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The effect on share prices listed on the JSE due to a non-investment grade announcement in the short term

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A research proposal submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Masters in Business Administration

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Abstract

This report examines the effect on share prices listed on the JSE due to a sovereign downgrade announcement to non-investment status in the short term. More specifically, it tests the Index response to such an announcement; the presence of information leakage prior to the announcement date; the extent to which each industry was affected; and how each sector within the financial industry responded to the announcement.

Actual returns were statistically tested for validity and reliability where after an event study methodology approach was followed. The event window was defined as from 30 days prior to 30 days after the announcement date. Abnormal cumulative average abnormal returns were then tested for significance at various confidence intervals. The confidence intervals were constructed by means of a Monte Carlo bootstrap simulation.

The findings show that the JSE was indeed affected by the non-investment grade credit rating announcement during the event window. No concrete evidence could be found for the presence of information leakage prior to the event and is as due to the occurrence of various related and unrelated news events preceding the announcement. The study furthermore indicates that in comparison to other industries the financial industry was affected the most severely. The analysis concludes by investigating each sector within the financial industry and found that the banking sector was affected to the greatest extend.

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Keywords

Junk Status; Credit Rating Agencies; Event Study; Announcement; Abnormal Returns

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I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

The name and the original signature of the student and the date should follow the declaration.

_____

G Croeser

_____

Date

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1. Chapter 1: Introduction to Research Problem

This proposed research paper is conducted on the effect of a sovereign credit rating downgrade to junk status on the equity market within the South African context. For the purpose of this study, the equity market if defined as all the listed companies on the Johannesburg Stock Exchange (JSE) All Share Index which consists of approximately 160 participants. During the course of 2016 and 2017 South Africa's credit rating and economic outlook has been downgraded numerous times by international rating agencies (Fitch Ratings, 2017; Moody's, 2017; Standard & Poor, 2017). These rating agencies are responsible for the evaluation and accreditation of a country's economic environment and is required to make their finding public in the global domain.

As of 2017 there are predominantly three global accredited rating agencies, Fitch Ratings, S&P and Moody's, that are tasked to evaluate each country around the globe. Even though these ratings are primarily associated with government bonds, state owned organisation received ratings on their day-to-day operations as well. These ratings serve as a basis for local and international investors as they provide an indication of governments ability to comply with their responsibilities. During the course of 2017, South Africa received two sovereign downgrades, one from Fitch and one from S&P (Fitch Ratings, 2017; Standard & Poor, 2017). Due to the poor credit rating prior to these downgrade announcements South Africa had no other option as to be labelled with junk bond status also known as non-investment grade. This raises the question; what was the initial effect on the South African equity market due to the grade change from investment status to non-investment status?

The effect of a non-investment grade announcement in South Africa will also shed some light upon the market efficiency of the JSE. The market efficiency hypothesis states that markets are either strong form, semi strong form or weak form efficient which allows some investors to benefit more from access to information than others (Naseer & Tariq, 2015). The hypothesis states that information is either readily equally available to all investors or not to some form of degree. When information is freely available to all investors in the market no one will be able to benefit more than another and it is for this reason that it is becoming more difficult for investors to outperform one another since they have equal access to the same information. All investors are therefore able to determine the intrinsic value of securities in the market as a result of information availability.

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1.1 Background on South African Sovereign Ratings

Sovereign ratings, produced by rating agencies, are important factors that local investors, foreign investors and limited partners need to consider during investment planning to deal with systematic risk. Moody's, Fitch and Standard & Poor (S&P) consider a variety of aspects within South Africa to evaluate and rate the economic conditions. These credit ratings are also accompanied by outlook projections to inform investors about the anticipated stability and outlook of South Africa. This was the case when Moody's downgraded South Africa's credit rating from A3 to Baa1 status in September 2012, followed by S&P and Moody's later in 2012 and 2013 (Group, 2013). Not only did S&P and Moody's downgrade the credit rating of South Africa's but also announced a negative outlook due to political tensions, poor growth, rising corruption levels, worsening government effectiveness and a widening current account deficit. South Africa has since received negative downgrades on a regular basis. Table 1 provides an overview of South Africa's credit rating history.

Date	Agency	Rating Event	From	To	Outlook From	Outlook To
27 Sep 12	Moody's	Downgrade	A3	Baa1	Negative	Negative
12 Oct 12	S&P	Downgrade	BBB+	BBB	Negative	Negative
10 Jan 13	Fitch	Downgrade	BBB+	BBB	Negative	Stable
13 Jun 14	S&P	Downgrade	BBB	BBB-	Negative	Stable
06 Nov 14	Moody's	Downgrade	Baa1	Baa2	Negative	Stable
12 Dec 14	S&P	Unchanged	BBB-	BBB-	Stable	Stable
12 Dec 14	Fitch	Unchanged	BBB	BBB	Negative	Negative
05 Jun 15	Fitch	Unchanged	BBB	BBB	Negative	Negative
04 Dec 15	S&P	Unchanged	BBB-	BBB-	Stable	Negative
04 Dec 15	Fitch	Downgrade	BBB	BBB-	Negative	Stable
08 Mar 16	Moody's	Rating under Review	Baa2	Baa2	Stable	Stable
06 May 16	Moody's	Unchanged	Baa2	Baa2	Negative	Negative
03 Jun 16	S&P	Unchanged	BBB-	BBB-	Negative	Negative

Table 1: Sovereign Rating History for South Africa

It should be noted that none of these ratings shown above, that is prior to 2017, resulted in a change from investment status to non-investment status. The change to non-investment status is therefore regarded as a unique event that should be investigated as the previous non-investment announcement was more than a few decades ago.

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1.2 Overview of Research Problem

For centuries investors have been obsessed with investment opportunities that provide adequate returns on their investments. These investments range in a variety of securities including government bonds, forex, commodities and publicly listed equity. In order to make informed decisions regarding investment opportunities, investors need to know the level of associated risk with a particular investment. The definition of total risk on an investment is defined as the aggregate of the systematic and the non-systematic risk (Firer, Ross, Westerfield, & Jordan, 2012).

The non-systematic risk can easily be reduced with portfolio diversification (Matsumura & Kakinoki, 2014). As diversification can almost eliminate non-systematic risk, investors are left with facing factors that influence systematic risk. The Beta (β) coefficient is a measure of systematic or non-diversifiable risk and is primarily subjective to macroeconomic conditions and would require investors to rebalance their portfolios due to changes in the market (Sergeeva & Nikiforova, 2012). This can be achieved with dynamic asset allocation (DAA) which is a proactive, systematic approach which incorporates a forward-looking strategy to asset allocation and rebalancing (Goodman & Miccolis, 2012). Systematic risk cannot be reduced by public equity portfolio diversification and is therefore subjective to the external environment such as sovereign credit rating downgrades.

Literature addresses the effects of a sovereign downgrade on government bonds on the equity market, but to the best of my knowledge very little has been done regarding the explicit investigation of a downgrade to junk status, let alone in the South African context. As some investors only partake in the listed equity environment it is essential to be aware of the systematic risks and their extent. This includes the effect of a credit rating downgrade to junk status. The research problem therefore aims to investigate the effect of a sovereign downgrade to non-investment status of government bonds on the equity market. In other words, the effect of A on B.

1.3 Significance of Study

The problem at hand is that very little research has been done on the effect of share prices as a result of being downgraded to junk status in the short term, where the short term is defined as 30 days prior to 30 days after the event, let alone on the Johannesburg Stock Exchange (JSE) and within the South African context. Apart from generic and

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universal factors that are being influenced due to a downgrade to junk status, South Africa is subject to unique circumstances. This includes land transformation, radical economic transformation and political instability in the form of cabinet reshuffles (Hutchings, 2017). One might argue that a credit rating downgrade to non-investment status will be best observed in the medium to long run, but the question still arises what is its effect in the short term?

As a downgrade to junk status is the transition from investment status to non-investment status within a country, it is crucial for investors to understand the implications thereof. Finance theory suggests a positive relation between risk and return (Fodor, Krieger, Mauck, & Stevenson, 2013). Thus, the presence of an increase in the market risk premium should show evidence of increased returns. It is therefore important for investors to be aware of the implications due to changes in the market risk premium as a result of being downgraded to non-investment status. Even though the market might anticipate a credit rating downgrade it is still worth investigating the markets immediate response thereof in the short term. This study should also shed light upon the market efficiency within South Africa.

South Africa was classified as an investment status in the early stages of the 21st-century almost two decades ago. Since then the country has gone through numerous changes ranging from the end of apartheid to hosting international sporting events like the Rugby and Soccer World Cup. To the best of my knowledge, very little formal literature about the South Africa's pre-2000 non-investment status is available that explicitly investigates the effect on listed equity during this time, especially in the short term before and after an investment status classification change. The research will therefore be conducted on a single event and the findings thereof should by no means be seen as a generalisation to a non-investment announcement within South Africa nor abroad.

There are many individual investors as well as authorized financial service providers that act on behalf of individual investors. These individuals and investment agencies participate in the local equity market in the form of diverse portfolios, mutual funds, unit trusts, retirement funds and hedge funds to name a few. As these investor's primary objective is to provide an adequate return on investment it would be extremely beneficial to be aware of the immediate effect of a non-investment classification. As a result, this study should shed light upon how the rating of one investment opportunity can affect the returns of another investment opportunity in a short time frame.

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The significance of the study is therefore to determine the link between government bond ratings and the equity market in a short time frame. More importantly, the effect of a rating change from investment status to non-investment status within South Africa. It is anticipated that the transition to junk status will render more severe consequences as a simple downgrade that remains within investment status. One might also argue that the anticipation of a downgrade to non-investment status was already priced into the market at the time of the announcement and that no effect will be present during analysis. This research at hand aims to address these questions with sound analytical results accompanied with significant intervals.

1.4 Research Objectives

The first and foremost part of the research objective is to get a firm understanding of the research problem that needs to be addressed and the relevance thereof. This requires an in-depth literature study followed by a structured question formulation section.

An in-depth literature study should be conducted to get a firm theoretical understanding of the dynamics involved with a sovereign downgrade to junk status. This theoretical study should shed some light upon the statistical tools and techniques required to provide the most insightful results. Furthermore, the study will help to bridge the gap between the theory, observations and the results obtained from the statistical analysis while providing a detailed explanation and interpretation of the results.

Once the literature study is completed appropriate research propositions should be formulated based on insights gained from the in-depth literature study. The primary focus of the research propositions should be to answer the research objective which states the following:

Research objective: The effect on share prices listed on the JSE due to a sovereign downgrade in the short term

Once a firm understanding of the research problem is obtained the choice of methodology can be formulated. The choice of methodology should address the proposed philosophy, approach, type of study, intended strategy, method and time horizon of the research project. The choice of methodology will furnish a detailed intended methodology framework accompanied by the design metrics that will be used to answer the formulated research propositions.

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The choice of methodology will be followed by the results obtained from statistical analysis and techniques intended to answer the research problem. A detailed discussion will succeed these calculations whereby findings will be presented and interpreted. The research project will then conclude by highlighting the principle findings including implications, limitations and suggestions for future research.

1.5 Purpose of the Study

The purpose of the study is to grasp a firm understanding of the research problem in order to formulate a structured procedure to be followed by means of an comprehensive literature review to answer the research problem.

The problem at hand is to determine the effect of a change from investment grade to non-investment grade on the equity market within South Africa. The study should not be confined to some form of index that serves as a proxy in isolation but should also consider the constitutes that make up the index. Therefore, evidence of the sovereign downgrade should also be investigated in all the industries and their corresponding sectors within the JSE.

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2. Chapter 2: Literature Review

2.1 Credit Rating Agencies

Credit Rating Agencies (CRAs) are independent institutions who aim to provide objective sovereign ratings to inform investors about the economic environment within a country. To date, the international front is dominated primarily by three rating agencies (Alsakka & Ap Gwilym, 2013). They are, Standard and Poor (S&P), Moody's and Fitch Ratings.

These agencies claim to base all their ratings on information publicly available to all investors. However, is it argues that this might not be the case and that the agencies are in possession of private information that is not in the public domain (Holthausen & Leftwich, 1986). In contrary, Lazareve argues that CRAs only use information publicly available to investors and that CRAs merely confirm what the market has already priced in (Lazareva, 2016). The effect of rating and forecast change announcement also appear to be agency depended whereby the market is more affected by some CRAs than others.

2.2 Credit Ratings

Sovereign ratings produced by Credit Ratings Agencies (CRAs) aim to provide guidance to investors about the macroeconomic conditions within a country and is regarded in some instances as more important as roles played by governments (Afonso, Gomes, & Taamouti, 2014). These ratings are becoming more important for developing countries as they enter financial integration and globalisation (Erdem & Varli, 2014). Even though a countries financial and political situation has a direct influence on its credit rating, Erdem and Varli found that Governance Indicators, Reserves/GDP, GDP per Capita, as well as Budget-Balance/GDP are the biggest factors that influence credit ratings in emerging markets. This confirms Afonso's findings that states that the macroeconomic factors that influences the credit ratings are different for developed and developing countries (Afonso, 2003). Furthermore, Erdem and Varli also found in their study that lower income countries received lower ratings than high income countries and questions whether rating agencies respond within the same timeframe for good news as they do to bad news.

Parameters that are used by credit rating agencies are industry specific. It is clear that in the service and retail trade industry factors like merchandising, competitiveness, quality of goods supplied, diversification and supply chain effectiveness are the

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predominant factors considered during the credit rating process (Hájek, 2012). As the service and retail trading industry is primarily dependent on these factors they are regarded as the main risk determents.

2.3 The Effect of Credit Ratings

Financial markets show an increase in volatility during a credit rating downgrade or a future outlook downgrade to negative (Afonso et al., 2014). However, in general, very little changes in volatility is reported during credit rating upgrades but in some instances markets reacted with a decrease in volatility. There also appears to be a strong correlation between the timing and the quality of information available before a credit rating announcement (Holthausen & Leftwich, 1986). When sovereign ratings were included during volatility modelling it resulted in an increase in returns and a reduction in risk. The study also found the presence of a systematic spill over to neighbouring countries and in some instances to international countries during credit rating downgrades. This phenomenon is also evident in a study conducted by Alsakka & Ap Gwilym (Alsakka & Ap Gwilym, 2013). It is observed that strong spill overs occur within the European Union and weak spill overs in the US.

There is a significant response to government bond yield spreads after the announcement of a change in rating or outlook forecast (Afonso, Furceri, & Gomes, 2012). Even though the market might anticipate a change it is reported that rating announcements are essentially not anticipated into the price for a period of 1 to 2 months prior to an announcement. There is also a clear indication that the bond yield spreads found in countries downgraded in the last six months is much larger than the ones found in countries downgraded more than six months before to the same credit ratings.

Sovereign rating downgrades does not influence financial corporations in a silo manner. Non-financial corporations are also severely affected by rating changes. Credit rating downgrades reduces financial and non-financial corporations access to debt capital and Foreign Direct Investment (FDI) (Nguyen & zu Knyphausen-Aufseb, 2014). Currency depreciation, creditworthiness of corporations combined with high inflation rates are only a few macroeconomic considerations that needs to be considered after a credit rating change. These macroeconomic condition changes have a great effect on the business cycles of corporations which in turn affects the country's economic cycle. In a study conducted about sovereign rating changes before and after the 2008 financial crisis, it was found that markets react in a much more volatile manner to rating changes after

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2008 then before. This is contributed to the fact that investors became more aware of rating agencies during this period and started to pay more attention after 2008 to their ratings then before the financial crises (Shahrivar & Asaba, 2013). Furthermore, it is found that the change to speculative bond status is also accompanied with greater abnormalities compared to that of a rating change that remains within investment grade (Lal & Mitra, 2011).

The effect of a credit rating announcement is in most instances accompanied with abnormal Cumulated Average Abnormal Returns (CAARs) prior the event. This is to a degree attributed to the lack in information whereby investors are unable to make informed investment choices. The presence of CAARs are also more common during downgrade announcements than that of upgrade announcements. It is quite surprising to note that announcements are either proceeded with negative CAARs or no movement in CAARs at all (Parnes, 2008). Insider trading is also regarded as a major contributor to abnormal CAARs where by investors react upon the anticipation of a credit rating announcement (Brandeis, 1992). It can be concluded that the degree of abnormal CAARs are directly proportional to the markets anticipation of a credit rating announcement.

The effect of a rating announcement is found to be time and country dependant (Holthausen & Leftwich, 1986). Once is therefore only able to make relative accurate predictions as to how the market will respond to an announcement. During the anticipation of a rating announcement an increase in trading volume is observed (Parnes, 2008). This increase is attributed to the expectations of idealistic and risk aversive investors as to how the market will respond. It is also interesting to note that international investors tend make equity investments during upgrades whereas local investors tend to sell their positions during this period (Ahn, Kim, Ryu, & Yang, 2016).

The effect of a credit rating on one financial instrument has a direct impact on other financial instruments. This is partially due to the ceiling effect whereby all financial institutes need to be regarded after a non-investment grade announcement and that most institutional investors are prohibited by law to invest in speculative and non-investment grade instruments (Kaminsky & Schumklar, 2002). Apart from these factors, the occurrence of currency crashes in recent times caused investors to be paranoid resulting an in an overreaction to sovereign news. It has also been found that local currencies are affected by credit ratings accompanied by spill overs to neighbouring countries (Alsakka & Ap Gwilym, 2013). Sovereign credit ratings are based on a long

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term outlook and is not just a reflection upon the current economic climate (Lobo, Paugam, Stolowy, & Astolfi, 2017). As sovereign credit ratings are performed on the financial industry, the financial industry appears to be affected to the greatest extent when compared to other industries.

Sectors within the financial industry also portray different reactions upon a non-investment grade announcement. Real Estate Investment Trusts (REITs) are traded less frequently as they are regarded as long-term investment instruments and therefore take on a long-term investment horizon (Guttery, Ghosh, & Sirmans, 1998). Investors are furthermore less concerned about the current stance of a credit rating as the sector is influenced primarily by macroeconomic variables such as inflation, gross domestic product (GDP) and interest rates to name a few. As a result, REITs are less volatile with diluted reactions to market news (Füss, Mager, & Zhao, 2014).

The credibility of companies within the insurance sector is dependent on their solvency perception within the market and any form of credit downgrade announcement will question their ability to comply with their obligations (Burton, Mike, & Hardwick, 2003). Furthermore, this sector relies on respectable credit ratings to attract external investors and will find it extremely hard to do so in its absence.

Credit rating downgrades to non-investment status reduces the ability for financial corporations to gain access to debt capital and FDIs (Nguyen & zu Knyphausen-Aufseb, 2014). Downgrades on a specific financial instrument indicates that the probability of default increases for that instrument and that any company or sector associated with that instrument pays the consequences of such an announcement. This is particularly applicable to the banking sector whereby such an announcement results in a blemished brand, increased borrowing costs and a reduced risk portfolio. Credit rating changes to junk status has a particularly long lasting and unforgiving effect on the banking sector (Apergis, Payne, & Tsoumas, 2012). Due to recent financial meltdowns and the failure of Enron and Lehman Brothers the market tends to overreact to these announcements (Habib, 2015).

