2021).

#### 3.4.1.4 Covariance & Correlation

Covariance is a statistical tool used to measure how two variables move in linear relation to one another. I.e. if the variables move in the same direction or opposite directions. If the variables move in the same direction, we say that the variables are directly proportional. If the variables move in opposite directions, we say that they are inversely proportional. Covariance does not measure the strength of the relationship but merely if the relationship exists or not. The resultant values of a covariance test can take on any number between the two opposite infinitives. Figure 2, shows how covariance between two different variables would look in different directions (MyGreatLearning.com, 2020).

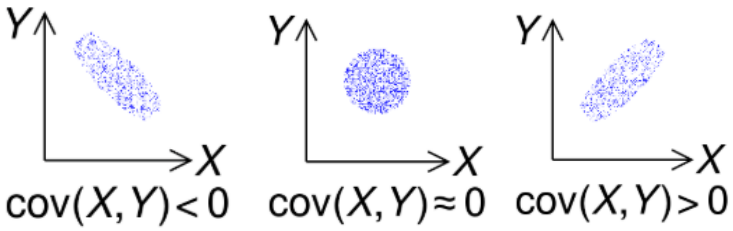



*Figure 2: Covariance relationship between two variables*

Correlation is a statistical evaluation tool used to study the strength of a relationship between two continuous variables. It not only shows the strength but also the direction of the relationship. Correlation can only assume a value between -1 and +1. The closer it is to +1 or -1, the more closely the two variables are related. Calculating the correlation coefficient involves normalising the covariance by dividing it by the product of the standard deviations of the two variables in question.

$$Correlation = \frac{Cov\ (x,y)}{\sigma x * \sigma y}$$

where:

- cov is the covariance
- $\sigma_X$ is the standard deviation of $X$
- $\sigma_Y$ is the standard deviation of $Y$

If the correlation coefficient is 0, then we can state that there is no linear relationship between the two variables. This is shown in Figure 3 below.

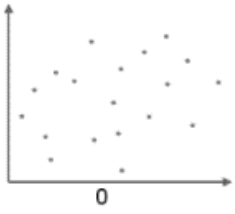


*Figure 3: Graphical depiction of the relationship between two variables when the correlation coefficient is equal to zero*

There may still however be a functional relationship between the two variables. If the correlation coefficient is positive, then when one variable increases, the other variable will increase, too. Perfect, high, and low correlations are graphically depicted in Figure 4 below.

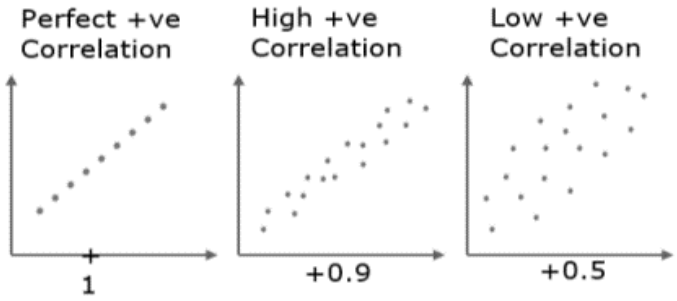



*Figure 4: Positive correlation coefficient relationship between two variables*

If the correlation coefficient is negative, then when one variable increases the other variable will decrease (MyGreatLearning.com, 2020). The different forms of negative correlation are shown in Figure 5 below.

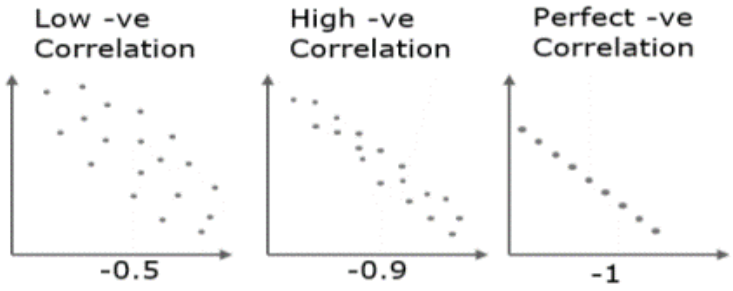



*Figure 5: Negative correlation coefficient relationship between two variables*

### 3.4.2 Kruskal-Wallis (KW) Test

This study will require parametric and non-parametric research tools that will enable the research to explore the day of the week return seasonality in large sample sizes, whilst also identifying and assessing any tendencies over the time-period. The parametric and non-parametric tests will be discussed further below. The null hypothesis is that the returns of each day of the week are equally distributed, whilst the alternative hypothesis is that a minimum of one day has returns that differ from the rest of the weekdays. The null and alternative hypotheses are expressed as follows:

$$H_0: \pi_1 = \pi_2 = \pi_3 = \pi_4 = \pi_5$$

$$H_1: \text{Not all } \pi_i \text{ are equal}$$

$\pi_i$ = is the return for the *i*th day of the week.

The non-parametric test used in this research is called the Kruskal-Wallis (KW) test and has been selected by its ability as an algorithm to study more than two independent samples (Redman, Manakyan, & Liano, 1997; Sheskin, 2003; Jadevicius and Lee, 2016). The KW test is a one-way analysis of variance (ANOVA) by ranks and is an extension of the Mann-Whitney *U* test which utilizes two independent samples. For this test to function, the data must first be re-ordered by rank (Jadevicius and Lee, 2016). After the data has been re-ordered, the following equation is approximated:

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} - 3(n+1) \qquad (1)$$

k = number of groups;
$n_j$ = the size of the *j*th group;
$R_j$ = the rank sum for the *j*th group;
*N* = sample size.

The H test statistic will be evaluated using a decision rule calculated using an alpha or significance level of 0.05 (5%) and of 0.1 (10%). The degrees of freedom (*df*) for this test are equal to *k – 1* and therefore, is equal to 1 as the *k* is equal to 2 as there are two days of the week or two groups of data sets being compared.

The decision rule for each alpha level was calculated by finding the intersection of the respective alpha level with a *df* of 1 on the Chi-Squared table. Therefore, if the H test statistic calculated is greater than the decision rule, we can reject the null hypothesis.

The p-value is used as an alternative rejection tool that calculates the smallest level of significance at which the Null hypothesis would be rejected. According to StatisticsHowTo.com (2021) “a p-value is used in hypothesis testing to help you support or reject the null hypothesis. The p-value is evidence against the null hypothesis. The smaller the p-value, the stronger the evidence that you should reject the null hypothesis”.