2.4 Information Leakage

Rating agencies meet with government officials prior to announcing any credit rating changes to the public domain. Unfortunately, due to information leakage, prior knowledge of credit rating changes leak from authorities into the public domain. In a

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study conducted with 400 sovereign rating upgrades and 291 downgrades it was found that there is clear evidence of sovereign rating leakage around the globe (Michaelides, Milidonis, Nishiotis, & Papakyriakou, 2015).

Furthermore, leakage showed a higher correlation in countries with low quality institutions. Local markets in low quality institutional countries overreacted before a rating change announcement was made even in the absence of sovereign rating news or unrelated news. In general, markets show an overreaction to sovereign rating announcements with a slight recovery after a few days. This recovery is regarded as a correction to the current market conditions. The study also found that sovereign downgrades has a greater effect on markets then upgrades. Evidence of this can be seen in Cypriot, where the stock market declined for three consecutive days before the public announcement of the countries sovereign government debt down grade where after it showed a slight improvement.

Information leakage is usually accompanied with abnormal CAARs before a credit rating downgrade announcement. It should however be noted that abnormal CAARs are not only a function of news related to a sovereign downgrade announcement but also to that of unrelated news and a thorough analysis should therefore be conducted to ensure that the presence of unrelated news is not mistaken for as information leakage. The magnitude of abnormal CAARs are also dependent on the rate at which related and unrelated news is distributed thought the market before the announcement (Goenka, 2003)

2.5 The Value Adding Debate

The debt crisis in 2007 led to the credit rating downgrade of several countries within the European Union. This sparked a debate as to whether these ratings produced by credit rating agencies really matter. The argument for the statement is based on that sovereign ratings tend to lag market developments and that it behaves in a reactive manner (Cavallo, Powell, & Rigobon, 2013). In other words, information is already available in the public domain before adjustments are made by rating agencies. This leads to the following argument, if rating agencies do not add any value they should not contribute to any changes in the market due to credit rating changes. This is clearly not the case. Markets show greater reaction to sovereign rating changes in the absence of a preceding outlook change. If a credit outlook forecast change there is a strong possibility that the effect of a credit change is already priced into the market and therefore shows a diluted

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reaction to the news. Rating agencies therefore do provide information that influences the market. Even though sovereign ratings might be very important for Foreign Direct Investments (FDIs) it is not particular important to the predominant investor class who wish to invest in developing countries (Lehmann, 2004). Cavelo, Powell and Rigobon provides clear evidence in their analysis of the value-added effect of rating agencies and report them in their findings.

2.6 Credit Ratings and Liquidity

In a study conducted with 40 countries from the year 1992 - 2009 it was found that there is a strong correlation between credit rating changes and the liquidity of stocks (Lee, Sapriza, & Wu, 2016). Once again, the loss of sovereign investment status has a particularly strong impact on a country's stock liquidity. On a firm level, companies with high ownership or lower liquidity showed a significant decrease in its liquidity levels whereas a firm with high turnover or high return on assets were less affected. From a country perspective, liquidity factors were found to be more country specific and not as generic as on the company level.

2.7 The Effect on Multinationals

Multinational organisations do not show the same volatility as domestic organisations during downgrades (Nguyen & zu Knyphausen-Aufseb, 2014). This is evident in lower corporate bond spreads which are observed in corporations that receive foreign revenue (Elango, 2010). This indicates that not only does the effect of a rating change influence a specific industry, but that the dynamics of an organisation within that industry also plays a significant role.

As multinationals take on more of a global stance they are less affected by the economic environment of a country in which they conduct business (Lombard, Roulet, & Solnik, 1999). Even though they are more diversified globally they are primarily affected by the domestic climate in which their headquarters reside. The diluted effect of a sovereign downgrade announcement on multinationals is also attributed to the fact that they need to be more productive in order to compete globally (Ferrante & Freo, 2012).

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2.8 Risk Factors

Every country is associated with its own sovereign risk, and every company within that country have different risks associated with them. There are even different levels of risk associated within each company. Some investors prefer to invest in riskier equity while others preferred to invest in lower risk bonds. It is important for investors to be aware of the fact that most care should be taken when considering a benchmark to establish a return on investment. Benchmarking a return on investments might indicate a positive return when compared to the local currency or other local investments, but when compared internationally the return on investment might be negative. This was the case in India when fixed bank deposits delivered negative returns due to inflation (Basu, 2015). Another problem arises when investors make use of a risk-free investment rate, in the form of Treasury bills, when using some form of Expected Return (ER) model. The problem with using the Treasury bill as the risk-free rate is that investors neglect to consider the debt to GDP of a country and that there is a possibility that the country might default on its debt (Basu, 2015). This was the case with Greece and Cyprus during a recent financial crisis. Stated another way, it will be practically impossible to convince investors that the government Treasury bills of Greece and Cyprus are risk-free securities. Great care should thus be taken when evaluating the effect on the South African stock market after the sovereign downgrade to non-investment status.

The theory suggests that there is a positive relation between risk and return (Fodor et al., 2013). Should this theory hold in the South African context the result would be that South African investors will receive higher returns on their riskier investments after the credit downgrade. This leads to the following question; does the market risk premium increase due to a non-investment status downgrade in South Africa in the short term and will the expected returns increase as prediceted by theory? If this is so, it will be contradictory to the finding, that apart from gold, monetary surprises within the South African economy was the only variable that consistently showed extreme negative impacts on stock market returns (Gupta & Reid, 2013).

In order to counter some of the negative effects of credit downgrades, governments imposes some form of regulation from time to time in order to compensate for these new undesirable economic conditions (Nguyen & zu Knyphausen-Aufseb, 2014). This is more commonly known as risk transfer techniques. One of these techniques are the regulation of payments whereby corporations are restricted from receiving payments in foreign currencies. Government also imposes higher taxes to compensate for increased

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borrowing costs resulting in companies having more difficulty paying their own debt. As a result, corporations reduce future investment planning which indirectly affects their stock prices.

Credit ratings inform investors about the associated risk of investments within a country, industry or organisation. This is especially evident in the manufacturing industry of Germany from an import and export perspective. Higher credit ratings allow companies in Germany to source a greater variety of goods from more countries which in turn leads to increased import margins (Wagner, 2015). The same is observed in the export market where a high investment credit rate leads to an increase in exports. Companies in general also show higher revenue contributions from exports during this time (Wagner, 2014). The lack of credit ratings for small firms put them under immense pressure as investors are more risk adverse due to the absence of credit rating information from internationally recognised agencies. This is evident in both the import and export market of manufactured goods. The effect of credit ratings is also apparent in other industries such as, the energy and financial industry. Countries that generate an annual revenue of more than 20% of GDP from oil and gas exports show considerable movements in prices due to credit rating changes (Breunig & Chia, 2015). The banking sector on the other hand shows great significance between asset liquidity, the banking system, the size of the financial system and credit ratings (Aktug, Nayar, & Vasconcellos, 2013).

From the literature, it is clear that a change in sovereign credit ratings or outlook forecast changes affect equity markets. These changes range from spill overs, volatility changes, information leakage, government bond yield spreads and stock liquidity. All of these factors influence the risk of investments which in turn influence the expected returns on these investments. The Capital Asset Prising Model (CAPM) as well as the improved version, the Intertemporal Capital Asset Pricing Mode (ICAPM) which includes additional variables have been used by investors to calculate the Beta (β) coefficients of securities compared to some proxy. An empirical test on the market risk premium for the JSE in South Africa concluded that market capitalisation and recourse shares have a positive correlation to Beta and a negative correlation to earnings yield (Ward & Muller, 2012). No correlation could be found between Beta and the price to book ratio.

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2.9 Credit Rating Ceilings

There is a strong relationship between sovereign ratings and corporate ratings. This is especially true in developing markets. Even though this is not the general case, in some countries the ceiling effect is present in which the credit ratings of individual corporations' do not surpass the countries sovereign rating. According to the sovereign ceiling doctrine all financial instruments and institutes need to be regraded accordingly as a result of the junk bond status rating. Therefore, the effect of a sovereign downgrade to non-investment status has a direct impact upon all sectors within the financial industry. This is evident in the study at hand as the financial industry displays abnormal CAARs at a higher significance level than any other industry (Kaminsky & Schumklar, 2002).

During a study conducted by Nguyen & zu Knyphausen-Aufseb no clear evidence could be found between the volume of equity traded and the sovereign rating of a country. There is also found to be a strong correlation between credit ratings and returns produced on stock market Indices. Countries with low credit ratings tend to provide higher returns on investments were in contrast high credit rating countries provide lower yields (Erb, Harvey, & Viskanta, 1995). This is as expected from a risk-return principle perspective.

As of November 2017, the most influential journal authors on the topic of finance and investments were found to be Eugene F. Fama Sr., Kenneth R. French, John Y. Campbell, Richard H. Thaler and Anjan V. Thakor (RePEc, 2017). Even though none of these authors published any recent finding on sovereign ratings they are a source for conceptual models and provide insights into fundamental findings which can be of great value during the research process.

The literature on the effects of credit rating changes on the capital market is relatively recent (Michaelides et al., 2015) thus supporting the notion for research to be conducted on the JSE index to determine the short-term effect of the sovereign downgrade to junk status. Credit downgrades has immense effects on local markets and it is thus worth investigating its effects in the South African context. Long term studies (Cornaggia, Cornaggia, & Hund, 2017) as well as medium term studies (Shahrivar, 2012) have been covered on this subject but to the best of my knowledge, no research has explicitly been done of the effect on the JSE, industries and sectors due to a credit downgrade to non-investment status. Apart from the CAPM, the Adjusted Market Model can also be used

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to provide more insight as to what effect a credit rating change has on the market due to a non-investment status announcement.

3. Chapter 3: Research Question and Propositions

The problem at hand is to determine the effect of a change from investment grade to non-investment grade on the equity market within South Africa. The study should therefore not be confined to the All Share Index (ALSI) in isolation but should also consider the constitutes that make up the index.

Due to the nature of the study a pragmatic philosophy is adopted. One should therefore be aware of what is possible and what is not possible during the research process. It is impractical to evaluate every share listed on the JSE against the local Index or some other Index to establish the effect of the South African credit downgrade. Instead, a portfolio of shares for the industry or sector under investigation should be selected to evaluate its response against the Index or other form of proxy. The research philosophy should ultimately serve as a tool to formulate and evaluate the propositions. The research objective should always be kept in mind during this process as the aim of the research study is to address the research objective.

The analysis would require a hands-on knowledge application approach to answer the propositions.

3.1 Proposition 1

It was found that in most cases there was a reaction in the market prior to a public sovereign rating change announcement due to information leakage (Michaelides et al., 2015). Even though this was found to be the general case one cannot just infer that this was the case on the JSE All Share Index prior to the announcement. Thus, the first preposition states the following:

Proposition 1: There is evidence of information leakage in the JSE All Share Index prior to the sovereign downgrade announcement to non-investment status.

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3.2 Proposition 2

As each companies' dynamics causes it to respond differently to changes in the market one cannot infer that a sovereign rating downgrade affects all companies in the same manner (Lee et al., 2016). Thus, one industry or sector should be affected more severely due to a rating change announcement than other industries or sectors. This is also expected from multinational and local listings. This leads to the second proposition which states:

Proposition 2: Multinationals listed on the JSE were less affected by the sovereign downgrade than others in the short term.

3.3 Proposition 3

With a credit outlook forecast change there is a strong possibility that the effect of a credit change is already priced into the market and therefore shows a diluted reaction to the news (Cavallo et al., 2013). Thus, there is a small possibility that the market did not respond to a sovereign downgrade in the short term. The third proposition states that:

Proposition 3: There is evidence that the JSE index was affected by the sovereign downgrade in the short term.

3.4 Proposition 4

Sovereign rating downgrades affects companies in different ways, ultimately leading some industries to be more volatile to rating news (Lee et al., 2016). It will thus be in the interest of investors to be aware of what industries are affected the most in the short term. The forth proposition address the shares of a specific industry listed on the JSE:

Proposition 4: Compared to all the industries listed on the JSE, the financial industry was affected the most in the short term.

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3.5 Proposition 5

The financial industry comprises of many individual sectors. This includes banking services, investment services, mortgage services and insurance services to name a few. In a recent bailout of banking institutions across the globe it raises the question as to how volatile this sector is to credit rating changes (Aktug et al., 2013). This leads to the fifth and final proposition.

Proposition 5: Within the financial industry, the banking sector was affected the most in the short term.

3.6 Research Objective

The results of the prepositions will then be used to answer the research objective which states:

Research objective: The effect on share prices listed on the JSE due to a sovereign downgrade in the short term

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4. Chapter 4: Research Methodology

In order to address the research problem, one is required to follow a structured research methodology to help construct and examine the fundamental ideas around a specific topic of interest (Saunders & Philip, 2012). The roadmap obtained from the choice of methodology served as a guiding instrument during the formal research process and ultimately contributed to more credible and accurate findings. The following section covers the methodology framework used during the formal research process.

An inductive research approach was followed. This bottom-up approach started with the collection of historical closing share price data (secondary data) to be analysed. An observation of the results obtained from statistical analysis revealed identifiable patterns, some with significance and some without. The findings were then ultimately used to answer the five research propositions. These results were then linked to literature in order to establish a theoretical basis and explanation thereof. The literature review and research propositions ultimately contributed towards answering the research objective.

During the research process, a firm understanding between the research problem and context was maintained. At first, the ALSI was analysed to determine the effect of a non-investment grade announcement on the Index itself which addressed proposition one and three. Thereafter, the Index was fragmented into its respective industries where industry specific shares were combined into a single share portfolio for analysis to valuate propositions four and five. This approach also revealed which industries were more affected than others due to the announcement. Proposition five required the additional fragmentation of the financials industry into its respective sectors. Finally, all multinationals were isolated and compared against the ALSI to answer proposition 2.

4.1 Type of Study

The descriptive research method was initially followed in order to gain a better understanding of the research problem. This approach was also more suitable to explain phenomenon's, events and situations but required measurable, quantifiable secondary data for statistical analysis. The secondary data was merely a recording of the daily closing prices on the JSE and was therefore regarded as reliable and suitable for the evaluation of the five research propositions.

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The descriptive research method was followed by an exploratory approach that provided more insight in addressing the research propositions. An in-debt literature study, in the form of peer reviewed journals and textbooks explained the observations obtained during analysis. Combining the theory with the analysed data provided new insights on the findings ultimately addressing the research topic. Not only did this approach clarify findings but also led to new questions and investigations. The exploratory study approach allowed for greater flexibility to answer the research propositions.

4.2 Strategy

The strategy was to make use of archival data and due the nature of the study at hand archival data formed the primary source of data used during analysis. Collected data was in the form of daily, weekly and monthly closing share prices as recorded by the JSE. The time window for the study is defined as 30 days before the announcement to 30 days after. As this study is concerned about the effect on listed equity due to a non-investment rating change in the short term only daily closing prices were adequate for analysis. Monthly data allowed for a maximum of three data points to be used and weekly data a maximum of eight data points. Monthly and weekly data was therefore insufficient and discarded as they were unable to contribute to the event under study. Another advantage of using historic share price data was that there is no bias included in the data. Share prices downloaded from various platforms were compared to ensure the validity thereof. This is an important factor to consider for ensuring sound results (Saunders & Philip, 2012).

The exploratory research process required an experimental strategy. The strategy required the identification of dependent and independent variables and could take on the form of different share portfolios, benchmark indices, time horizons and Beta (β) values derived from market models to name a few. Once these variables were identified and isolated the independent variable was used to evaluate its effect on the dependent variable.

4.3 Choice

A Mono-method was used to address the research objective. This method proved to be sufficient for the evaluation of the propositions. The objective was achieved by a Pragmatic, primarily Inductive and Descriptive approach, with the use of historical data.

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4.4 Time Horizon

The longitudinal approach was followed during the research project. Historical daily share price data from January 2012 to September 2017 was obtained which allowed for a time horizon analysis adjustment of 5 years before to 6 months after the credit rating announcement. As this study is concerned about the pre-and post-effects of the rating change the use of a longitudinal study approach allowed for changes over time to be observed. This time horizon of 30 days before to 30 days after the announcement allowed for a maximum of 60 daily data points.

4.5 Populations

It would have been ideal to include every share listed on the JSE index for the event analysis. Unfortunately, this would have not only been a tedious and cumbersome process, but also unrealistic or even impossible since there is a continuous listing and delisting of shares on the JSE. It was therefore not possible to do probability sampling. Even though financial markets can be found around the globe our interest was confined to the JSE Index which therefore represented the population. The sample frame was selected to be the JSE All Share Index (ALSI) which represented roughly the top 160 listed shares according to market capitalisation from the population with the sample of interest selected from this sample frame. It was important to select the sample size that represented the entire population in order to draw credible and accurate conclusions. As the ALSI represents about 99% of the entire JSE index it was regarded as representative (SA Shares, 2017).

At the time of the announcement, 163 companies were listed on the ALSI (Thomson Reuters, 2017). From the 163 listings, eight were removed as they were listed after the 1st of January 2016 and rendered insufficient data to calculate representative Beta's that were required to calculate abnormal returns. This brought the total sample size under investigation to 155.

4.6 Unit of Analysis

As we were concerned about the effect of the non-investment grade announcement on the JSE the unit of analysis was defined as the daily closing share prices. It was therefore requited to determine the main independent variables and their effect on the dependant variable, the unit of analysis.

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Even though the primary objective was to determine the effect of the announcement on the JSE, the study also investigated returns on each industry and selected sectors within its corresponding industry. This provided insight as to how the constitutes within the Index were affected by the announcement. On an individual level, only a single industry or sector portfolio was used to measure the risk and return associated with the announcement. On the aggregate level, multiple industries were aggregated to represent the effect on the ASLI. From a portfolio perspective, the dependent variable was the returns of a selected industry or industry sector portfolio where the specific industry or industry sector portfolio served as the independent variable.

For the purpose of this study the primary independent variable was regarded as the credit rating announcement and its corresponding effect on the unit of analysis.

Table 2 provides a list of credit ratings and their corresponding grade for each of the three Credit Rating Agencies (CRAs). Apart from the actual grading itself, rating agencies also reserve the right to make forecast announcements. Therefore, credit grade ratings are usually accompanied by either a negative outlook, stable or positive outlook forecast.

Grade	Moody's	S&P	Fitch
Prime	Aaa	AAA	AAA
	Aa1	AA+	AA+
High Grade	Aa2	AA	AA
	Aa3	AA-	AA-
	A1	A+	A+
Upper Medium Grade	A2	A	A
	A3	A-	A-
	Baa1	BBB+	BBB+
Lower Medium Grade	Baa2	BBB	BBB
	Baa3	BBB-	BBB-
Non-Investment Grade	Ba1	BB+	BB+
Speculative	Ba2	BB	BB
	Ba3	BB-	BB-
	B1	B+	B+
Highly Speculative	B2	B	B
	B3	B-	B-
	Caa1	CCC+	CCC+
Substantial Risks	Caa2	CCC	CCC
	Caa3	CCC-	CCC-
Extremely Speculative	Ca	CC	CC
In Default with Little Prospect for Recovery		SD	RD
	C	D	D
In Default			DD
			DDD

Table 2: Credit Rating Assignment *(Country Economy, 2017)*

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To reiterate, the focus of this study was therefore the investigation of the explicit movement form lower medium grade to non-investment grade.