## 3.5 Data Collection

The data that will be used for the analysis of this paper will be retrieved from the FTSE/JSE Africa REIT Index (J867) and the FTSE/JSE Top 40 (J200) for the period 01/01/2014 to

31/12/2019. This data to be used is the daily total return figures for the period. Data from 2020 has specifically been disregarded due to COVID-19 and the effects it may have. Dividends are assumed to be re-invested.

## 3.6 Ethical Risks and Mitigation Strategy

I acknowledge that this research needs to go through the ethical approval process of the University of the Witwatersrand to obtain an ethical clearance certificate from the University Research Ethics Committee (Non-Medical) (University of the Witwatersrand, 2019). I do not believe that there will be any ethical clearance concerns with the research as it does not deal with outside influences: no human participation was required nor does it require permission from any organisation or other participants as the research is aimed at a sectoral level of the economy and not at any individuals or corporations.

The research acknowledges that no data can be collected without first having ethics clearance (University of the Witwatersrand, 2019).

The research acknowledges that if the research carried out included qualitative or quantitative data gathered from individuals or corporations, I would need to ensure that their identities would be kept confidential (Hofstee, 2006).

In addition to the above, there has been no fabrication of data to prove or disprove the testable hypothesis of this research. All primary data was downloaded from Stats SA's website. There are also no conflicts of interest to be declared, and all research has been done with honesty and transparency.

# 4. Chapter 4: Data Analysis and Discussion

## 4.1. Data Processing

Once all of the data was collected, the JSE Top 40 (J200) and JSE Africa Real Estate Investment Trusts Index (J867) had to be processed and converted into useable information to ensure that the statistical analysis was correct.

### 4.1.1. Conversions

The data was converted using Microsoft Excel. The date attached to each data point was converted into its' day of the week (e.g. 03/01/2014 was translated into "Friday"). The percentage return for each day was calculated using the difference between the closing price of that specific day and the closing price of the share price of the day before. Following this, a Pivot Table was generated and the data was split into columns for each day of the week.

## 4.2. Data Analysis

This section of the research will look at the descriptive statistics that have been derived from the data sets collected for this study. The Kruskal-Wallis (KW) test analysis will be conducted and the results discussed.

### 4.2.1. Descriptive Statistics

The descriptive statistics will highlight certain characteristics which have been identified in each data set.

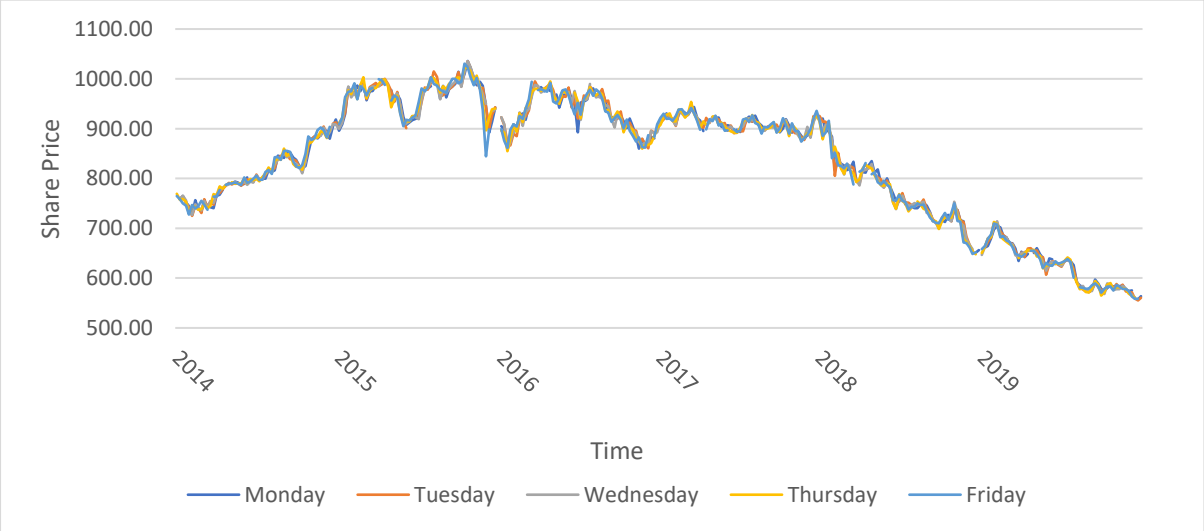



*Figure 6: FTSE/JSE Africa REIT (J867) Weekday Share Price*

In Figure 6 above, the closing share price of the FTSE/JSE Africa REIT (J867) for days of the week between the 1st of January 2014 and then 31st of December 2019 is shown. The price is seen to have steadily increased between the beginning of 2014 to around the beginning of 2015. From early 2015, the price decreased to around the 900 mark after which it made a solid recovery and even reaching an all-time high around Q4 2015. Following the all-time high in early Q4 2015, the price made a sharp decline towards the end of 2015. This may have been linked to the controversial replacement of the Finance Minister Nhlanhla Nene by President Jacob Zuma. Following on from this, the share price recovered slightly to levels about the 950 mark. Between mid-2016 to the latter part of 2017, the share price largely traded in the 850 to 950 band. From the beginning of 2018 until the end of 2019, it is observed that there has been a steady decline in the share price to levels around the 550 mark.