It should be noted that as the number of independent variables increase the marginal increase in explanatory power on the dependent variable decreases after some threshold (Fabozzi, Focardi, & Ma, 2005). It was therefore important to keep the independent variables to a minimum during analysis.

4.7 Sampling Method and Size

Due to the continuous change in size of the population a census sampling method was used during the analysis. The 155 selected stocks, according to market capitalisation and data availability, ensured a clearly defined sample at each time without the need to sample. This method of sampling also eliminated any problem associated with representatively and allowed for the maximum relevant industry inclusion while maintaining an acceptable representation per industry. From the 155 listings in the sample, 57 belonged to the financials industry, 72 to industrials and 26 to resources. Figure 1 provides a graphical representation of each industry weighting within the ALSI.

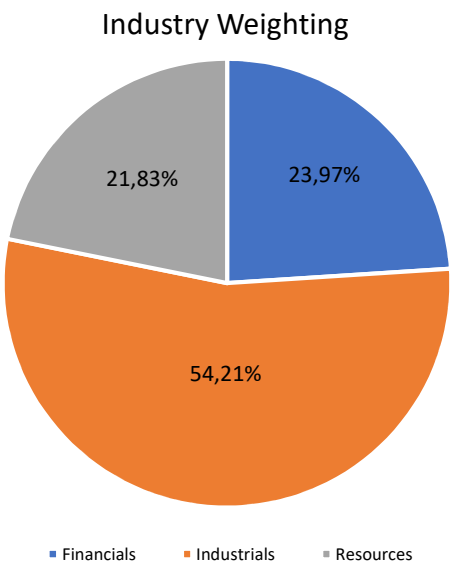

Figure 1: JSE All Share Index Industry Constitutes

Even though the aim was to achieve an accurate representation of the population one should also consider diminishing returns (Fabozzi et al., 2005). There is a point in time were increasing the shares within a portfolio, which serves to represent an industry, will

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not have a significant effect on the findings. It should also be noted that as the validity of data increases the sample size can decrease (Combs, 2010).

4.8 Measurement Instrument

Continuous data in the form of daily closing share prices was used to evaluate the performance of portfolios, individual shares and the ALSI which in effect represented the JSE Index. Ratio data gave an accurate representation of changes experienced on these parameters due to the sovereign credit rating downgrade. As the secondary data used for this study was regarded as valid and reliable one could imply that the ratio data is also valid and reliable resulting in accurate findings resulting from analysis. The validity of data played an important role as any doubt thereof would lead to speculation which in turn could question the studies credibility and findings (Saunders & Philip, 2012).

4.9 Data Collection

Historical share price data is readily available from the Internet. These sources include online trading platforms, financial websites and online news streaming channels. Another advantage of using historical share price data is that it is captured daily without any bias included. Most sources provide this data in spreadsheet format which makes it ideal for quick manipulation. This study focused on an event that occurred in the past and therefore secondary data formed the primary source of data. This quantitative data could also take on the form of graphs, values and tables.

Historical stock prices were collected in raw format which meant that it was not manipulated or processed in any form. As this was a longitudinal study multiple sources of secondary data were compared to ensure the validity thereof. This form of data collection did not require the investigation of “concepts and definitions” and was available in the public domain.

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Historical daily closing share price data used for the calculation and testing Cumulative Average Abnormal Returns (CAARs) for significance was obtained from PMPal, JSE Ltd, Thomson Reuters (Eikon) and Yahoo Finance. Alternative proxies were also used to serve as benchmarks. The following data sets were obtained for the research project:

- JSE Industrial 25 Index (J211)
- JSE Resource 20 Index (J210)
- JSE Top 40 Index (TOPI)
- JSE All Share Index (J203)

Sovereign ratings as well as event dates were obtained from the homepages of Moody's, Standard & Poor (S&P) and Fitch. This determined the epicentre of the research study as the study was concerned about "the event" in the short term. The reader can refer to Appendix A for a detailed history of South Africa's credit ratings.

In evaluating proposition 1 additional data was required. This included institutional quality variables, obtained from Transparency International Index and news related variables to ensure that changes in the market could be isolated from random news and noise which is not related to the sovereign rating change announcement. Without including this data into the analysis, one could easily mistake market changes as a result of leakage and not general news events.

4.10 Event Study

The event study was originally developed as a statistical tool for empirical research in accounting but has since been used in a variety of other disciplines particularly in capital market research (Corrado, 2011). The ease of incorporating market models such as the Capital Asset Pricing Model (CAPM) had a great contribution to the success of event studies. The event study model has stood the test of time and is now commonly accepted as a tool that provides evidence of insider trading in recent years. Event studies has become the benchmark for measuring the reaction of listed equity to some form of event or announcement and was therefore used during analysis to address the research problem (Binder, 1998).

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4.10.1 Definition of the Event

Event study methodology required one to specify the event of interest which is also referred to as "the event". The occurrence of "the event" was denoted by t_0 in event time and formed the epicentre of the event study. To investigate the market's reaction to the event, special interest was given to Abnormal Returns (ARs) and Cumulative Average Abnormal Returns (CAARs) where ARs were defined as the difference between actual returns and expected returns (Peterson, 1989).

The change in the time domain is due to the fact that event studies are usually done in an aggregate form. Data regarding similar events are collected and aggregated for analysis. The results are usually generalised and one can expect future events of similar nature to present similar results at some confidence interval. Even though this is standard practice, once off events are by no means excluded from standard event study methodology. Once off event studies portray the consequence of a single event and their findings are usually not generalised as it is the investigation of a unique occurrence.

For the purpose of the study at hand, the event was defined as the public announcement of a downgrade in the sovereign credit rating from investment grade to non-investment grade on the JSE.

4.10.2 Population

The population for the event study comprised of all companies listed on the JSE Index from which the ALSI was selected as the sample window as it was regarded representative of the JSE Index. From the 163 samples in the sample window eight were removed as they were either delisted or represented inadequate information to be included in the sample. The samples size was therefore 155.

4.10.3 Event Date

Great care was taken to determine the official event date of "the event". A corporation might release information regarding its day to day operations only to be reported days later by the financial press (Peterson, 1989). Organisations are required by the Securities and Exchange Commission to release certain information, but the financial press is by no means obligated to report on these new findings. One should therefore be aware that

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information circulated by the media might have been available to the public prior the media house publication.

Standard and Poor (S&P) downgraded South Africa's sovereign credit rating from investment grade "BBB-" to non-investment grade "BB+" with a negative outlook on the 3th of April 2017. This was followed a few days later by the announcement of Fitch Ratings whereby the CRA also downgraded South Africa from "BBB-" to "BB+" with a stable outlook on the 7th of April 2017. As two CRAs are required to rate a country at non-investment grade before it is official (International Monetary Fund, 2017), the 7th of April is regarded as the event date t_0. The regulation is stated as follow:

> *"At least two rating agencies must agree on sub-investment grade status and the rating must apply to local currency debt for a country to be ejected from the key global government bond index."*

4.10.4 Confounding Events

During analysis special attention was given to the possibility of cofounding events. These events are regarded as instances that influences both the dependent variable and independent variable causing a false association or findings. To mitigate the risk of confounding events a short event window was selected to isolate the event under study. Confounding events are discussed in more detail in chapter 6.

4.10.5 Historical Events

Its been decades since South Africa has been downgraded to non-investment status and to the best of my knowledge very little information and historical data is available for analysis, thus the relevance of the current research problem. Due to the lack of information on historical events the occurrence thereof could not be included in the current study to produce an aggregate sample.

4.10.6 Select Appropriate Model for Expected Returns

The market model is used to adjust for factors that influence the overall market or benchmark proxy and should not be ignored during the study of interest (Corrado, 2011).

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The market model coefficients were obtained by means of a regression analysis between an Index that served as a proxy and a share portfolio of interest.

Even though the CAPM has proven to be more than adequate for event studies (Binder, 1998) it should also be noted that the CAPM has come under severe criticism during the past few decades and that it was found to be inversely proportional in some instances (Ward & Muller, 2012). Research has also suggested that as the event window decreases the reliance on some form of market model also decreases (Peterson, 1989).

In order to ensure the validity of the findings, two alternative market models were also used. They were the two-factor linear market model against an industry and a straight-line adjustment against the benchmark without a Beta adjustment.

4.10.7 Define Event Window

The occurrence of an event is denoted by time t_0 and represents the date or time on which a specific event or announcement took place. Although the event took place at a specific date or time, event time was used during analysis to maintain consistency in historical sample data. Pre-event time is therefore denoted by t_{-x} where -x represents x days prior the event and t_x represents x day post the occurrence of the event.

Care should be taken in selecting an appropriate event window. The window should be large enough to include all expected wealth that might result from the event but small enough to exclude confounding events such as news announcements that might influence dependant and independent variables.

For the purpose of the current study, the event window was defined as from 30 trading days prior the official non-investment credit rating announcement to 30 trading days after the announcement.

4.10.8 Calculate Cumulative Abnormal Returns

The occurrence of abnormal behaviour can best be observed by testing the ARs and CAARs for significance (Eckbo, 2014). The expected returns are what the market anticipate a particular share or portfolio will return in the future and is a function of some form of proxy that serves as a benchmark and its corresponding β obtained from regression analysis. The expected returns can be expressed as follow:

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$$E(R) = \beta * \text{Index Return}$$

The ARs were then determined by calculating the difference between the actual returns and expected returns where the actual returns were the returns observed in the market in the form of change in daily closing prices.

$$Abnormal\ Returns = Actual\ Returns - Expected\ Returns$$

The CAARs were obtained by calculating the Average Abnormal Returns (AARs) of the ARs that resulted due to the occurrence of the event. The CAAR can be expressed as:

$$CAAR = \sum_{t=-x}^{x} AAR_{tj}$$

Where t denotes the time, pre- and post the event and j the portfolio of interest.

4.11 Test for Significance

It is common practice to assume that the distribution of ARs follow a normal distribution (Corrado, 2011). Even though this is common practice, ARs were tested to ensure that no skewness was present in the data.

One should also be aware of the fact that, say return R_{t-}, might be statistically large due to other firm-specific information and that it is by no means that significance is only a function of "the event" under investigation (Corrado, 2011). Special attention should therefore be given to confounding effects.

4.12 Analysis Approach

From the literature overview, it was clear that an event study had to be used for the analysis. As the sovereign rating downgrade to non-investment status in South Africa was regarded as a once off event it could not be treated as a continuous process. The event study was approached from a short-horizon event study methodology perspective.

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Historical ALSI share price data was categorised into its respective industries (financials, industrials and resources) with the financials industry subdivided into its corresponding sectors for analysis. The constitutes of the financials industry are listed below:

- Banks
- Equity Investments
- General Financials
- Life Insurance
- Non-Life Insurance
- Real Estate Developments
- Real Estate Investment Trusts

Industry representative portfolios were constructed by combining all industry specific shares into a single portfolio. This allowed for the evaluation of the central tendency, mean, standard deviation and variance of each portfolio in order to gain a better perspective of its characteristics and reaction to the announcement. As with industry portfolio construction the financial sector shares were also combined into portfolios to represent its respective sectors. This configuration provided the basis for addressing prepositions 1, 3, 4 and 5.

Preposition 5 required the identification and isolation of listed multinationals within the ALSI. The multinationals were then added into a single portfolio in order to determine whether they reacted in a different manner to local listings after the announcement. Once again, descriptive statistics were used to gain a general perspective.

The market's reaction to the event could be best observed in the CARs and CAARs of the representative portfolios. It was therefore necessary to calculate the actual- and expected returns, ARs, AARs, CARs and ultimately the CAARs. The primary market model, the CAPM, was used to provide more clarity regarding the risk premium associated with each industry and sector portfolio. Additional benchmarks and market models were also included into the analysis to investigate how portfolio returns reacted to the announcement. In other words, how the independent variables affected the dependant variables. The additional benchmarks included the following:

- JSE Industrial 25 Index (J211)
- JSE Resource 20 Index (J210)
- JSE Top 40 Index (TOPI)

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Even though the aggregate of the ARs could be observed in the CAARs for each portfolio the regression coefficients were also calculated and plotted to gain a better perspective of the reaction to the event. This also provided insight upon which industry was affected the most by the credit rating change and which one the least.

The analysis was concluded with significance testing. All CAARs were plotted within confidence intervals to determine the likelihood of abnormal behaviour within each CAAR. The confidence intervals, or boot strap intervals, were constructed by means of a Monte Carlo analysis.

4.13 Limitations

The key to constraints is that one should be aware of them and design a research methodology in such a way that it isolates these limitations (Saxena, Martin, & Stubbs, 2013).

It was important to maintain a high internal validity of the findings resulting from the research process. Special attention was given to potential biasness during the statistical analysis. These potential biases took on the form of using particular statistical models to verify expectations or assumptions.

External validity was maintained by addressing the fact that the study was subjective to the JSE and within the South African context only and might not be valid for other countries or markets. One could therefore not generalise the findings that result from this research and expect other markets to show the same characteristics. For one to draw a conclusion on an international level, additional countries that experienced the same event would have to be included into the research project.

Apart from validity, it was of the utmost importance to maintain a reliable and objective viewpoint during the analysis as the absence thereof may have led to some form of subject bias. Consistency was kept by incorporating the same statistical methodology to obtain results during statistical analysis. Results were also presented clearly to avoid misinterpretation or speculation

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5. Chapter 5: Results

5.1 Sample Data

From the 163 samples in the sample window eight were removed as they were either delisted or rendered inadequate data to be included in the population for analysis. Samples included and excluded from the sample frame is shown Table 3.

Apart from companies being delisted, data availability required to calculate representative Beta's (β's) were one of the main factors to be considered during sample selection. Companies listed after the 1st of January 2016 were therefore removed from the sample as their β's are not regarded as a true and accurate representation of its reaction to market changes. The sample size for the study at hand is therefore a total of 155 which represents 98% of the JSE. The samples are therefore regarded as an adequate representation of the South African equity market as well as the ALSI and is viewed sufficient to address the research objective and propositions.

Furthermore, data gathering and valuation was done in accordance with the steps outlines by Saunders and Lewis to ensure the reliability and validity of consistent results obtained from analysis (Saunders & Philip, 2012).

J203	Company	Industry	First Trade Date	Status
BGA	Barclays Africa Group Ltd	Financials	21 May 93	Included
CPI	Capitec Bank Holdings Ltd	Financials	18 Feb 02	Included
FSR	FirstRand Ltd	Financials	21 Sep 93	Included
NED	Nedbank Group Ltd	Financials	21 Sep 93	Included
RMH	RMB Holdings Ltd	Financials	21 Sep 93	Included
SBK	Standard Bank Group Ltd	Financials	21 Sep 93	Included
BRN	Brimstone Investment Corporation Ltd	Financials	08 Jul 98	Included
NIV	Niveus Investments Ltd	Financials	13 Sep 12	Included
REI	Reinet Investments SCA	Financials	21 Oct 08	Included
AFH	Alexander Forbes Group Holdings Ltd	Financials	24 Jul 14	Included
BAT	Brait SE	Financials	28 Sep 93	Included
CML	Coronation Fund Managers Ltd	Financials	13 Jun 03	Included
HCI	Hosken Consolidated Investments Ltd	Financials	26 Mar 93	Included
INL	Investec Ltd	Financials	26 Apr 93	Included
INP	Investec PLC	Financials	22 Jul 02	Included
JSE	JSE Ltd	Financials	05 Jun 06	Included
KST	PSG Konsult Ltd	Financials	18 Jun 14	Included
PGR	Peregrine Holdings Ltd	Financials	10 Jun 98	Included
PSG	PSG Group Ltd	Financials	21 Sep 93	Included
RMI	Rand Merchant Investment Holdings Ltd	Financials	08 Mar 11	Included
TCP	Transaction Capital Ltd	Financials	07 Jun 12	Included
TTO	Trustco Group Holdings Ltd	Financials	19 Feb 09	Included
ZED	Zeder Investments Ltd	Financials	01 Dec 06	Included

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DSY	Discovery Ltd	Financials	21 Oct 99	Included
LBH	Liberty Holdings Ltd	Financials	22 Sep 93	Included
MMI	MMI Holdings Ltd	Financials	21 Sep 93	Included
OML	Old Mutual PLC	Financials	12 Jul 99	Included
SLM	Sanlam Ltd	Financials	30 Nov 98	Included
SNT	Santam Ltd	Financials	21 Sep 93	Included
ATT	Attacq Ltd	Financials	14 Oct 13	Included
BWN	Balwin Properties Ltd	Financials	15 Oct 15	Included
CCO	Capital & Counties Properties PLC	Financials	10 May 10	Included
EPP	Echo Polska Properties NV	Financials	13 Sep 16	Excluded
GRP	Greenbay Properties Ltd	Financials	31 May 16	Excluded
MSP	MAS Real Estate Inc	Financials	03 Sep 09	Included
NRP	NEPI Rockcastle PLC	Financials	12 Jul 17	Excluded
SRE	Sirius Real Estate Ltd	Financials	05 Dec 14	Included
STP	Stenprop Ltd	Financials	12 Dec 14	Included
TDH	Tradehold Ltd	Financials	06 Nov 00	Included
APF	Accelerate Property Fund Ltd	Financials	12 Dec 13	Included
AWA	Arrowhead Properties Ltd	Financials	09 Dec 11	Included
CRP	Capital & Regional PLC	Financials	15 Oct 15	Included
DLT	Delta Property Fund Ltd	Financials	02 Nov 12	Included
EMI	Emira Property Fund	Financials	12 Dec 03	Included
EQU	Equites Property Fund Ltd	Financials	18 Jun 14	Included
FFA	Fortress Income Fund Ltd	Financials	22 Oct 09	Included
FFB	Fortress Income Fund Ltd	Financials	22 Oct 09	Included
GRT	Growthpoint Properties Ltd	Financials	13 Apr 93	Included
HMN	Hammerson PLC	Financials	01 Sep 16	Excluded
HYP	Hyprop Investments Ltd	Financials	29 Mar 93	Included
IAP	Investec Australia Property Fund	Financials	24 Oct 13	Included
IPF	Investec Property Fund Ltd	Financials	14 Apr 11	Included
ITU	Intu Properties PLC	Financials	24 Jun 99	Included
L2D	Liberty Two Degrees	Financials	06 Dec 16	Excluded
OCT	Octodec Investments Ltd	Financials	23 Sep 93	Included
RDF	Redefine Properties Ltd	Financials	23 Feb 00	Included
REB	Rebosis Property Fund Ltd	Financials	17 May 11	Included
RES	Resilient Reit Ltd	Financials	06 Dec 02	Included
RPL	Redefine International PLC	Financials	28 Oct 13	Included
SAC	SA Corporate Real Estate Fund Managers Pty Ltd	Financials	27 Sep 95	Included
TEX	Texton Property Fund Ltd	Financials	11 Aug 11	Included
VKE	Vukile Property Fund Ltd	Financials	24 Jun 04	Included
MTA	Metair Investments Ltd	Industrials	30 Sep 93	Included
CVH	Capevin Holdings Ltd	Industrials	06 Aug 12	Included
DST	Distell Group Ltd	Industrials	22 Sep 93	Included
AFT	Afrimat Ltd	Industrials	07 Nov 06	Included
PPC	PPC Ltd	Industrials	21 Sep 93	Included
RBX	Raubex Group Ltd	Industrials	20 Mar 07	Included
WBO	Wilson Bayly Holmes - Ovcon Ltd	Industrials	21 Sep 93	Included
CIL	Consolidated Infrastructure Group Ltd	Industrials	28 Nov 07	Included
RLO	Reunert Ltd	Industrials	21 Sep 93	Included
TKG	Telkom SA SOC Ltd	Industrials	04 Mar 03	Included
BID	Bid Corporation Ltd	Industrials	30 May 16	Excluded
CHP	Choppies Enterprises Ltd	Industrials	27 May 15	Included
CLS	Clicks Group Ltd	Industrials	22 Mar 96	Included
DCP	Dis-Chem Pharmacies	Industrials	18 Nov 16	Excluded
PIK	Pick N Pay Stores Ltd	Industrials	21 Sep 93	Included
SHP	Shoprite Holdings Ltd	Industrials	04 Jan 93	Included
SPP	SPAR Group Ltd	Industrials	18 Oct 04	Included
ARL	Astral Foods Ltd	Industrials	09 Apr 01	Included
AVI	Avi Ltd	Industrials	08 Dec 94	Included
CLR	Clover Industries Ltd	Industrials	14 Dec 10	Included
OCE	Oceana Group Ltd	Industrials	24 Sep 93	Included
PFG	Pioneer Food Group Ltd	Industrials	22 Apr 08	Included