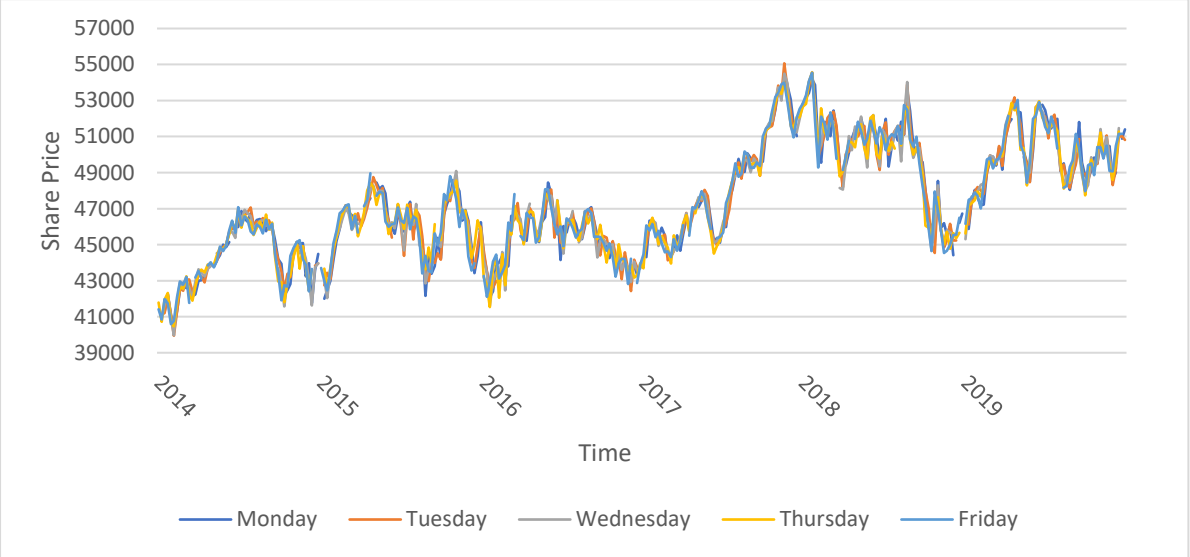



*Figure 7: FTSE/JSE Top40 (J200) Weekday Share Price*

Similarly, in Figure 7 above, the closing share price of the FTSE/JSE Top 40 (J200) for the days of the week between the 1st of January 2014 and then 31st of December 2019 is shown. As observed, the share price was fairly volatile and traded largely between 42000 and 48000 from early 2014 to around Q2 2017. The share price then broke the upper limit of this band of 48000 and went on to reach a new high of 54000 in early 2017, which was a continuation of a strong bullish trend that started in late 2016. The share price experienced a sharp decline in mid-2018 but had largely recovered by early 2019. Since early 2019 the share price had primarily traded between a lower limit of around 48000 and an upper limit of 52000.

These are two very contrasting share price history graphs with the J867 REITs chart showing a net loss of 201.66 or 26,4% over the period whilst the J200 JSE Top 40 chart showing a net gain of 9980.15 or a 24,1% over the period. This is a net difference between the two data sets of 54%.

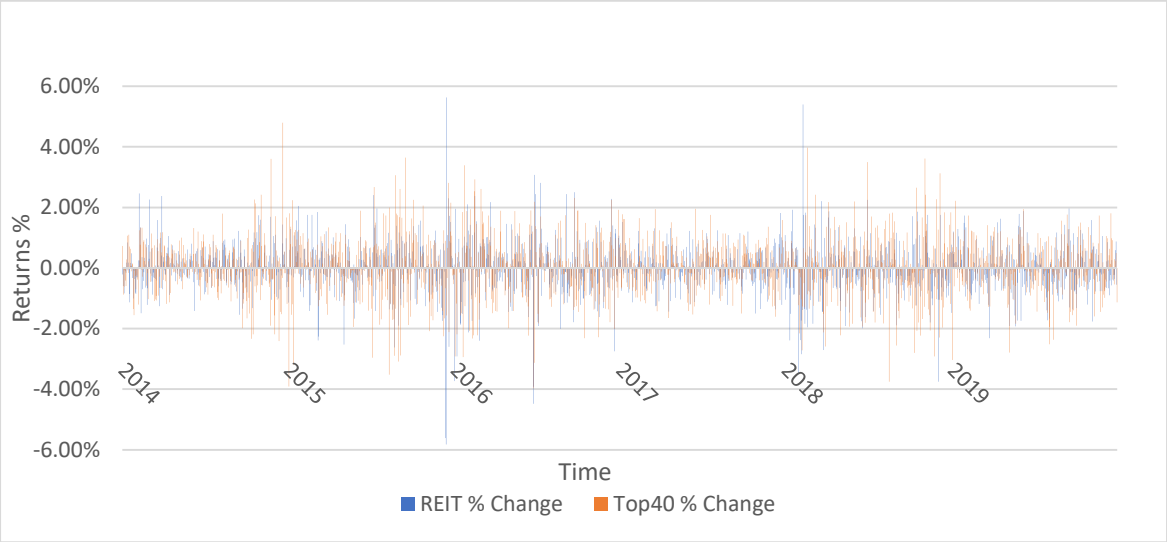



*Figure 8: FTSE/JSE Africa REIT (J867) & Top40 (J200) Index % Daily Return*

As observed in Figure 8 above, the largest daily % changes for the REIT data occurred in late 2015 and early 2018, both in line with major share price decline turning points. The largest daily % changes for the Top40 data occurred in late 2014, mid-2015, and mid-to-late-2018.

Measures of central tendency, dispersion, normality, and correlation and covariance will be discussed below per data set.

4.2.1.1. Central Tendency:

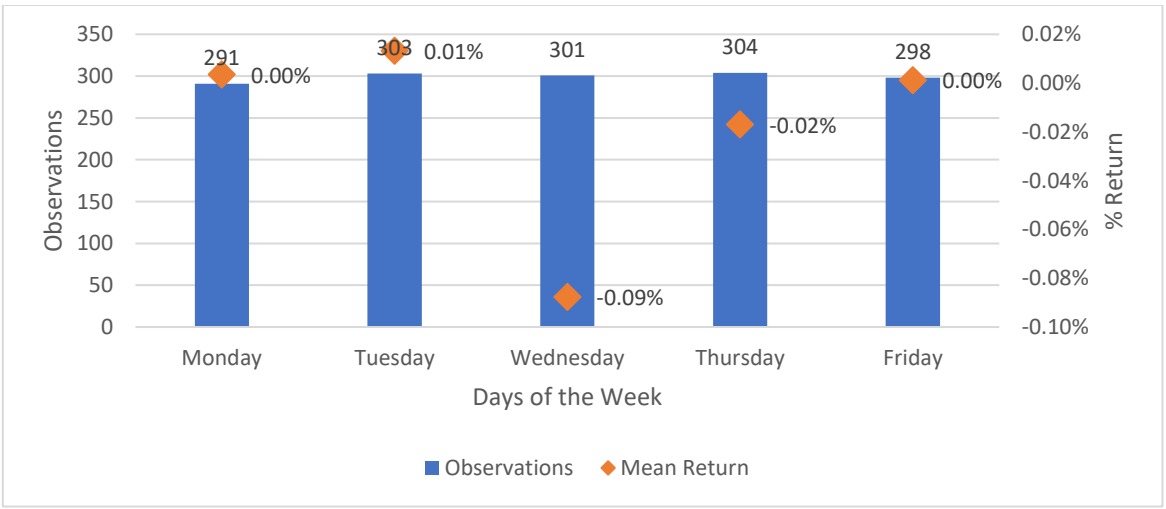



*Figure 9: FTSE/JSE Africa REIT (J867) Weekday Observations and % Mean Returns*

In Figure 9 above, it can be seen that the mean value for Tuesday was the highest with 0.01% and Wednesday with the lowest of -0.09%. This is a difference of roughly 0.1%.