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RCL	RCL Foods Ltd	Industrials	22 Sep 93	Included
RFG	Rhodes Food Group Holdings Ltd	Industrials	02 Oct 14	Included
TBS	Tiger Brands Ltd	Industrials	21 Sep 93	Included
TON	Tongaat Hulett Ltd	Industrials	21 Sep 93	Included
BAW	Barloworld Ltd	Industrials	19 Jan 94	Included
BVT	Bidvest Group Ltd	Industrials	21 Sep 93	Included
KAP	KAP Industrial Holdings Ltd	Industrials	30 Jan 95	Included
MPT	Mpact Ltd	Industrials	11 Jul 11	Included
MUR	Murray & Roberts Holdings Ltd	Industrials	21 Sep 93	Included
NPK	Nampak Ltd	Industrials	28 Mar 94	Included
REM	Remgro Ltd	Industrials	26 Sep 00	Included
ADH	Advtech Ltd	Industrials	20 Nov 97	Included
COH	Curro Holdings Ltd	Industrials	02 Jun 11	Included
CSB	Cashbuild Ltd	Industrials	21 Sep 93	Included
HSP	Holdsport Ltd	Industrials	18 Jul 11	Included
ITE	Italtile Ltd	Industrials	07 Apr 93	Included
LEW	Lewis Group Ltd	Industrials	04 Oct 04	Included
MRP	Mr Price Group Ltd	Industrials	23 Sep 93	Included
MSM	Massmart Holdings Ltd	Industrials	04 Jul 00	Included
TFG	Foschini Group Ltd	Industrials	21 Sep 93	Included
TRU	Truworths International Ltd	Industrials	11 May 98	Included
WHL	Woolworths Holdings Ltd	Industrials	20 Oct 97	Included
ACT	AfroCentric Investment Corp Ltd	Industrials	17 May 06	Included
LHC	Life Healthcare Group Holdings Ltd	Industrials	10 Jun 10	Included
MEI	Mediclinic International PLC	Industrials	08 Feb 16	Excluded
NTC	Netcare Ltd	Industrials	04 Dec 96	Included
SNH	Steinhoff International Holdings NV	Industrials	23 Sep 98	Included
IVT	Invicta Holdings Ltd	Industrials	22 Nov 93	Included
GND	Grindrod Ltd	Industrials	01 Mar 93	Included
IPL	Imperial Holdings Ltd	Industrials	22 Sep 93	Included
SPG	Super Group Ltd	Industrials	24 Oct 95	Included
TRE	Trencor Ltd	Industrials	21 Sep 93	Included
CAT	Caxton and CTP Publishers and Printers Ltd	Industrials	22 Sep 93	Included
NPN	Naspers Ltd	Industrials	13 Sep 94	Included
BLU	Blue Label Telecoms Ltd	Industrials	14 Nov 07	Included
MTN	MTN Group Ltd	Industrials	18 Aug 95	Included
VOD	Vodacom Group Ltd	Industrials	18 May 09	Included
CFR	Compagnie Financiere Richemont SA	Industrials	21 Sep 93	Included
AIP	Adcock Ingram Holdings Ltd	Industrials	25 Aug 08	Included
APN	Aspen Pharmacare Holdings Ltd	Industrials	05 Dec 94	Included
ASC	Ascendis Health Ltd	Industrials	22 Nov 13	Included
AEL	Allied Electronics Corporation Ltd	Industrials	08 Oct 93	Included
DTC	Datatec Ltd	Industrials	30 Jan 95	Included
EOH	Eoh Holdings Ltd	Industrials	14 Aug 98	Included
HDC	Hudaco Industries Ltd	Industrials	21 Sep 93	Included
NT1	Net 1 UEPS Technologies Inc	Industrials	08 Oct 08	Included
NVS	Novus Holdings Ltd	Industrials	31 Mar 15	Included
BTI	British American Tobacco PLC	Industrials	28 Oct 08	Included
CLH	City Lodge Hotels Ltd	Industrials	21 Sep 93	Included
FBR	Famous Brands Ltd	Industrials	30 Jan 95	Included
SUI	Sun International Ltd	Industrials	22 Sep 93	Included
SUR	Spur Corporation Ltd	Industrials	29 Nov 99	Included
TSH	Tsogo Sun Holdings Ltd	Industrials	08 Dec 94	Included
AFE	AECI Ltd	Resources	26 Mar 93	Included
AFX	African Oxygen Ltd	Resources	30 Sep 93	Included
OMN	Omnia Holdings Ltd	Resources	21 Sep 93	Included
SOL	Sasol Ltd	Resources	21 Sep 93	Included
MND	Mondi Ltd	Resources	02 Jul 07	Included
MNP	Mondi PLC	Resources	02 Jul 07	Included
SAP	Sappi Ltd	Resources	21 Sep 93	Included
ACL	ArcelorMittal South Africa Ltd	Resources	21 Sep 93	Included

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KIO	Kumba Iron Ore Ltd	Resources	20 Nov 06	Included
AGL	Anglo American PLC	Resources	21 Sep 93	Included
AMS	Anglo American Platinum Ltd	Resources	21 Sep 93	Included
ANG	AngloGold Ashanti Ltd	Resources	21 Sep 93	Included
ARI	African Rainbow Minerals Ltd	Resources	21 Sep 93	Included
ASR	Assore Ltd	Resources	05 Jan 94	Included
BIL	BHP Billiton PLC	Resources	28 Jul 97	Included
EXX	Exxaro Resources Ltd	Resources	26 Nov 01	Included
GFI	Gold Fields Ltd	Resources	21 Sep 93	Included
GLN	Glencore PLC	Resources	13 Nov 13	Included
HAR	Harmony Gold Mining Company Ltd	Resources	19 Nov 92	Included
IMP	Impala Platinum Holdings Ltd	Resources	21 Sep 93	Included
LON	Lonmin PLC	Resources	21 Sep 93	Included
NHM	Northam Platinum Ltd	Resources	21 Sep 93	Included
PAN	Pan African Resources PLC	Resources	06 Sep 07	Included
RBP	Royal Bafokeng Platinum Ltd	Resources	08 Nov 10	Included
S32	South32 Ltd	Resources	18 May 15	Included
SGL	Sibanye Gold Ltd	Resources	11 Feb 13	Included

Table 3: Selected Data from Sample Frame

5.2 Industry and Sector Weighting

Apart from proposition one and three which aims to address the effect of a sovereign downgrade to junk status on the JSE as a whole, proposition four and five aims to address the effects of such a downgrade on a specific industry and sector within that industry. It is therefore beneficial to gain a better perspective by determining the market size of the financial industry as well as the banking sector within the financial industry. By determining the weighting of the financial industry and banking sector one will be able to draw a better inference as to what its effect will be on the Index and the respective industry. The weighting of each industry as well as each sector within the financials industry can be seen in Figure 2 and Figure 3. At almost 24%, the financial industry represents the second largest industry on the ALSI. It can therefore be inferred that changes due to market reactions in the financial industry will have an effect on the ALSI as a whole while keeping all other industries constant. The same inference can be made for the banking sector as this sector represents about 31% of the financial industry.

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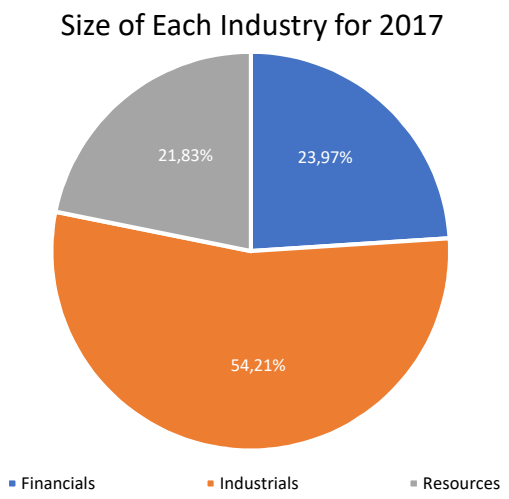

Figure 2: Industry Weighting for ALSI

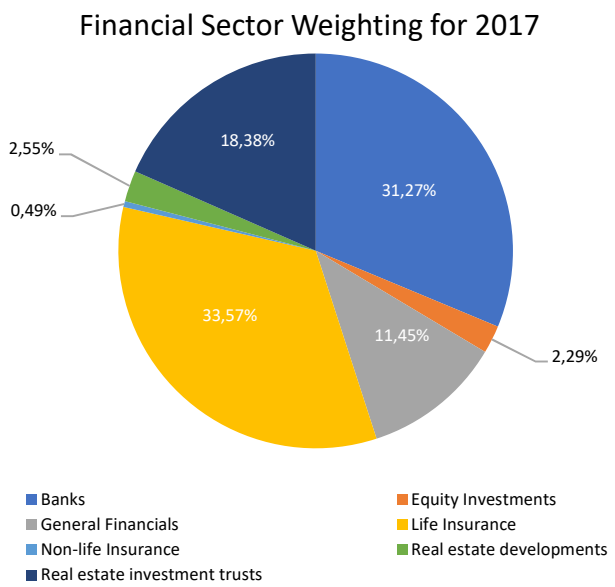

Figure 3: Sector Weighting of Each Sector Within the Financials Industry

5.3 Tests of Assumptions

To address the assumption that the historical data obtained from the JSE is valid and reliable, comparisons were made to other online platforms to ensure that this is indeed the case. It was found that additional data sources corresponded to the data used for analysis and it can therefore be confirmed that the unprocessed historical data obtained from the JSE is indeed valid and reliable.

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Even though it is common practice to assume individual residuals are independent from one another, they were tested to ensure that this is indeed the case. Various statistical procedures were used to ensure that the data series used for analysis are statistically valid and reliable. The statistical tests conducted are as follows:

- Durbin-Watson test.
- Model ε distribution for Monte Carlo bootstrap.
- Time series return tests over training period as well as event window.
- Autocorrelation tests over training period as well as event window.

This was essential to ensure that the unprocessed historical data is statistically valid and reliable as the data was used to calculate the Abnormal Returns (ARs), Cumulative Abnormal Returns (CARs), Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CAARs). These calculations formed the primary basis of evaluation and it was therefore essential to ensure that the primary data used is valid and reliable.

All calculations and findings are plotted on spaghetti graphs to allow for the identification of obvious data problems.

5.3.1 Serial Correlation

The CAPM or other market models are only valid if the model errors from the β's estimation period aren't serially correlated. This can be verified by means of the Burbin-Watson test on the daily closing prices for 2016.

The Durbin-Watson test is an evaluation method for the sum of squares of differences of corresponding values for two arrays. The test is based on the relationship between variables separated by a given time lag. The assumption that individual residuals are independent from one another is also known as the assumption of independent errors.

To ensure the credibility of the research findings it was necessary to conduct a Durbin Watson test in order to avoid any assumptions or inferences regarding serial correlation. The Durbin Watson test statistic ranges from 0 to 4 and indicates whether there is positive serial correlation (0), no serial correlation (2) or negative serial correlation (4).

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The results of the Burbin-Watson test for each industry (financials, industrials and resources) over the training period is shown in Figure 4 to Figure 6.

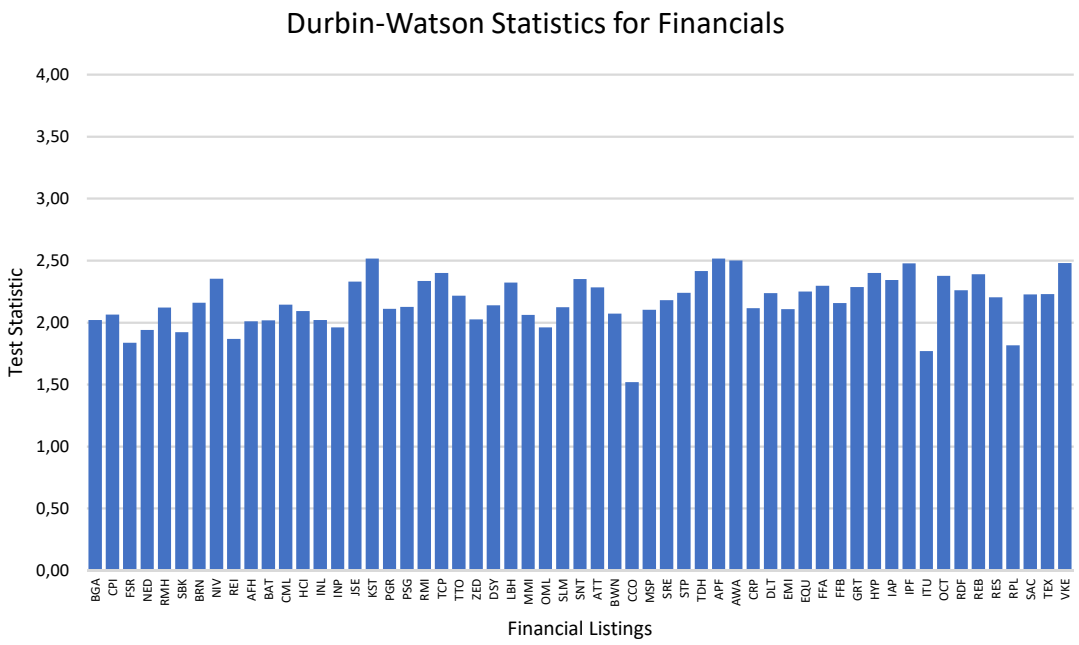

Figure 4: Durbin-Watson Statistics for Financial Industry

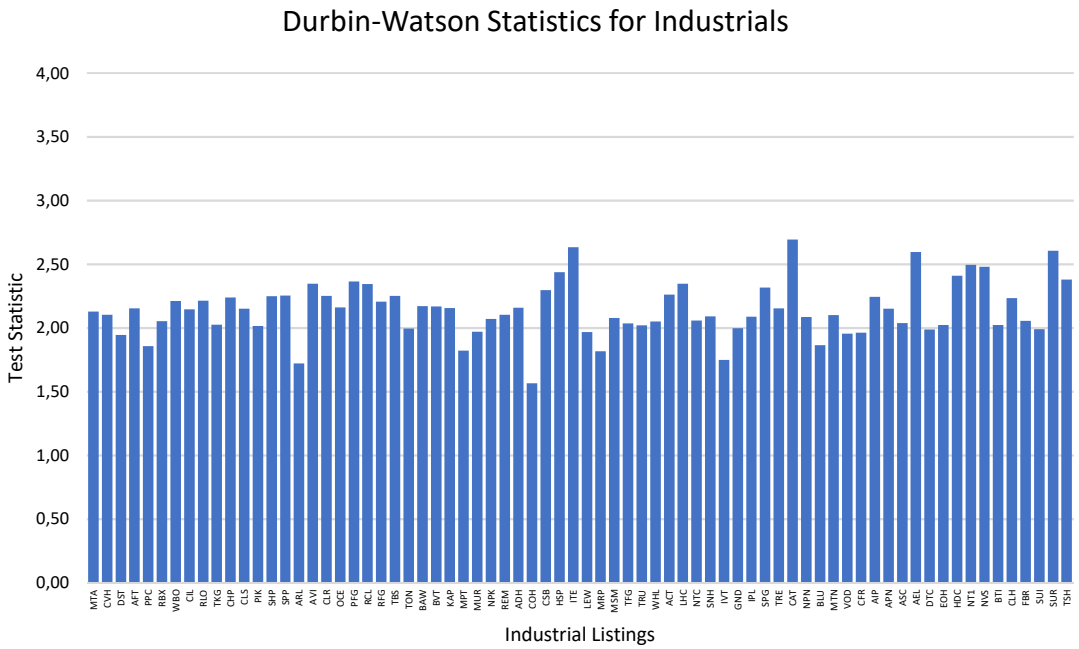

Figure 5: Durbin-Watson Statistics for Industrial Industry

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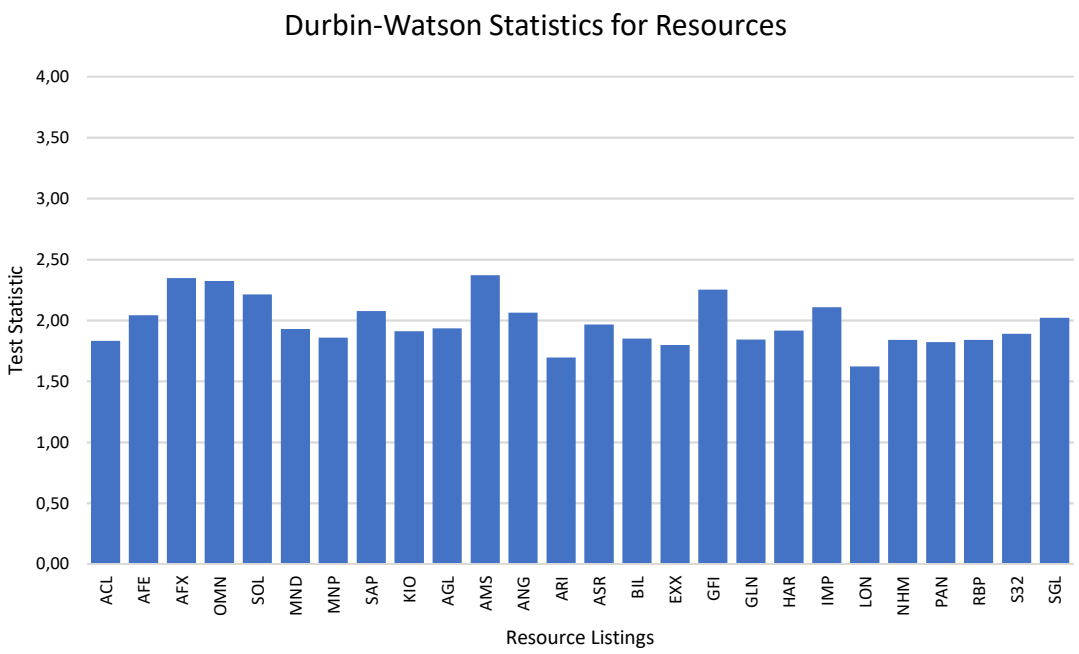

Figure 6: Durbin-Watson Statistics for Resource Industry

The test statistics obtained from the Durbin Watson test indicate that there is no positive or negative correlation within the individual samples. It can therefore be concluded that the errors are indeed independent and show no sign of serial correlation.

5.3.2 Monte Carlo Model ε Distribution

The Monte Carlo bootstrap model was used to construct various confidence intervals for evaluating CAARs. To ensure the validity of this model it was necessary to determine the model ε distribution over the training period and evaluate whether the model is skewed or normally distributed. The AAR and CAAR Monte Carlo bootstrap for the event window is displayed in Figure 7 and Figure 8. The Monte Carlo modal ε distribution over the training period is shown in Figure 9.

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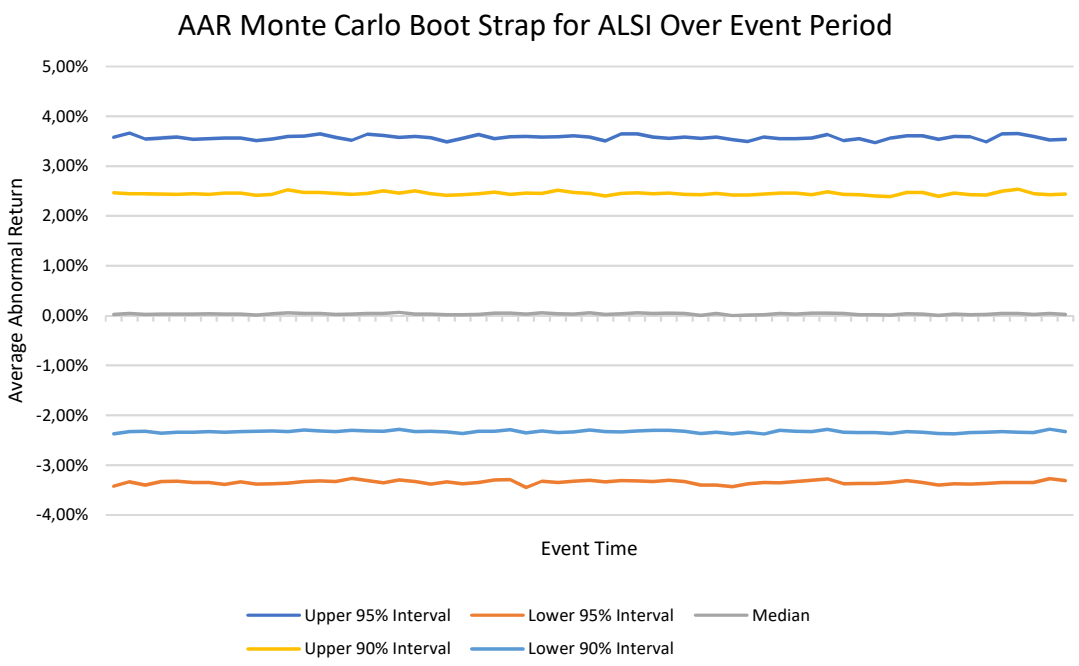

Figure 7: Monte Carlo 90% and 95% AAR Intervals

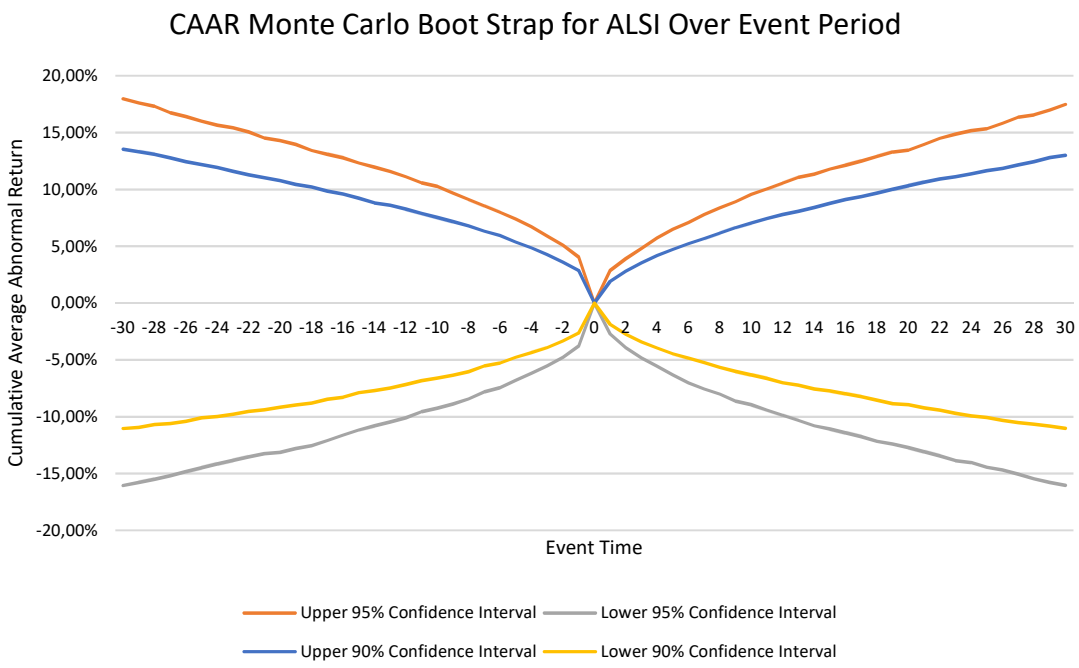

Figure 8: Monte Carlo 90% and 95% CAAR Confidence Intervals

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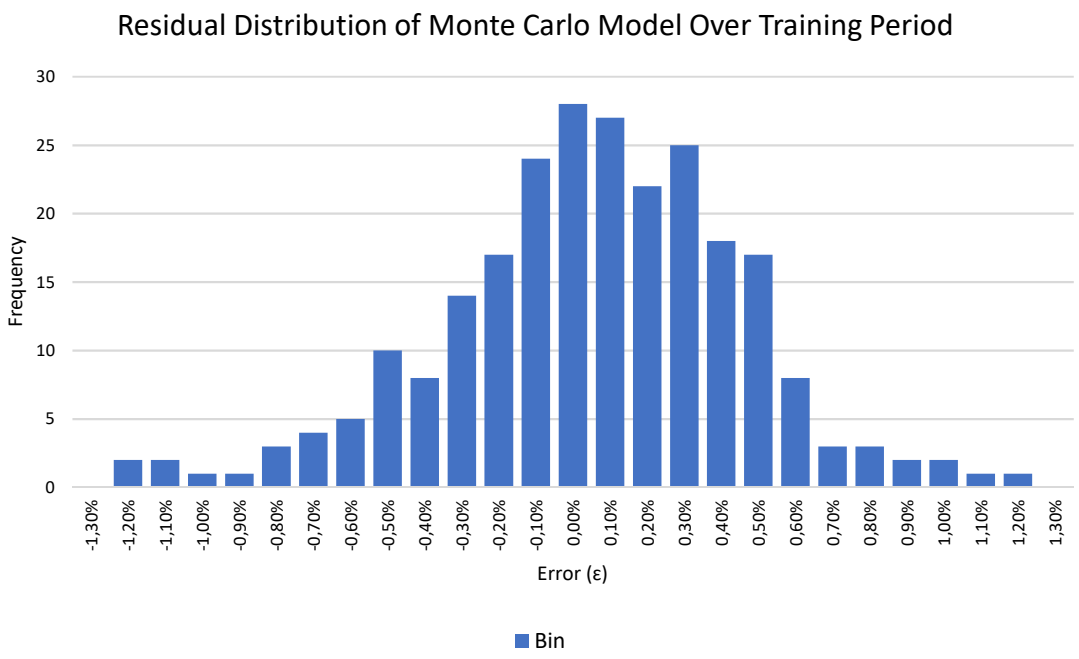

Figure 9: Distribution of Monte Carlo Model ε

The error distribution of the Monte Carlo bootstrap does not show any signs of skewness and follows a relatively good normal distribution. As a result, the Monte Carlo bootstrap model will be sufficient to construct confidence intervals to evaluate the results obtained from analysis.

5.3.3 Tests for Stationary Time Series

To ensure that the data is suitable for analysis it should be tested to determine whether the time series is stationary or not. This required the calculation of actual returns based on daily closing prices over the training period as well as the event window. The results were then analysed to determine whether there are any trends present in the time series and that the joint probability of the time series do not change over time. In order for the times series to be stationary the median, standard deviation and variance should remain the same during the training period and event window. The joint probability can be expressed as follow:

$$f(Y_t) = f(Y_t + k)$$

where can k represent a time offset.

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The results for the median, standard deviation and variance of each sample can be found in Appendix C. Once again Spaghetti plots were constructed to identify any trends that might be present in the time series. Plots were constructed for various Indices and each Industry within the ALSI. The graphs for the training period can be found in Figure 10 to Figure 13, where as Figure 14 to Figure 17 represents time series for the event window.

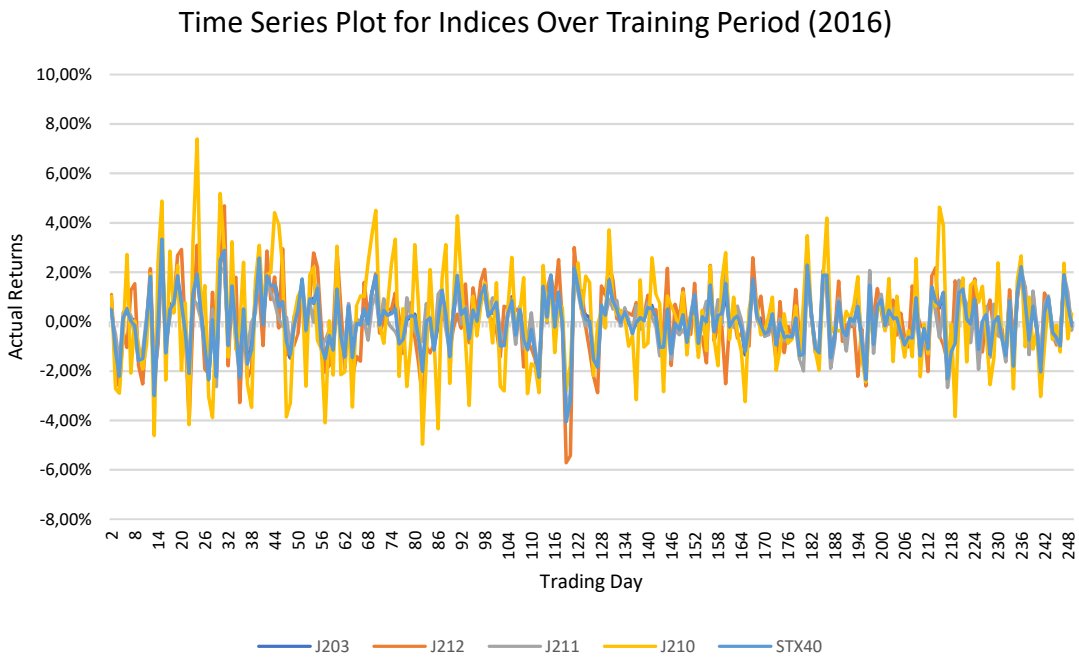

Figure 10: Time Series for ALSI Over Training Period

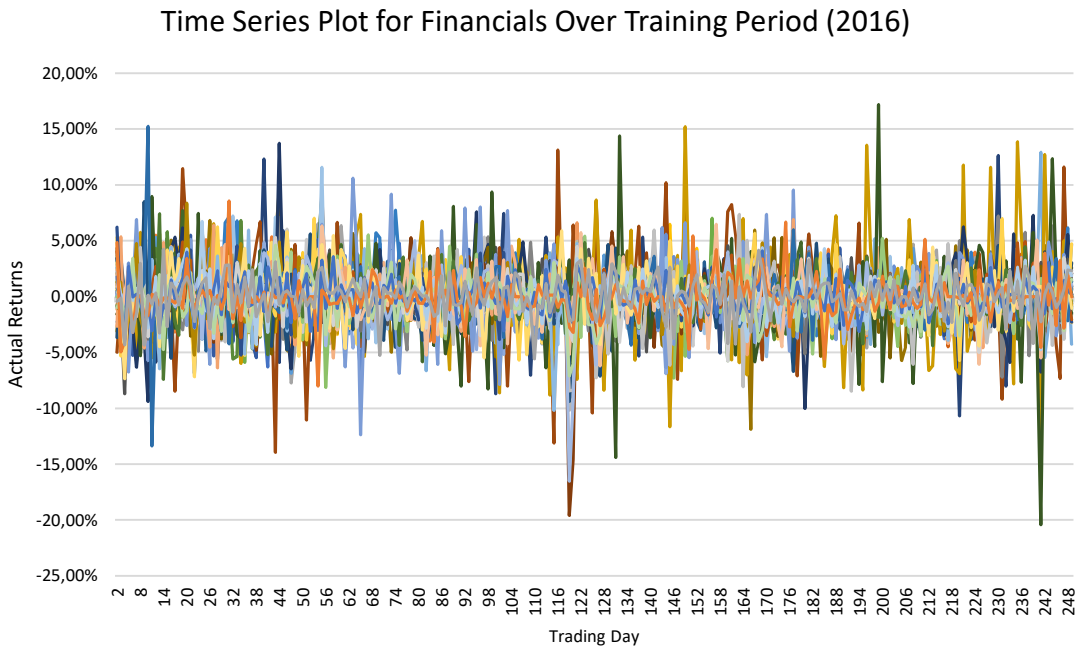

Figure 11: Time Series Plot for Financials Over Training Period

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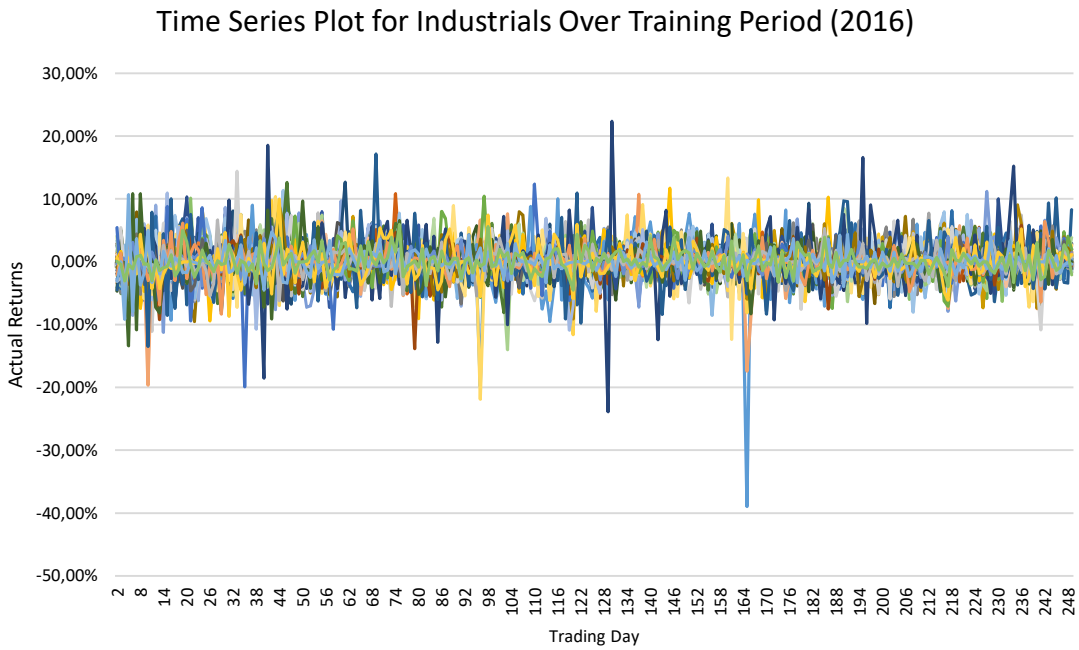

Figure 12: Time Series Plot for Industrials Over Training Period

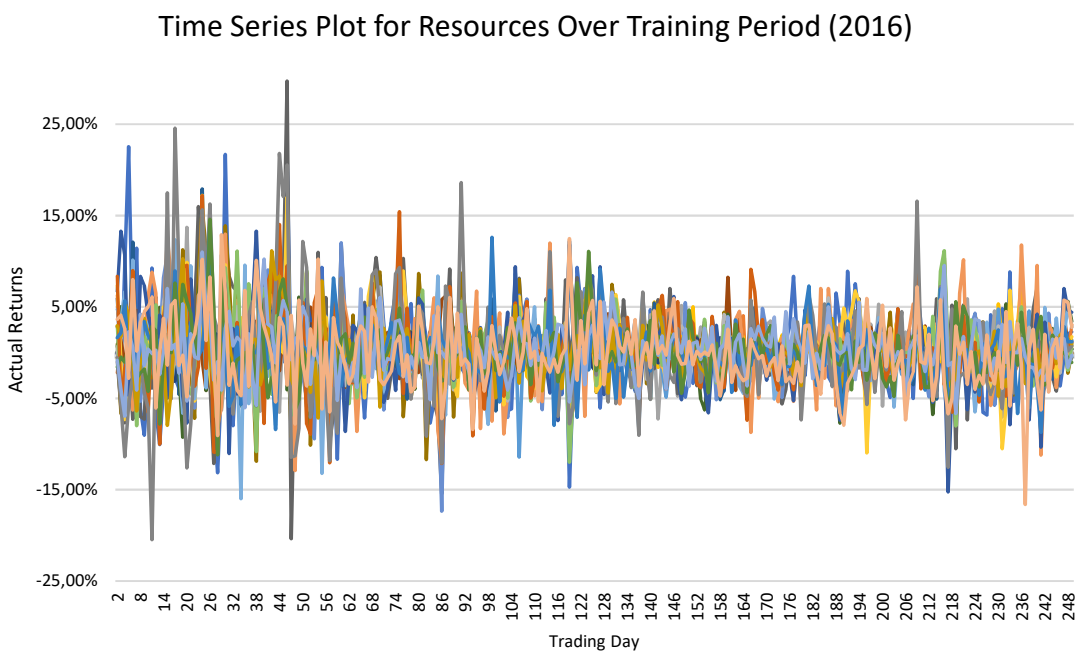

Figure 13: Time Series Plot for Resources Over Training Period

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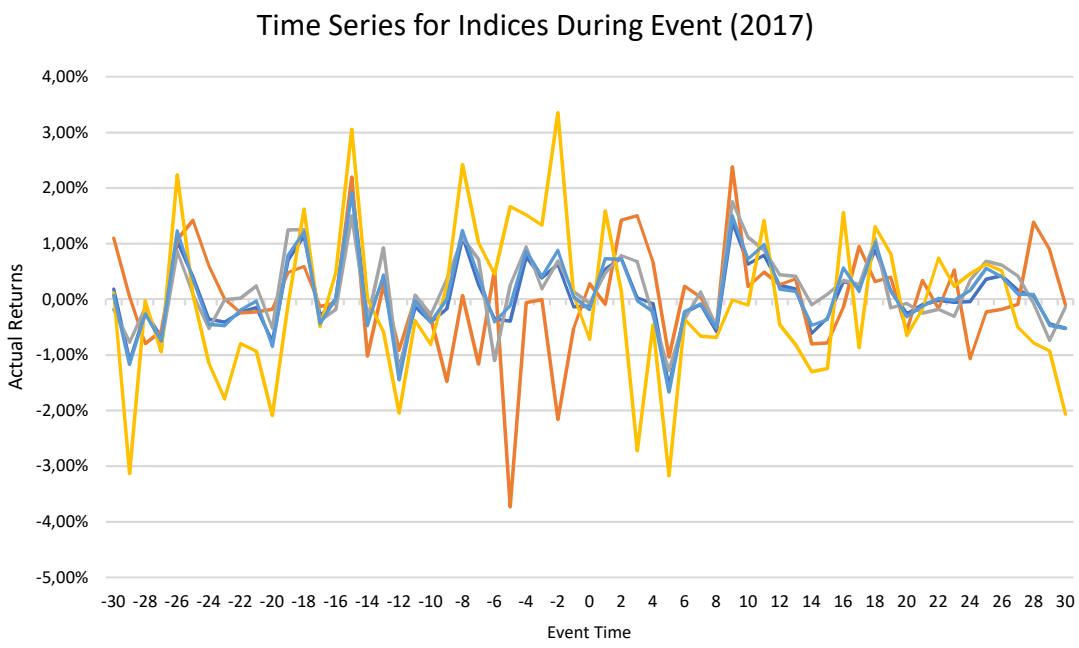