| J867 REIT | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Observations | 291 | 303 | 301 | 304 | 298 |
| Sum | 1.049% | 4.006% | -26.383% | -5.163% | 0.361% |
| Mean | 0.00% | 0.01% | -0.09% | -0.02% | 0.00% |
| Median | -0.02% | -0.01% | -0.06% | -0.05% | -0.01% |

*Table 1: FTSE/JSE Africa REIT (J867) Central Tendency*

The medians for the two samples were also close in value with Friday standing at -0.006% and Wednesday at 0.0574% as seen in Table 1 above. This is a difference of only 0.05%. The most stand-out figure in the table above is the sum of Wednesday's returns which stands at -26.383%. This may indicate that avoiding trading on a Wednesday and Thursday could enhance your average returns, however, we cannot create a trading rule around this figure in isolation. In contrast to this, the highest cumulative day increase is Tuesday with 4.006%.

As these figures were quite interesting to the research, the sum of the returns on an annual basis was calculated. The results are tabulated in Table 2 below.

| J867 REIT | Monday | Tuesday | Wednesday | Thursday | Friday | Total |
|---|---|---|---|---|---|---|
| 2014 | 0.42% | 4.73% | -0.40% | 4.43% | 7.51% | **16.68%** |
| 2015 | 10.01% | 4.26% | -5.00% | 9.84% | -14.05% | **5.06%** |
| 2016 | 0.60% | 5.67% | -4.70% | -2.22% | -1.32% | **-1.97%** |
| 2017 | 3.41% | -3.24% | -0.30% | 2.40% | 1.08% | **3.34%** |
| 2018 | -10.80% | -1.05% | -8.86% | -13.19% | -0.23% | **-34.13%** |
| 2019 | -2.58% | -6.36% | -7.12% | -6.42% | 7.38% | **-15.01%** |
| Total | **1.05%** | **4.01%** | **-26.38%** | **-5.16%** | **0.36%** | **-26.03%** |

*Table 2: FTSE/JSE Africa REIT (J867) Annual Returns 2014 to 2019*

The above table suggests that whilst a certain day of the week may experience large yearly gains or losses, the net gain/loss over a longer period of time is not so drastic (e.g. Monday and Thursday), however, it can also be seen that Wednesday did not have a net positive return figure for the six years under review and in 2018 the REIT index had its' worst performance in terms of returns.

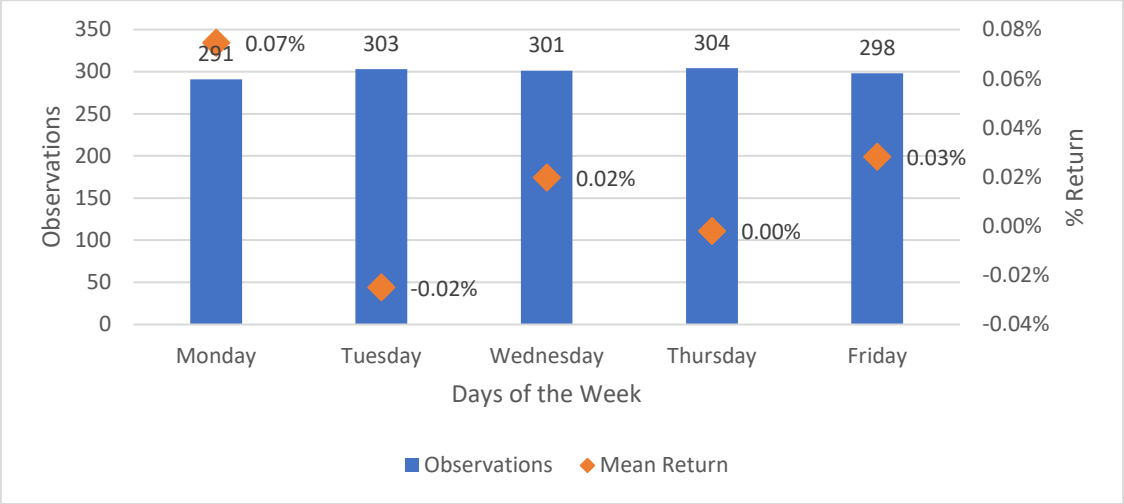



*Figure 10: FTSE/JSE Top40 (J200) Index Observations and % Mean Returns*

For the FTSE/JSE Top 40 (J200) Index as seen in Figure 10 above, Monday has the highest mean value at 0.07% and Tuesday has the lowest mean value at -0.02%, a net difference of 0.09%. This is consistent with the findings of cumulative returns as seen in Table 3 below.

| J200 Top40 | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Observations | 291 | 303 | 301 | 304 | 298 |
| Sum | 21.711% | -7.567% | 5.940% | -0.613% | 8.399% |
| Mean | 0.07% | -0.02% | 0.02% | 0.00% | 0.03% |
| Median | 0.17% | 0.05% | 0.02% | -0.11% | 0.07% |