Figure 14: Time Series for Indices During Event

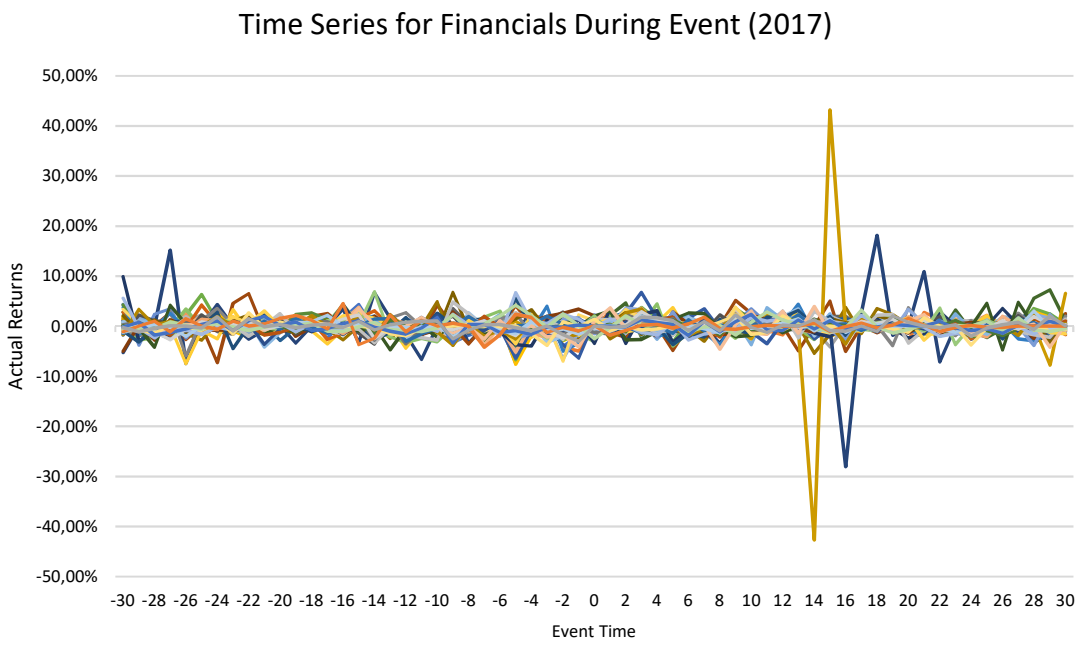

Figure 15: Time Series for Financials During Event

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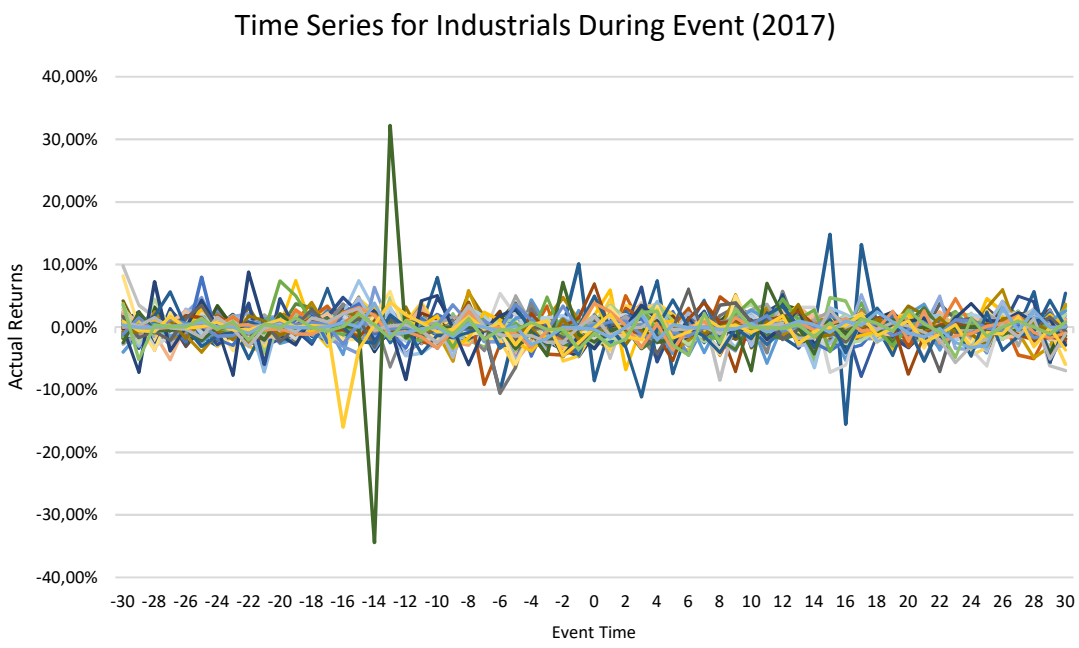

Figure 16: Time Series for Industrials During Event

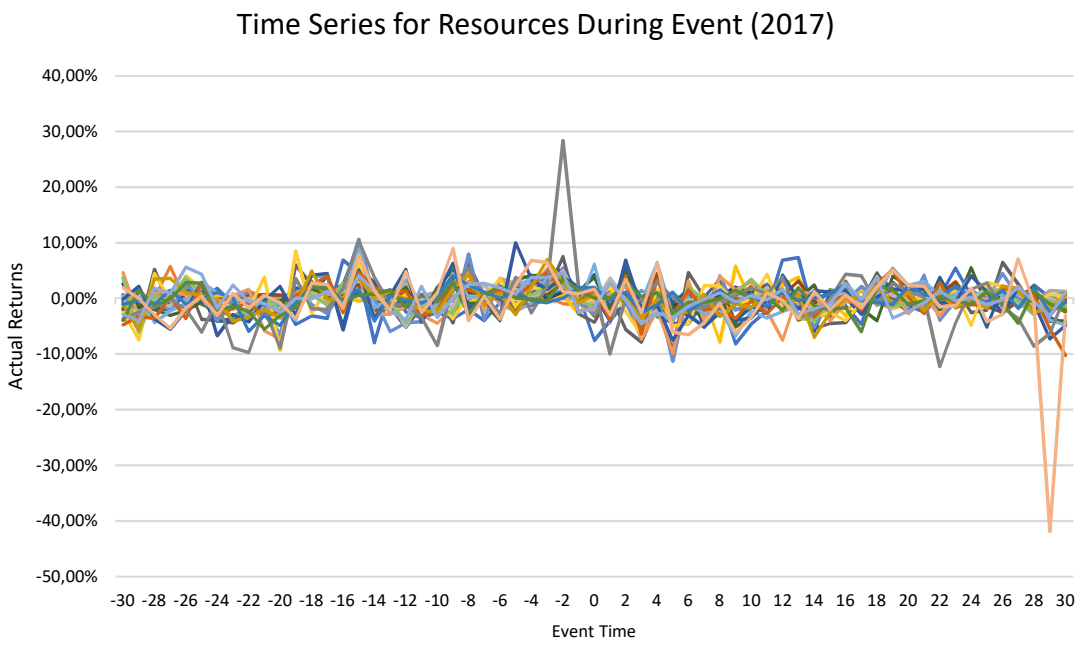

Figure 17: Time Series for Resources During Event

All samples maintained a median of zero during the training period and event window. The standard deviation and variance for each sample showed no signs of significant changes and no presence of any trends could be observed in the spaghetti plots. Each

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sample was fitted with a regression line to ensure that the absence of any form of trend could be confirmed mathematically. Each sample in the population showed a slope of zero for the training as well as event window. Samples that showed extreme deviations from the zero mean in the spaghetti plots were evaluated individually to ensure that they comply with the requirements for a stationary time series. As this was the case no sample was excluded from the population and all samples complied with the requirements of a stationary time series.

5.3.4 Autocorrelation

The autocorrelation function was used as an additional and final data evaluation tool. Up to a 5th order (lagging factor) autocorrelation was done to ensure that there no cyclical trends were present in the data. The autocorrelation function was performed on various Indices and each respective industry within the ALSI. The constitutes of each industry was plotted on a single spaghetti graph to determine any data problems that might be present. The graphs for the training period can be found in Figure 18 and Figure 19, where as Figure 20 to Figure 21 represents the event window. Appendix D lists all the autocorrelation coefficients that resulted from the analysis.

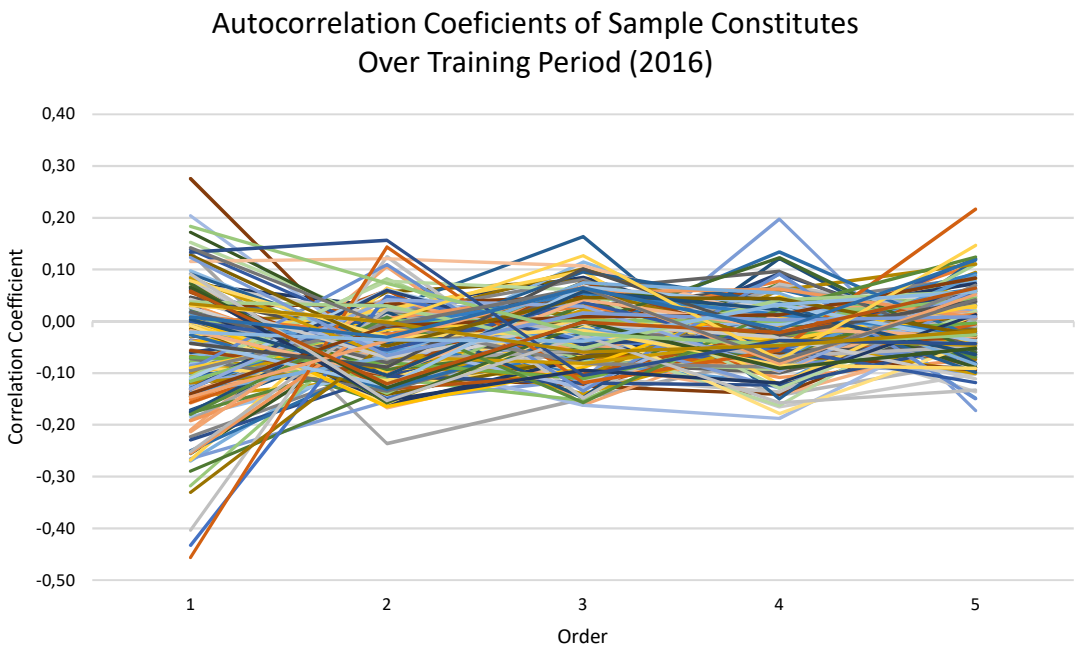

Figure 18: Autocorrelation of Sample Over Training Period

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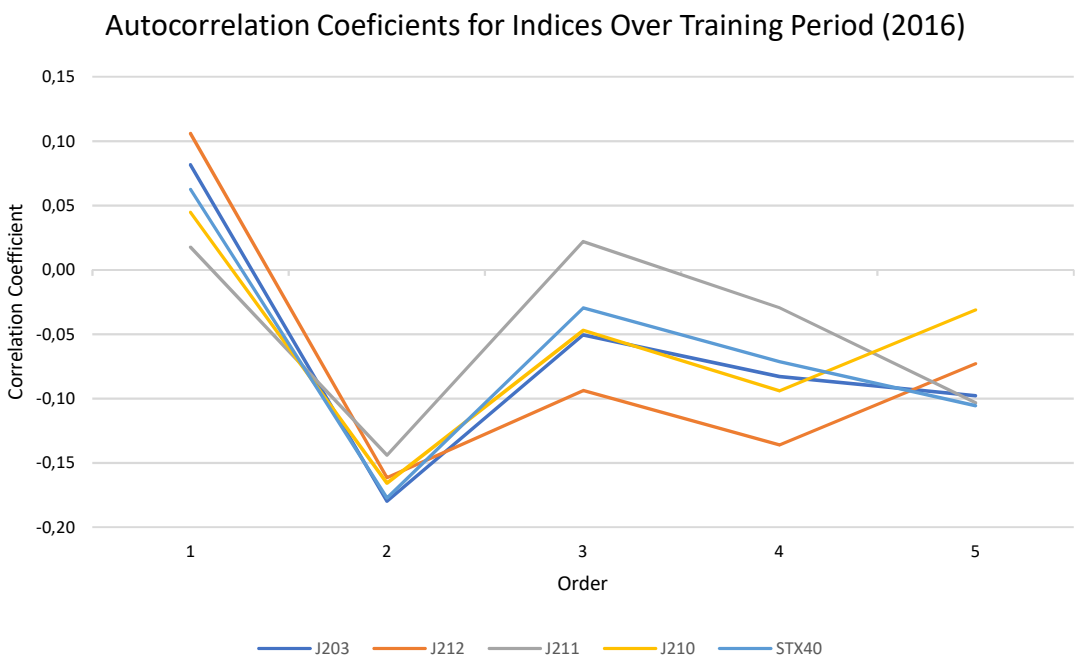

Figure 19: Autocorrelation of Indices Over Training Period

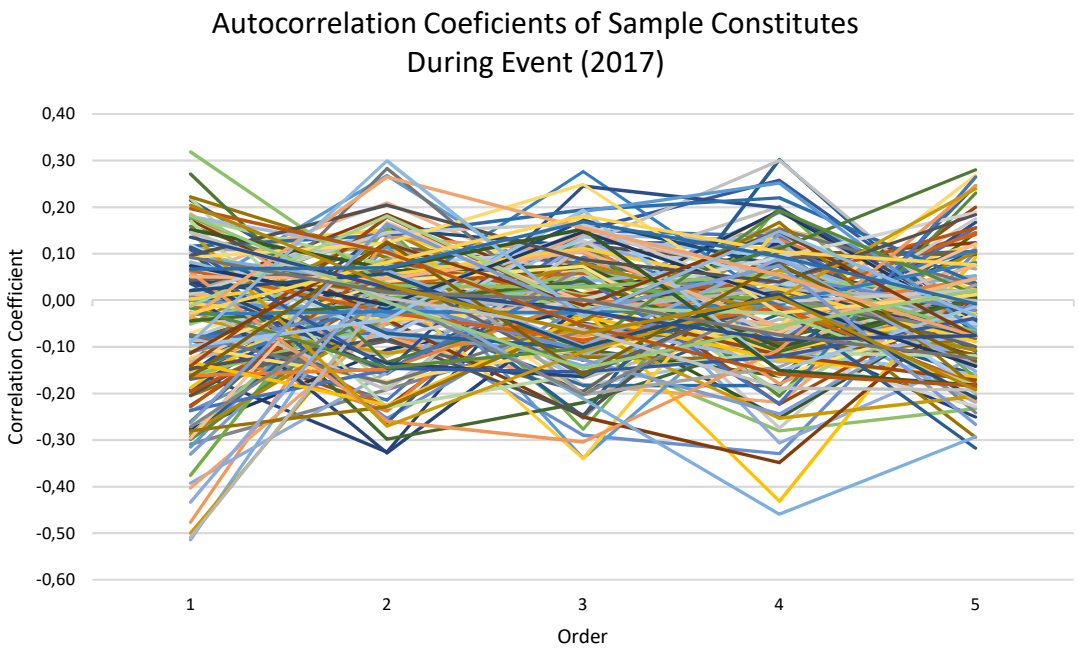

Figure 20: Autocorrelation of Sample During Event

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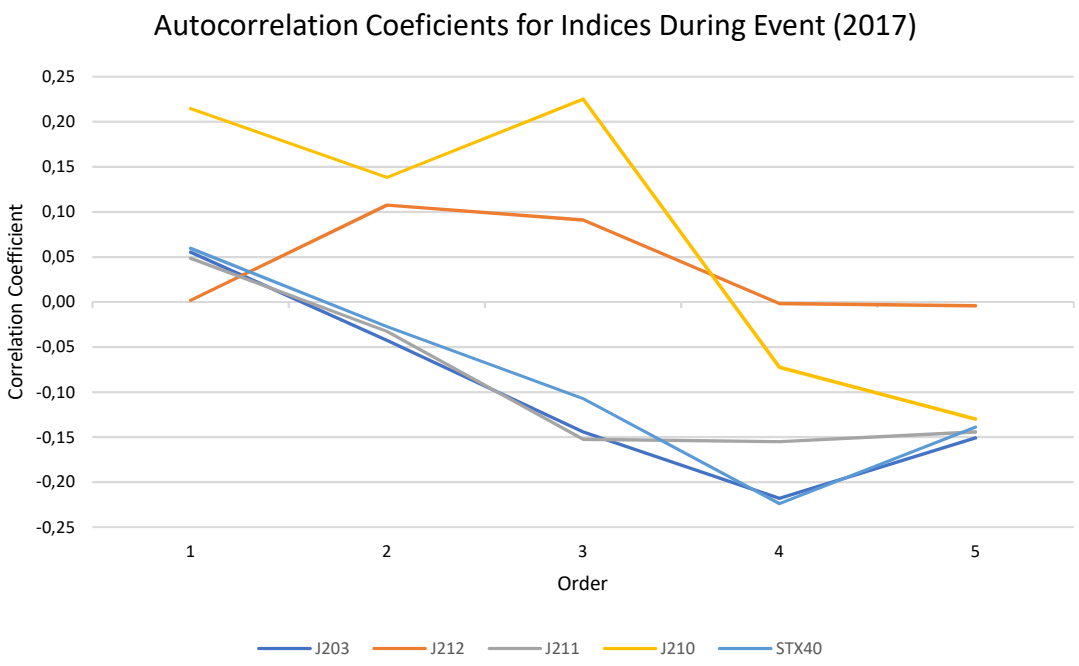

Figure 21: Autocorrelation of Indices During Event

As the correlation coefficients for each factor and sample remained relatively low, it can be confirmed that none of the samples showed any signs of a cyclical nature.

5.3.5 Conclusion

Before the historical daily share price data could be used to evaluate the five propositions and ultimately address the research objective the validity and reliability thereof needed to be tested for compliance. It was found that the data does not show any signs of serial correlation and all samples produced a Durbin Watson statistic in the region of two which confirms the absence of any positive or negative serial correlation. The Monte Carlo error distribution followed a relatively normal distribution deeming it as an adequate measure to construct confidence intervals. By evaluating the time series over the training period and event window it was found that actual returns comply with the requirements of a stationary time series. As an additional measure to ensure reliability and validity an autocorrelation was performed up to the fifth order. This revealed that there are no signs of any cyclical patterns within the data. As the data complied to all statistical requirements it could be used to calculate and evaluate ARs, CARs, AARs and CAARs.

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5.4 Average Industry Beta's

Beta values for each company in the sample can be found in Appendix B. It should also be noted that not all companies in the sample have been listed for 5 years and that some figures are as of Initial Public Offering (IPO) to date. Figure 22 provides an overview of the average industry Beta's calculated on a daily and monthly basis. For the purpose of this discussion, the training period is defined as 2016 and only 2016 daily closing prices were used to calculate β values. This was done to ensure that the true market volatility is captured within all β's as calculations based on weekly or monthly intervals might represent inadequate market volatility

Due to the fact that all listings after the 1st of January 2016 were excluded from the population all samples rendered sufficient data to calculate β's. The training period could not be extended to include 2015 as only 96% of the samples rendered sufficient data to calculate β's based on two years, 92% on three years, 88% on four years and only 85% on 5 years. In order to make accurate conclusions all β's were calculated based on the same time horizon.

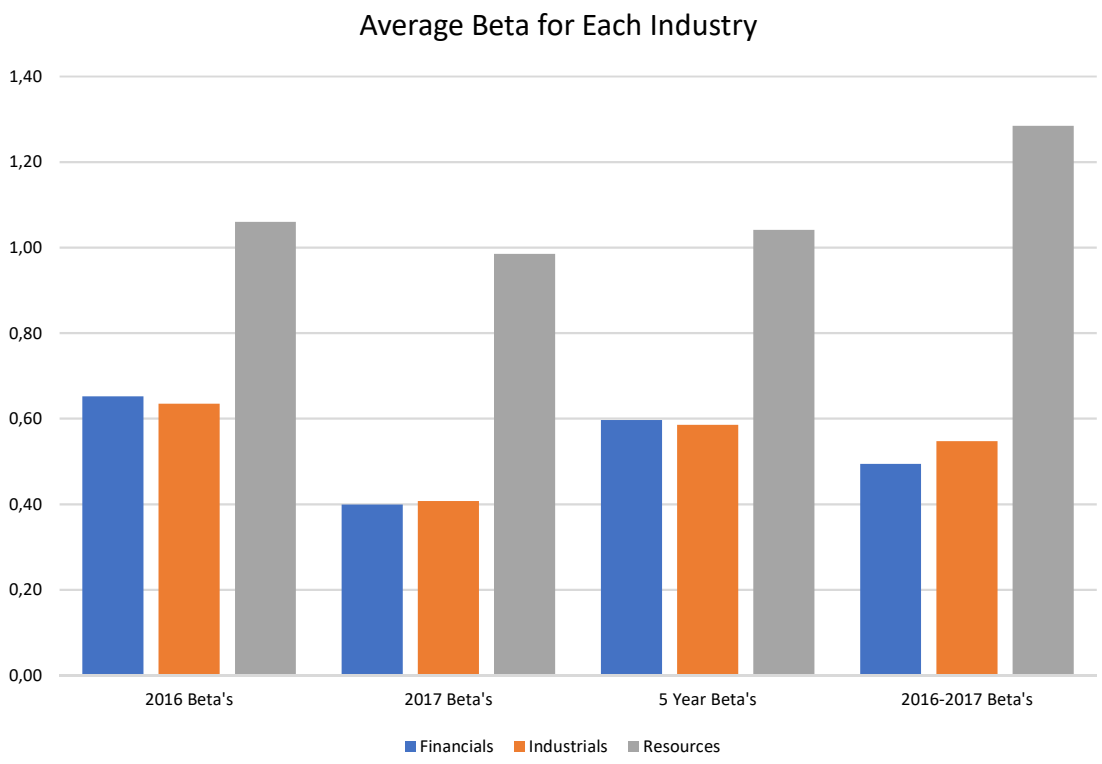

Figure 22: Average Beta Values per Industry

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From figure 22 it is clear that the methodology used to calculate β's has a significant effect on the values obtained. Average β's were calculated for each industry to determine its anticipated reaction to market changes. It is evident that regardless of the methodology used to calculate β values that the resource industry is the most sensitive to market changes. As the average β values for the financial and industrial industries remain relatively equal it is inferred that they will also react in the same manner to market changes.

5.5 Market Models

Due to the limitations of each market model, various market models and β's were used to calculate ARs, AARs, CARs and CAARs. The results of each market model were then plotted on a single graph to gain a general perspective of the market's reaction to a non-investment grade announcement. Three market models were identified and used during evaluation. They are as follow:

(i) Capital Asset Pricing Model (CAPM).

(ii) Straight market adjustment against the benchmark, without a β adjustment.

(iii) The two-factor linear model against an industry and Index.

5.6 Proposition 1

5.6.1 Aggregate Cumulative Abnormal Returns of Samples

To identify the presence of any outliers in the sample data an aggregate spaghetti plot of each CAR in the population were constructed and evaluated. The ARs used to calculate the CARs were based on the Capital Asset Pricing Model. The results can be seen in Figure 24 and show no signs of extreme outliers in the sample data.

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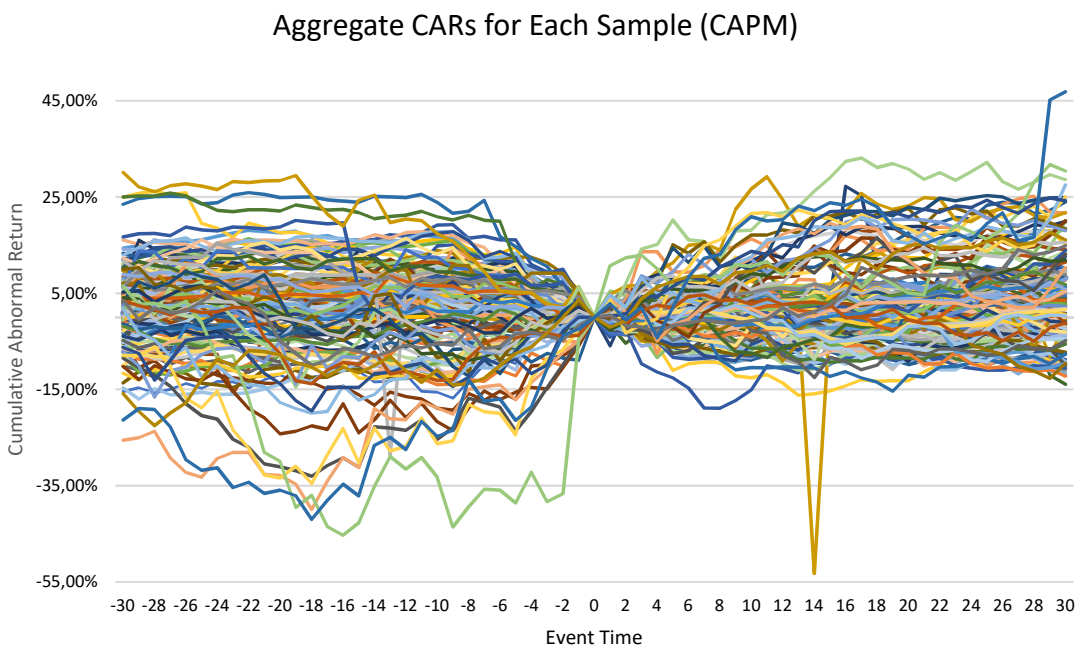

Figure 23: Cumulative Abnormal Returns for Each Company

5.6.2 Cumulative Average Abnormal Returns for All Industries

The CAARs for all industries, that is the whole population, is shown in Figure 24 with an 85% and 90% confidence interval bootstrap. In order to mitigate the risk of relying solely on only one market model ARs and CAARs were calculated for all three market models. This was done to assess the presence of abnormal share returns that might have resulted from the credit rating announcement.

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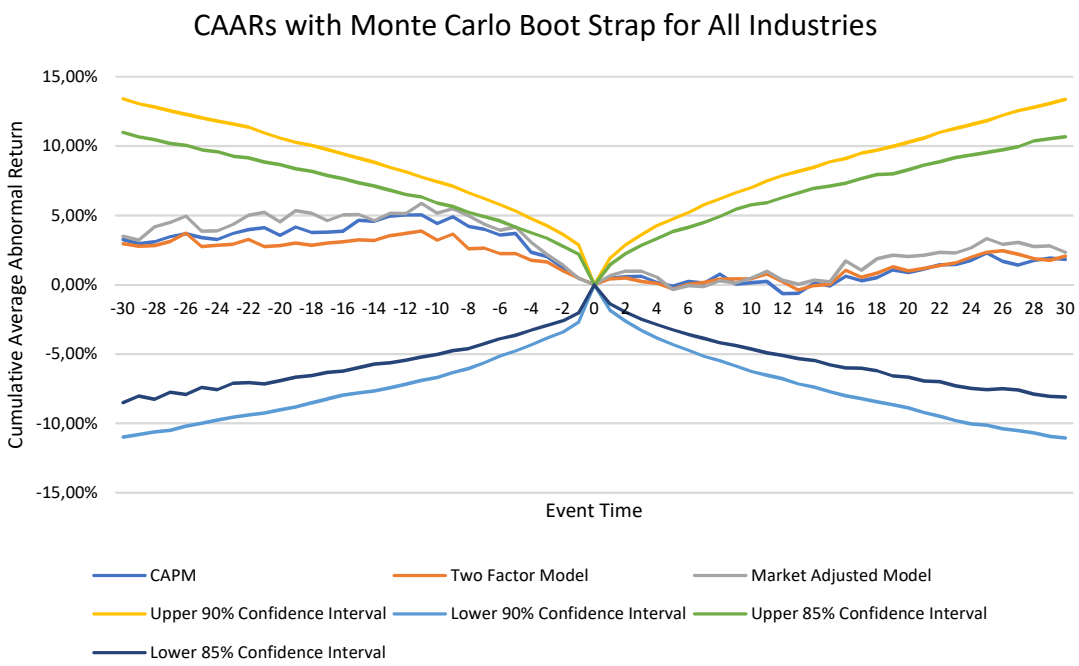

Figure 24: CAARs for All Share Index

The market shows little initial movement for the period [t_{-30},t_{-12}] in the event window. Thereafter, the market appears to anticipate the news of a sovereign downgrade to non-investment status 10 days (t_{-10}) before the announcement. The negative market reaction continued up to the announcement day (t_0) where after it levelled off for the period [t_0,t_{15}]. The CAARs based on the market adjusted model shows brief significance at t_{-5} at an 85% confidence interval. Thus, the presence of positive abnormal returns can only be made with an 85% certainty. The market reacted in a positive manner for the period [t_{15},t_{25}] where after it settled up to t_{30}.

5.7 Proposition 2

5.7.1 Multinational Listings

For the purpose of this discussion, multinational companies are defined as companies whose headquarters are not based within South Africa. From the 155 samples in the population 24 were identified as multinationals and are listed in Table 4.

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Ticker	Company	Country of Headquarters	City / Town
AGL	Anglo American PLC	United Kingdom	London
BAT	Brait SE	Malta	San Gwann
BIL	BHP Billiton PLC	United Kingdom	London
BTI	British American Tobacco PLC	United Kingdom	London
CCO	Capital & Counties Properties PLC	United Kingdom	London
CFR	Compagnie Financiere Richemont SA	Switzerland	Bellevue
CHP	Choppies Enterprises Ltd	Botswana	Gaborone
CRP	Capital & Regional PLC	United Kingdom	London
GLN	Glencore PLC	Switzerland	Baar
IAP	Investec Australia Property Fund	Australia	Sydney
INP	Investec PLC	United Kingdom	London
ITU	Intu Properties PLC	United Kingdom	London
LON	Lonmin PLC	United Kingdom	London
MNP	Mondi PLC	United Kingdom	Addlestone
MSP	MAS Real Estate Inc	Isle of Man	Douglas
OML	Old Mutual PLC	United Kingdom	London
PAN	Pan African Resources PLC	United Kingdom	London
REI	Reinet Investments SCA	Luxembourg	Luxenburg
RPL	Redefine International PLC	United Kingdom	London
S32	South32 Ltd	Australia	Perth
SNH	Steinhoff International Holdings NV	Netherlands	Amsterdam
SRE	Sirius Real Estate Ltd	Guernsey	St Peter Port
STP	Stenprop Ltd	Guernsey	St Peter Port
TTO	Trustco Group Holdings Ltd	Namibia	Windhoek

Table 4: Multinational Companies Listed on the ALSI

5.7.2 Multinational Industry and Market Capitalisation Weightings

All multinational companies were isolated from the population and categorised into their respective industries (financials, industrials and resources). This was conducted to gain a better perspective of the constitute weightings within the multinational cluster. The multinational industry weightings are shown in Figure 25.

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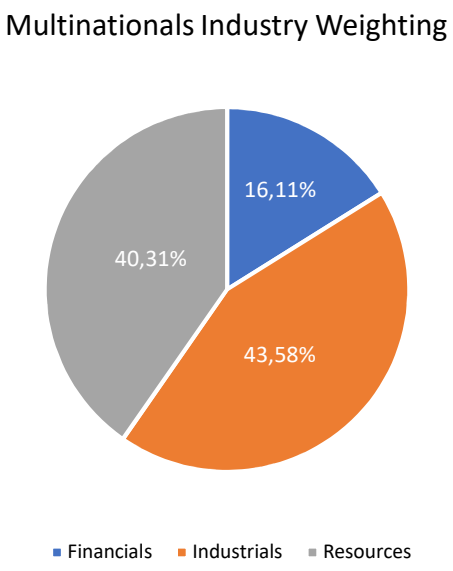

Figure 25: Multinationals Industry Weighting

Apart from the industry weightings within the multinational cluster it was also regarded as beneficial to determine what fraction of the ASLI is represented by multinationals. This would allow one to gain more insight as to what the effect will be on the ALSI as a whole due to market reactions of multinationals and local companies in isolation.

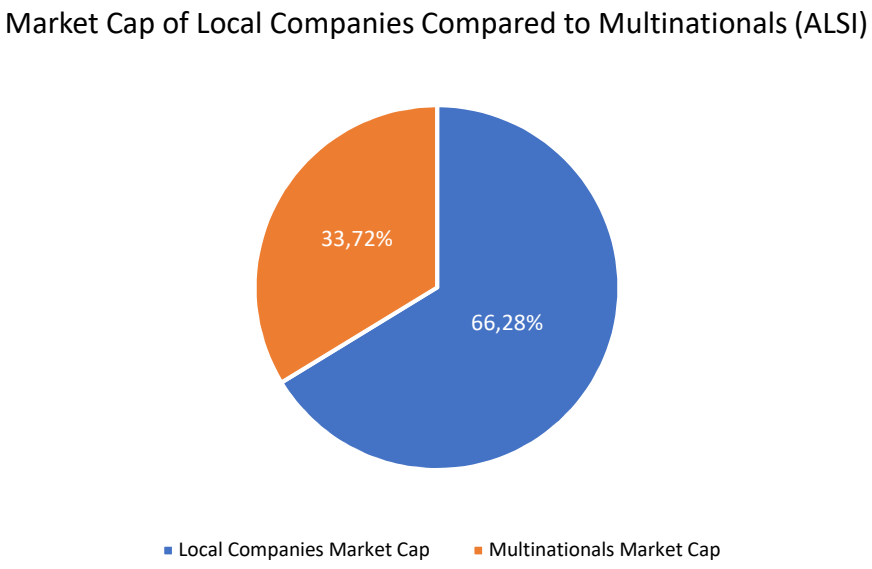

Figure 26: Market Cap of Local Companies Compared to Multinationals

5.7.3 Comparison of CAARs for Multinationals and Local Companies

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In order to address proposition two, all multinationals and non-multinationals had to be isolated into their own respective industries. The ARs and CAARs for each was calculated be means of the Capital Asset Pricing Model and the Market Adjusted Model. The Two-Factor Model rendered poor R^2 values and was therefore omitted.

From the 57 companies classified as financials on the ALSI, 44 were local companies and 13 multinationals. The CAARs for each is shown in Figure 27

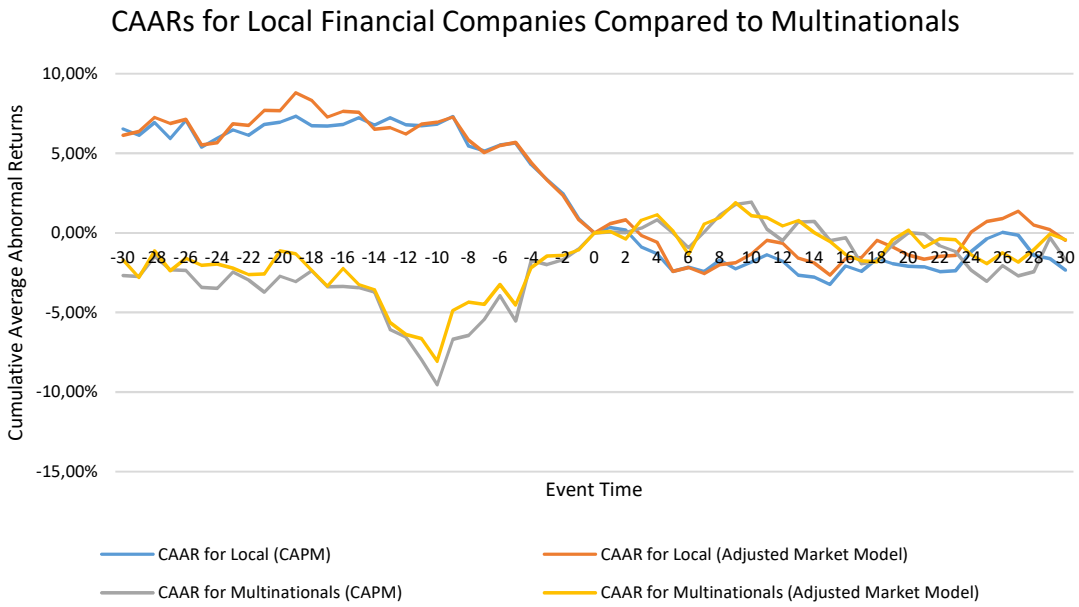

Figure 27: Local Financial Companies Compared to Multinationals

Little movement is observed in the financial industry as a whole for the period [t_{-30},t_{-16}]. At t_{-16} a sharp decline is observed in the CAARs for multinational financial listings which persist until t_{-10} whereby it abruptly changes to a positive trend. The positive trend continues from t_{-10} up to the date of the credit rating change announcement. It is quite interesting to note that the change in trend occurs at the same time (t_{-10}) for non-multinationals and start to show a negative market reaction. Both industries level off after the announcement and remains relatively stable up to the t_{30}.