*Table 3: FTSE/JSE Top40 (J200) Central Tendency*

The results above may indicate that trading on a Monday, Wednesday and Friday alone could enhance your returns, whilst avoiding Tuesdays could limit your losses. Further analysis would be needed before a conclusive trading strategy could be formulated. Again, the research felt it necessary to investigate the sum of the return figures shown in the Monday, Tuesday, and Friday columns. This has been tabulated in Table 4:

| J200 Top40 | Monday | Tuesday | Wednesday | Thursday | Friday | Total |
|---|---|---|---|---|---|---|
| 2014 | 4.77% | 5.88% | -4.00% | -3.58% | 3.73% | **6.81%** |
| 2015 | -1.78% | -2.12% | 6.39% | 17.04% | -13.81% | **5.73%** |
| 2016 | -0.41% | -6.07% | 4.97% | -1.94% | 0.86% | **-2.59%** |
| 2017 | 15.54% | -0.06% | 2.95% | -1.75% | 1.90% | **18.57%** |
| 2018 | 3.92% | -8.63% | -7.65% | -4.81% | 7.19% | **-9.98%** |
| 2019 | -0.33% | 3.43% | 3.28% | -5.57% | 8.53% | **9.33%** |
| **Total** | **21.71%** | **-7.57%** | **5.94%** | **-0.61%** | **8.40%** | **27.87%** |

*Table 4: FTSE/JSE Top40 (J200) Index Annual Return 2014 to 2019*

The annual return figures of this table paint a mixed picture and once again it is evident that short term gains or losses can be nullified in the long term (see Thursday and Friday as

examples), however, 2017 proved to be a particularly strong year for Mondays and as a year in general. Fridays also performed positively in every year except 2015.

After analysing the central tendency of the data, it can be seen that certain days of the week do stand out from an aggregate return perspective, however, upon further analysis by breaking the data down into their day of the week by respective year, it can be seen that the large daily aggregate return may be the result of one strong year or period, for example Mondays in 2017 for the J200 data or Thursdays in 2018 for the J867 data. It can also be seen that the very strong years can be counter balanced by very weak years or consistently weak years (and vice versa) which may aggregate to a low net gain/loss, for example Thursdays for the J200 data and Fridays for the J867 data. This is why we cannot conclusively formulate a trading strategy based on these figures alone.

4.2.1.2. Dispersion

| J867 REIT | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Maximum | 5.63% | 3.07% | 5.40% | 2.50% | 2.28% |
| Minimum | -3.92% | -2.12% | -2.53% | -5.61% | -5.82% |
| Range | 9.55% | 5.20% | 7.92% | 8.11% | 8.10% |
| Std. Dev. | 0.009 | 0.008 | 0.008 | 0.009 | 0.009 |

*Table 5: FTSE/JSE Africa REIT (J867) Dispersion*

In Table 5 above, for the J867 REITs, Monday has the highest maximum value and range for the data set with 5.63% and 9.55% respectively. Friday has the lowest maximum value of the data set but also has the lowest minimum value of the data set with 2.28% and -5.82% respectively. Interestingly, the lowest minimum value that occurred (-5.82%) occurred on the trading day before the highest maximum value of 5.63%. This occurred in late 2015. The lowest range value is attributed to Tuesday with a range of 5.2%.

For the J200 Top40 data as shown in Table 6 below, Thursday has the highest maximum value of 4.70%, occurring in late 2014, with Tuesday at the lowest of 3.06%. Thursday also had a higher minimum value compared to the other days of the week and a higher range value when compared to the range values of the other days of the week. Friday had the lowest minimum value of -3.97% which occurred in mid-2016. The highest standard deviation of values occurs on Wednesday.

| J200 Top40 | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Maximum | 3.12% | 3.06% | 3.64% | 4.79% | 3.60% |
| Minimum | -3.91% | -3.09% | -3.76% | -2.79% | -3.97% |
| Range | 7.03% | 6.15% | 7.40% | 7.58% | 7.57% |
| Std. Dev. | 0.010 | 0.010 | 0.011 | 0.010 | 0.010 |

*Table 6: FTSE/JSE Top40 (J200) Dispersion*

The above data may indicate that Thursday could statistically be the best day to trade on as there is, on average, higher minimum values and higher maximum values than other days of week. Further investigate would be required in order to confirm this.

4.2.1.3. Normality

| J867 REIT | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Skewness | 0.139 | 0.147 | 0.765 | -0.856 | -1.223 |
| Kurtosis | 6.362 | 0.486 | 6.837 | 5.217 | 7.170 |
| Jarque-Bera | 491.652 | 4.078 | 615.610 | 381.810 | 712.578 |
| p-value | 0.000 | 0.396 | 0.000 | 0.000 | 0.000 |

*Table 7: FTSE/JSE Africa REIT (J867) Normality*

As seen in Table 7 above, of the days of the week, only Thursday and Friday have a negative skewness of -0.856 and -1.223 respectively. This indicates that their data distribution curve has long left tails or, in other words, there are lower values than the sample means of each data set. However, Monday, Tuesday, and Wednesday have positive skewness with 0.139, 0.147, and 0.765 respectively. These positive values tell us that the samples are made up of values mostly higher than the sample mean and the data sets will have long-right tails.

All of the days of the week have positive kurtosis values. If a kurtosis value of 3 means that the distribution is normally shaped, then Monday, Wednesday, Thursday, and Friday have leptokurtic-shaped distribution curves which means they are more peaked than flatted in natured. Only Tuesday has a positive kurtosis value that is less than 3. The distribution curve for Tuesday will therefore be more flatted than peaked but still peaked in nature.

The Jarque-Bera test statistics for Monday, Wednesday, Thursday, and Friday are all extremely high. As these numbers are large, this points to their sample data not having normal distribution curves. This is supported by low p-values (lower than 0.05) meaning that there is sufficient evidence to support that the data is not from a normal distribution. However, for Tuesday, the Jarque-Bera test statistic is only 4.078 and has a p-value greater than 0.05. We therefore cannot reject the hypothesis that the distribution curve is normally distributed.

The above data analysis may indicate that there is the potential to formulate a trading strategy around Tuesdays as the data is normally distributed and therefore can be predicted with greater certainty that the other days of the week. This information coupled with the central tendency information and cumulative returns for Tuesdays, may indicate that trading on Tuesdays alone may allow you to outperform the J867 market. Further analysis is required to confirm this theory.

| J200 Top40 | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Skewness | -0.537 | -0.245 | -0.330 | 0.657 | 0.071 |
| Kurtosis | 1.517 | 0.426 | 1.340 | 2.464 | 1.595 |
| Jarque-Bera | 41.897 | 5.324 | 28.013 | 98.779 | 31.824 |
| p-value | 0.000 | 0.256 | 0.000 | 0.000 | 0.000 |

*Table 8: FTSE/JSE Top40 (J200) Normality*

The J200 Top40 data depicted in Table 8 above is different from the J867 REIT data as Monday to Wednesday have positive skewness figures which indicate that their distribution curves have longer right-hand tails than left-hand tails, with Thursday and Friday having negative skewness values showing that their samples are made up mostly of values lower than their sample means. This is opposite to what is found in the J867 REIT data.

All of the kurtosis values for the days of the week are positive but not equal to 3. This indicates that their distribution curves are more flatted than sharp in shape. These shaped curves are also referred to as leptokurtic in nature.

Similar to the J867 REIT data, all of the days of the week but Tuesday showed high Jarque-Bera test statistics. Monday, Wednesday, Thursday, and Friday also have low p-values indicating that we can indeed state that these days of the week do not have normally distributed data samples. However, Tuesday, like with the J867 REIT data, has a low Jarque-Bera test statistic and a p-value higher than 0.05. We can therefore accept the null hypothesis of normality and state that the sample data for Tuesday is normally distributed.

Unlike the J867 data, there is difficulty in proposing a potential trading strategy at this point. Further information will be required to determine if there is a day-of-the-week effect for the J200 data.

#### 4.2.1.4. Covariance & Correlations

Table 9 below shows the covariance and correlation coefficients (see the right-hand side of the table for reference) for the J867 REIT data with the results being largely mixed. The covariance is negative only between Monday and Wednesday, Wednesday and Tuesday, and

Monday and Friday. This shows us that the variables move in opposite directions or are said to be indirectly proportional. The correlation coefficients of the aforementioned pairs are also negative, but only slightly, showing that the relationship is weak. In fact, it is strongest between Monday and Friday with -0.16726 which is to say that it is not very strong. The covariance between Monday and Tuesday, Monday and Thursday, Tuesday and Thursday, Tuesday and Friday, and Wednesday and Friday all have 0 covariances indicating that there is no relationship between variables. Aside from when the day is paired with itself, the only other positive relationships between two days are Wednesday and Thursday and Thursday and Friday which are directly proportional. The strength of the relationship between Thursday and Friday is the strongest with a correlation coefficient of 0.18658.

| J867 REIT | Monday | Tuesday | Wednesday | Thursday | Friday | |
|---|---|---|---|---|---|---|
| Monday | 0.00009 | | | | | Cov |
| | 1.00000 | | | | | Corr |
| Tuesday | 0.00000 | 0.00007 | | | | Cov |
| | -0.05199 | 1.00000 | | | | Corr |
| Wednesday | -0.00001 | -0.00001 | 0.00007 | | | Cov |
| | -0.07387 | -0.07867 | 1.00000 | | | Corr |
| Thursday | 0.00000 | 0.00000 | 0.00001 | 0.00008 | | Cov |
| | 0.04260 | -0.07867 | 0.09718 | 1.00000 | | Corr |
| Friday | -0.00001 | 0.00000 | 0.00000 | 0.00002 | 0.00008 | Cov |
| | -0.16726 | 0.00085 | -0.06595 | 0.18658 | 1.00000 | Corr |

*Table 9: FTSE/JSE Africa REIT (J867) Covariance & Correlation*

The premise that there may be a Tuesday day-of-the-week effect based on the previous descriptive statistic analysis is neither confirmed nor disproved by the above table. The relationship between Tuesdays and the other days of the week are weak at best.

In Table 10 below, the covariance and correlation coefficient for the J200 Top40 data is shown. The positive covariance figures are between Monday and Wednesday with 0.0001, Tuesday and Friday with 0.0001, and Wednesday and Thursday with 0.0001. Of these pairs, only Tuesday and Friday have a negative correlation coefficient with -0.08234, however, the other two pairs do not show significantly strong relationships with the Monday and Wednesday pair being the strongest at 0.08624. In contrast to the J867 REIT data, there are no pairs that have a covariance of zero. For all of the pairs with a negative covariance, all of the correlation coefficients are low negative values showing that the relationship is not very strong.

| J200 Top40 | Monday | Tuesday | Wednesday | Thursday | Friday | |
|---|---|---|---|---|---|---|
| Monday | 0.00010 | | | | | Cov |
| | 1.00000 | | | | | Corr |
| Tuesday | -0.00001 | 0.00010 | | | | Cov |
| | -0.13907 | 1.00000 | | | | Corr |
| Wednesday | 0.00001 | -0.00001 | 0.00011 | | | Cov |
| | 0.08624 | -0.08880 | 1.00000 | | | Corr |
| Thursday | -0.00001 | -0.00001 | 0.00001 | 0.00010 | | Cov |
| | -0.06509 | -0.08880 | 0.06827 | 1.00000 | | Corr |
| Friday | -0.00001 | 0.00001 | -0.00001 | -0.00001 | 0.00010 | Cov |
| | -0.07123 | -0.08234 | -0.08742 | -0.05222 | 1.00000 | Corr |

*Table 10: FTSE/JSE Top40 (J200) Covariance & Correlation*

### 4.2.2. Kruskal-Wallis (KW) Test

#### 4.2.2.1 South African REITs

Below is a table with a breakdown of the components of the KW test conducted on the FTSE/JSE Africa REIT (J867) data.

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Sum | 221279 | 230059 | 213760 | 228454 | 227701 |
| n | 291 | 303 | 301 | 304 | 298 |
| $R^2/n$ | 168262528.7 | 174677041.2 | 151805108.3 | 171681678 | 173985722.8 |
| n total | 1497 | | | | |
| k | 5 | | | | |
| *H* test statistic | 3.1764 | | | | |
| p-value | 0.5288 | | | | |

*Table 11: FTSE/JSE Africa REIT (J867) Kruskal-Wallis Test & Results*

The Sum component refers to the total sum of the ranked share price value of the sample. The total number of observations (*n*) was 1497. The $R^2/n$ value is simply the sum of the ranks squared divided by the number of observations for each day. The *k* value is the number of groups in the data. In this case, the *k* is equal to 5 as we are analysing five groups; Monday, Tuesday, Wednesday, Thursday, and Friday. *H* is the test statistic for the KW test and, for the FSTE/JSE Africa REIT (J867) data, it has yielded a value of 3.1764.

| Significance Level | 5% | 10% |
|---|---|---|
| df | 4 | 4 |
| Decision rule | 9.487729037 | 7.77944034 |

*Table 12: KW Test Significance Levels & Corresponding Decision Rules*

According to the decision rule determined using the Chi-squared table and seen in Table 12 above, if the *H* test statistic is greater than 9.4877 at a significance level of 5% or greater than 7.7794 at a significance level of 10% then we would have sufficient evidence to reject the Null hypothesis. The *H* test statistic is well below both of these values and therefore we do not reject the Null hypothesis. To support this finding, we look at the p-value of 0.5288 which is greater than 0.05 and 0.10, thus confirming the non-rejection of the null hypothesis at the 5% significance value and the 10% significance level. This statistic indicates that there is no statistical significance in any day of the week or, there is no day-of-the-week effect for the J867 data.

4.2.2.2. JSE Top 40

Below is a table with a breakdown of the components of the KW test conducted on the FTSE/JSE Top 40 (J200) data.

The total sum of ranks for both Monday and Friday is equal to 1121253. This was checked against the KW test for the FTSE/JSE Africa REIT (J867) data and was found to be the same, along with the number of data points for the data sets. This is only a basic check to determine if anything has been overlooked.

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Sum | 229529 | 223111 | 228112 | 217111 | 223390 |
| n | 291 | 303 | 301 | 304 | 298 |
| $R^2/n$ | 181043167.8 | 164285539 | 172874035 | 155056534 | 167460041 |
| n total | 1497 | | | | |
| k | 5 | | | | |
| H test statistic | 4.8204 | | | | |
| p-value | 0.3062 | | | | |

*Table 13: FTSE/JSE Top40 (J200) Kruskal-Wallis Test & Results*

The *H* test statistic is equal to 4.8204. As the same decision rules apply as per Table 13 above, we will therefore not reject the null hypothesis at either of these significance levels as the *H* test statistic is below 9.4877 at a significance level of 5% and also lower than 7.7794 at a significance level of 10%. This is supported by a p-value of 0.3062 which is greater than 0.05 and 0.1.

The outcomes of the tests performed above indicate that there is no evidence to reject the null hypothesis for either of the data sets. At this level, the evidence points to the % daily returns of the data sets to be equal in nature.

Similarly to the J867 data calculations, the J200 data does not show a day-of-the-week effect in the KW test statistic and supporting p-values.

## 4.3 Summary of Findings

The descriptive statistical measures revealed mixed results. For central tendency, the REIT index data showed that Wednesday has the lowest mean return figure with -0.09%. Tuesday showed the highest mean return figure with 0.01%, and for the JSE data, Monday showed the highest %mean return with 0.07% and Tuesday showed the lowest percentage mean return with -0.02%. These findings are in contradiction with findings by Friday and Higgins (2000), Connor, et al. (2002) and Lee and Ou (2010). However, the findings did support what Hardin, et al., (2005) found where Monday's returns were positive but not statistically significant.

With regards to normality, the REIT index data was positively skewed for Monday to Wednesday, with Thursday and Friday being negatively skewed. This is in stark contradiction to what was identified in the JSE data which showed Thursday and Friday being positively skewed and Monday to Wednesday being negatively skewed. For both data sets, Tuesday was the only day that gave sufficient evidence to not reject the null hypothesis of normality

For the last descriptive statistical measure used, correlation and covariance, mixed results were observed with daily pairs that showed positive, negative, and zero covariance. The strongest positive relationship was between Thursday and Friday at 0.18658 for the REIT data and between Monday and Wednesday at 0.08624 for the Top40 data. The strongest negative correlation coefficients for the REIT and Top40 data sets were between Monday and Friday at -0.16726 and between Monday and Tuesday at -0.13907 respectively

The Kruskal-Wallis and supporting p-value tests were conducted on the two data sets where the decision rules were calculated at 9.4877 for a significance level of 5% and 7.7794 for a significance level of 10% from the Chi-squared table using degrees of freedom equal to 4. The *H* test statistic for the REIT data was computed at 3.1764 with a p-value of 0.5288 and the *H* test statistic for the JSE data was calculated at 4.8204 with a p-value of 0.3062. Therefore, neither result of either data set gives sufficient evidence to reject the null hypothesis that the percentage daily returns are statistically equal. This result is on contradiction with Jadevicius and Lee (2016) who found evidence that return anomalies do exist in UK REIT markets, but came to a similar conclusion to Ramiah, Lowies, Gabe, Xu, & Mossa, (2017) who found no abnormal seasonal anomalies.

# 5. Chapter 5: Conclusions, Recommendations, and Further Work

## 5.1. Summary

This section of the report will conclude by referencing the initial aim and objectives set out in the earlier parts of the research. The reason why this research was conducted was to identify if there are daily share price anomalies that can be taken advantage of to make an above-average return in the stock market, and secondly, to better understand the origins of REITs and their dual nature. Research into this field had been conducted extensively in equity markets and US REIT markets with more recent trends of research into non-US REIT markets. However, there is very little research on this topic in emerging markets and specifically, South Africa. The reason for this could be because REITs are still relatively new investment vehicles in South Africa when compared to markets like the United States, which began investing in REITs more than 50 years before. Thus, this research aimed to establish if there is a day-of-the-week effect on REIT returns.

## 5.2. Conclusion

The aim mentioned above in the Summary is linked to three main objectives, namely; to determine the theoretical origins of the day-of-the-week effect and the Efficient Market Hypothesis, to ascertain if there is a day-of-the-week effect on SA REIT returns, and, to determine if a trading strategy can be developed using this research to achieve abnormal investment returns from South African REITs.

To realise the first of the three objectives, a review of existing literature needed to be undertaken to understand the elemental theories that have developed these theories. The first sign of either theory was from Bachelier (1900) who identified the existence of calendar irregularities relating to the stock market. On the other hand, the first signs of efficient market research were in the late 1960s/early 1970s and closely linked to Eugene Fama who

empirically proved that share prices follow a random walk process (Fama, 1970). This theory came to be known as the Efficient Market Hypothesis.

Following on from this the research identified the research that had been conducted on these topics with regards to equity markets and REITs. This was done by systematically searching for keywords related to the topic in Google Scholar. These keywords included terms like: 'calendar anomalies', 'the Efficient Market Hypothesis', 'Random Walk theory', 'The day-of-the-week effect', 'REITs', etc,. Most of the papers were for equity markets in the United States, with fewer papers focusing on REIT markets than equity markets, however, the vast majority of REIT papers were still focused on the United States. This emerging trend was that REIT anomaly studies were shifting from US focused to other markets, however, there was still very little research on the South African and other emerging REIT markets. This is understandable as many emerging markets do not have established REIT markets and those that do have, have relatively young markets or limited data to study

The research also highlighted the contradictory evidence found regarding calendar anomalies showing that empirical results were situational rather than wide-spread.

To achieve the second objective, the research conducted a quantitative analysis of the share FTSE/JSE Africa REIT (J867) and FTSE/JSE Top 40 (J200) Index price data from January 2014 to December 2019. The main data analysed is the daily return data, however, it was noted that the share prices themselves showed very contrasting information. The shares for the FTSE/JSE Africa REIT (J867) showed a net decline in value of 26,4% over the period while the FTSE/JSE Top 40 (J200) Index showed a net gain of 24.1% over the period.

The descriptive statistics were identified and analysed, which included central tendency, dispersion, and normality. For the FTSE/JSE Africa REIT (J867) data, Wednesday showed the lowest mean return figure of -0.09% whilst Tuesday showed the greatest percentage mean return gain of 0.01%. For the FTSE/JSE Top 40 (J200) Index data, Monday had the highest percentage mean return value of 0.07% while Tuesday saw the greatest loss with a percentage mean return of -0.02%. With regards to the normality of the data, the FTSE/JSE Africa REIT (J867) data had positively skewed distribution curves for Monday to Wednesday with Thursday and Friday being negatively skewed. This was the exact opposite for the JSE Top40 data with Thursday and Friday being positively skewed the rest being negatively skewed. It was also found that for both data sets only Tuesday gave sufficient evidence to not reject the null hypothesis for normality. For covariance and correlation coefficients, the research

observed mixed results. There were daily pairs that showed positive, negative, and zero covariance. The correlation coefficients showed generally weak relationships between the daily pairs with the strongest positive between Thursday and Friday at 0.18658 for the REIT data and between Monday and Wednesday at 0.08624 for the Top40 data. The strongest negative correlation coefficients for the REIT and Top40 data sets were between Monday and Friday at -0.16726 and between Monday and Tuesday at -0.13907 respectively.

To reinforce the data analysis, the research applied the Kruskal-Wallis test to identify any tendencies over time and to test for the anomalies in the data. Each data set had a total of 1497 data points. The decision rules were calculated using the Chi-Squared table at significance levels of 5% and 10% with degrees of freedom equal to 4. The final decision rules were calculated at 9.4877 at the 5% significance level and 7.7794 at the 10% significance level.

Once the KW test had been run, the H test statistic for the FTSE/JSE Africa REIT (J867) data was calculated to be 3.1764 with a p-value of 0.5288. For the FTSE/JSE Top 40 (J200) Index data the H test statistic was calculated to be 4.8204 with a p-value of 0.3062. Neither of these outcomes gave sufficient evidence to reject the null hypothesis and the research can thus conclude that the % daily total returns are equal and that there are no statistically significant calendar anomalies identified by the statistical tests applied to each data set.

As there is not sufficient evidence to support the calendar anomaly theory within the framework applied to this data set, the research can conclude that the Efficient Market Hypothesis theory does exist in the South African FTSE/JSE REIT and Top40 Index. It seems that trading on certain days of the week (or for that matter, avoiding trading on certain days of the week) will gain you marginal returns. For example, if one were to have avoided trading the REIT Index on Wednesdays, one could have saved themselves 26.38% (excluding fees). While this may seem like a significant amount, when broken down into annual returns and compared to the Top40 Index, one would still be in a net better position by buying and holding the Top40 Index. Remember; the FSTE/JSE Top40 Index outperformed the JSE/FTSE Africa REIT Index by 54% over this period.

## 5.3. Hypothesis

The initial hypothesis of this research was that there would be a day-of-the-week effect on the returns incurred by South African REIT shares. The literature review conducted has shown us that there have been mixed results in previous studies on calendar anomalies in both equity

and REIT markets. However, the only other known study on South African equity anomalies did show the existence of holiday anomalies.

With regards to the quantitative element of this paper and the comparison to the null hypothesis, the results indicate that there is not sufficient evidence to reject the null hypothesis which implies that there is no statistically significant day-of-the-week effect in South African REIT or JSE Top 40 markets.

## 5.4 Contributions

This paper discussed the day-of-the-week effect in equity markets and REIT markets in markets around the world. The suggestion was that returns on different days of the week were significantly different from one another and by identifying these differences, one could develop a trading strategy to outperform the market. Whilst there is documented evidence of this calendar anomaly existing in REIT markets, such as the UK, there was no evidence to support the theory of calendar anomalies in South African REIT markets. This study effectively supports the Efficient Market Hypothesis theory with empirical evidence from the Kruskal-Wallis test.

## 5.5. Limitations

The limitations of conducting this study revolved around; time, resources, and scope.

Limited time restricted the research from thoroughly exploring all of the previously identified types of calendar anomalies in a global, emerging market and South African context. In addition to this, the time scale of the data available was limited as REITs were only introduced in South Africa in May 2013 and due to Covid-19, the data used was limited to between January 2014 and December 2019.

In addition to the limitation of time, the research was faced with limited scope and resources. Researchers with access to more resources could widen the scope of the research to include more emerging economies.

## 5.6. Recommendations

The data used to conduct this empirical study spanned 6 years from January 2014 to December 2019. When looking at other studies conducted on this topic in other markets, for example, the US and UK markets, the data sets used are for much longer periods of time.

South Africa's REIT markets are still comparatively very young and the recommendation to other research would be to wait a few years before conducting this study to give the market a bit more time to mature.

## 5.7. Further Work

Further research into this topic or area could look to include investigating calendar anomalies in other emerging markets and more specifically in African markets (such as Nigeria, Ghana, and Kenya) where REITs are still relatively new investment vehicles. Investigations into these markets could better our understanding of property sectors in emerging economies as well as assist in developing trading strategies for investors in these markets to help achieve above-market returns. It must be noted that the South African REIT market has been in existence and is more mature than the Nigerian, Ghanaian, or Kenyan REIT markets and thus it may be best to wait for the data to accumulate before conducting these studies.

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