Even though fluctuations of the CAARs for multinationals is present during the event, the CAARs at t_{-30} and t_{+30} remains relatively the same. This however is not the case with local companies. Non-multinationals show a decrease of more than 5% in its CAARs over the event period.

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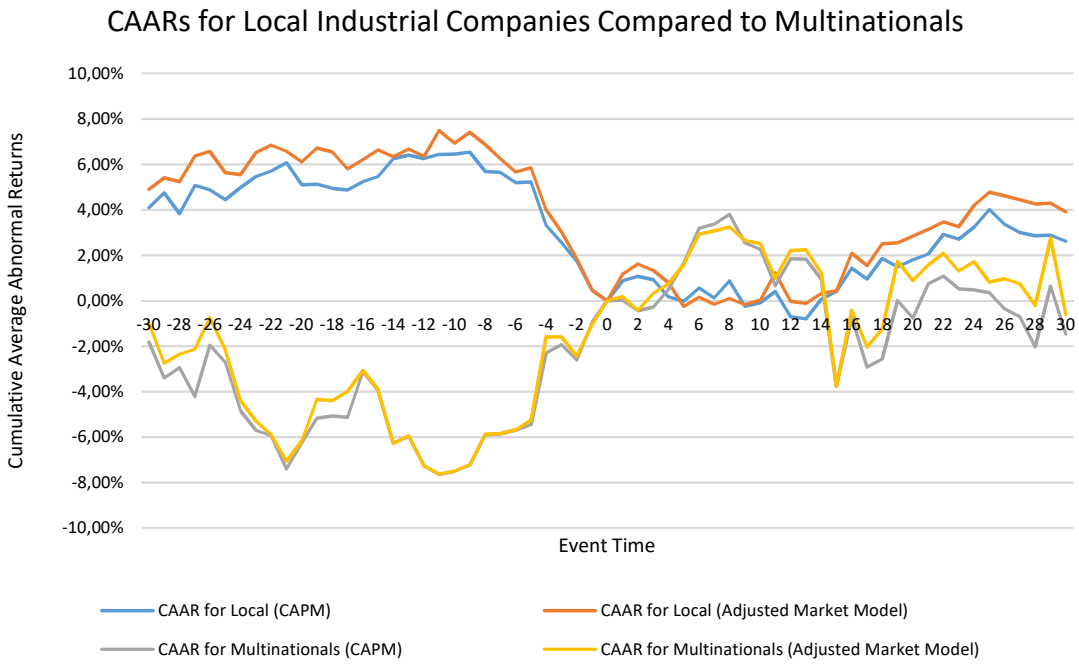

Figure 28: Local Industrial Companies Compared to Multinationals

From the 72 companies classified as industrials in the population, 68 were local companies and 4 multinationals at the time of the event. The CAARs for each is shown in Figure 28. It is evident from Figure 28 that the CAARs of the industrial industry experience more volatility than that of the financial industry. Multinational CAARs also appear to be more volatile than that of non-multinational listings.

The CAARs of non-multinationals remains relatively constant up to t_{-10} where after it shows evidence of a negative market reaction for the period [t_{-10},t_0]. After the rating announcement at t_0 little movement is observed up to t_{11} where after a positive trend is present followed by an even off period after t_{25}. Multinational listings initially follows a negative market reaction but recovers by the time of the announcement. It remains quite volatile from there on.

As with the financial industry, multinational and non-multination industrials show a convergent pattern after t_{-10}. Even though fluctuations of the CAARs for multinationals is present during the event, the CAARs at t_{-30} and t_{+30} remains relatively the same. Once again, this is not the case with local companies. Non-multinationals show a decrease of approximately 1% in its CAARs over the event period.

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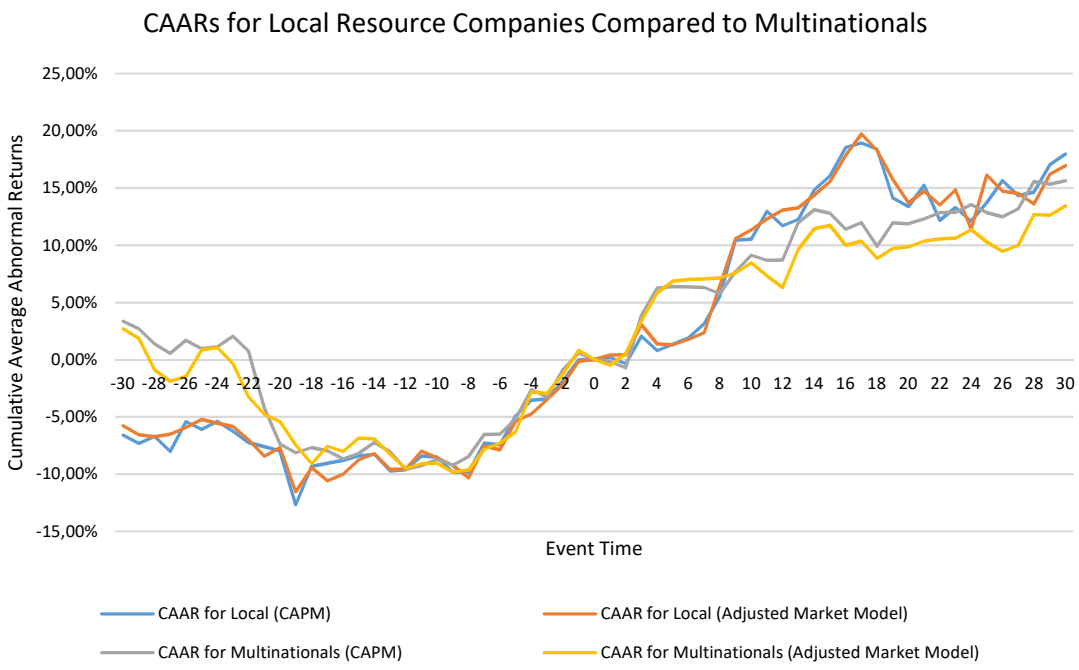

Figure 29: Local Resource Companies Compared to Multinationals

From the 25 companies classified as resources in the population, 19 were local companies and 6 multinationals at the time of the event. The CAARs for each are shown in Figure 29. Unlike the financial and industrial industries, resources follow a similar pattern over the period [t_{-30},t_{30}]. They also show less volatility than that of the industrial industry.

Both, multinationals and non-multinationals show a negative market reaction for the period [t_{-30},t_{-10}]. Thereafter they adopt a positive trend and remain so up to t_{17}. From t_{17} to t_{30} both industries (multinational and non-multinational resources) remain relatively constant up to t_{30}.

Unlike the CAARs of financials and industrials, the CAARs for multinational and non-multinational resources increase over the event period. Multinational CAARs increase by approximately 12% and that of non-multinationals by 20%. As with the financial and industrial industries, the change in trend is observed at t_{-10}.

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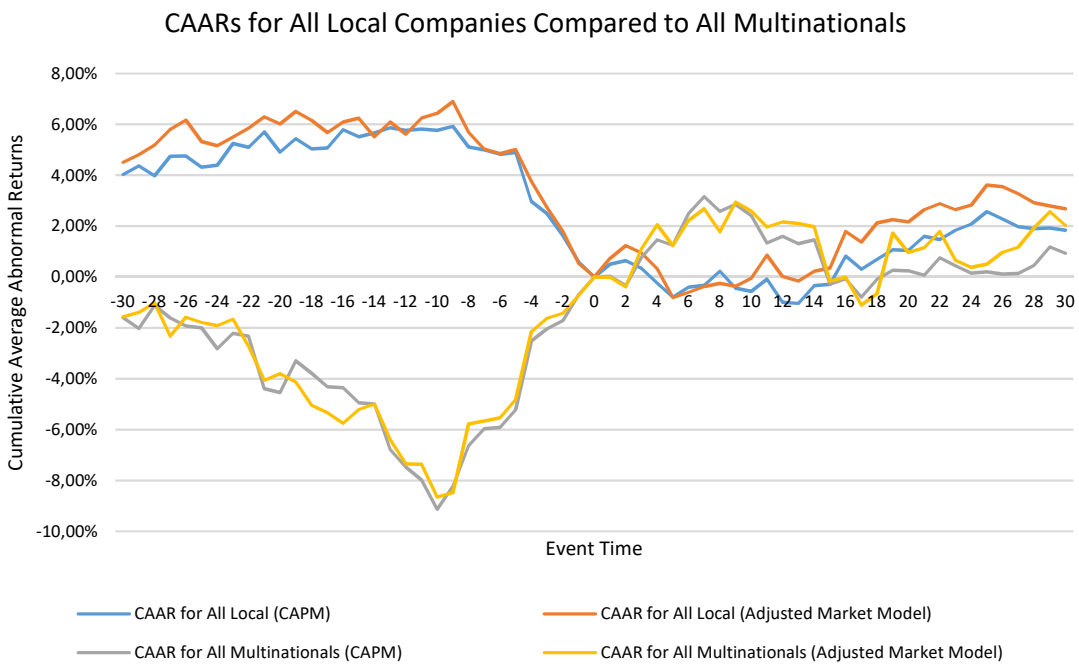

Figure 30: All Local Companies Compared to All Multinationals

In order to address proposition two, an industry aggregate (multinational and non-multinational) CAARs plot was constructed. From the 155 companies in the population, 131 were local companies and 24 multinationals at the time of the event. The CAARs for each are shown in Figure 30.

During event period [t_{-30},t_{-10}] the CAARs for non-multinational listings remained relatively constant whereas the CAARs for multinationals follow the trend of a negative market reaction. As with the financial and industrial industries, the aggrege of all the industries start to converge after t_{-10}. After the event, t_0, both industries show signs of increased volatility.

On average, the CAARs of multinationals increased by 2.06% whereas the CAARs of non-multinationals decreased by 2.87% over the event period [t_{-30},t_{30}].

5.8 Proposition 3

To assess the reaction of the ALSI to the credit rating change announcement is was necessary to test CAARs for significance. Three market models (CAPM, Two-Factor Model and Market Adjusted Model) were used to calculate ARs during the event window

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[t_{-30},t_{30}]. The CAARs with an 85% and 90% Monte Carle confidence interval are shown in Figure 31.

5.8.1 CAARs with Monte Carlo Boot Strap for ALSI

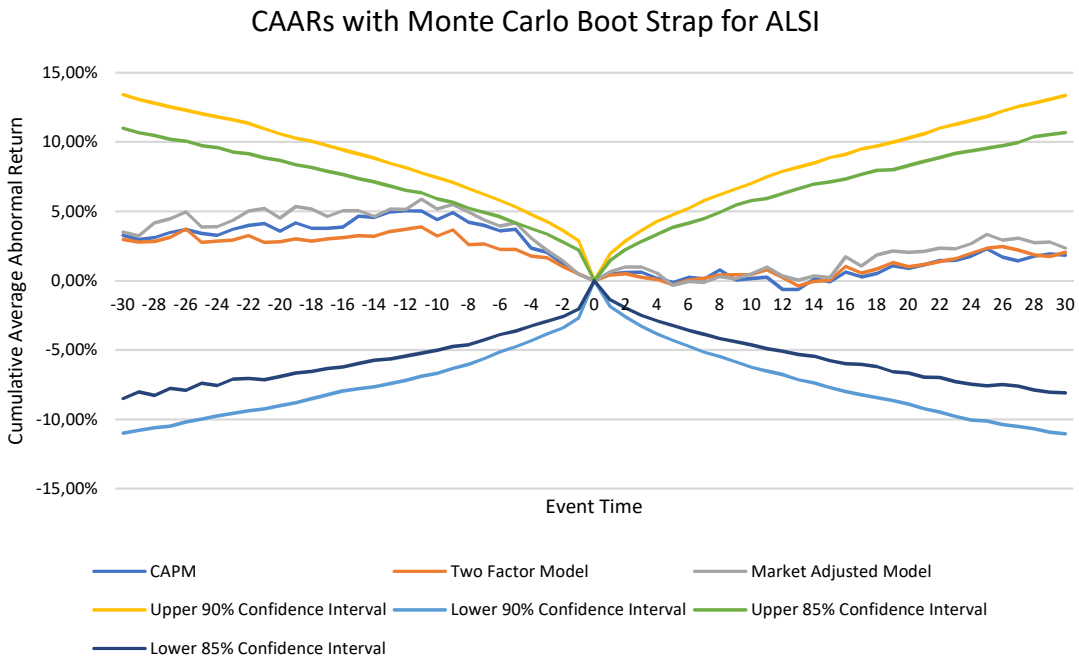

Figure 31: CAARs with Monte Carlo Boot Strap for ALSI

The market shows little initial movement for the period [t_{-30},t_{-12}] in the event window. Thereafter, the market appears to anticipate the news of a sovereign downgrade to non-investment status 10 days (t_{-10}) before the announcement. The negative market reaction continued up to the announcement day (t_0) where after it levelled off for the period [t_0,t_{15}]. The CAARs based on the Market Adjusted Model show brief significance at t_{-5} at an 85% confidence interval. Thus, the presence of positive abnormal returns can only be made with 85% certainty. The market reacted in a positive manner for the period [t_{15},t_{25}] where after it settled up to t_{30}. The CAARs also decreased by approximately 1% during the period [t_{-30},t_{30}].

5.8.2 Correlation Between ALSI and International Indices

The correlation between the ALSI and various well known international Indices were computed as an additional metric to determine the presence of abnormal behaviour in the ALSI due to the credit rating announcement. The correlation coefficients were

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computed for the training period as well as the event window and are listed in Table 5 and Table 6.

(2016)	ALSI	CAC	DAX	DJI	FTSE	HIS	NASDAQ	SPX
ALSI	1.00							
CAC	0.65	1.00						
DAX	0.61	0.95	1.00					
DJI	0.42	0.61	0.59	1.00				
FTSE	0.64	0.87	0.83	0.58	1.00			
HIS	0.51	0.49	0.47	0.25	0.45	1.00		
NASDAQ	0.36	0.59	0.59	0.87	0.56	0.23	1.00	
SPX	0.41	0.64	0.62	0.96	0.61	0.25	0.95	1.00

Table 5: Correlation Coefficients for Indices Over Training Period

(2017)	ALSI	CAC	DAX	DJI	FTSE	HIS	NASDAQ	SPX
ALSI	1.00							
CAC	0.40	1.00						
DAX	0.47	0.88	1.00					
DJI	0.30	0.55	0.57	1.00				
FTSE	0.60	0.67	0.71	0.42	1.00			
HIS	0.62	0.15	0.25	0.21	0.44	1.00		
NASDAQ	0.23	0.51	0.54	0.85	0.33	0.17	1.00	
SPX	0.26	0.57	0.58	0.95	0.38	0.13	0.93	1.00

Table 6: Correlation Coefficients for Indices During Event Window

A comparison of the results is tabulated in Table 7. Apart from one, all other coefficients show a decrease in correlation between the ALSI and other international Indices from the training period to the event window.

Index	2016	2017
	ALSI	ALSI
CAC	0.65	0.40
DAX	0.61	0.47
DJI	0.42	0.30
FTSE	0.64	0.60
HIS	0.51	0.62
NASDAQ	0.36	0.23
SPX	0.41	0.26

Table 7: Correlation Comparison for Training Period and Event Window

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Additional results obtained from evaluating proposition 4 will also be used to prove or disprove proposition 3

5.9 Proposition 4

In order to address proposition 4, it was required to separate all samples within the population into their own respective industries. From the 155 samples in the population, 57 were classified as financials, 72 industrials and 26 resources. Calculations for ARs and ultimately CAARs were computed by means of the three market models previously defined. The Adjusted Market Model rendered relatively low R^2 values resulting in poor ARs predictions. Never the less, the CAARs trends derived from this model displayed the same characteristics of the two complimentary market models and were therefore included in the results. The CAARs for each market model and industry accompanied by a Monte Carlo bootstrap are shown in Figure 32 to Figure 34.

5.9.1 CAARs for Each Industry

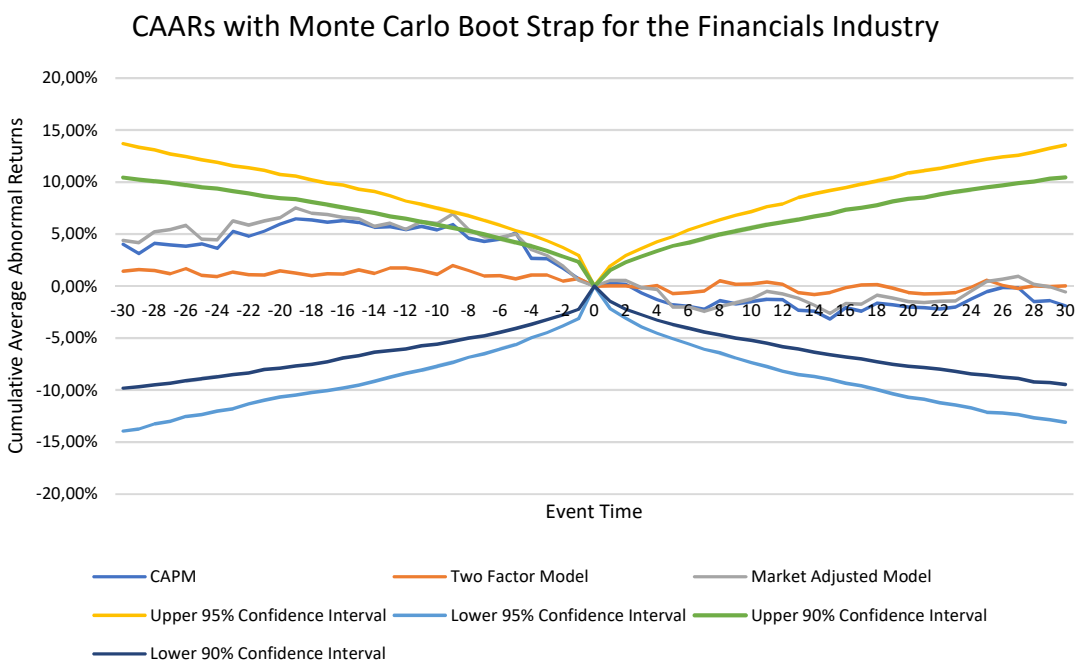

Figure 32: CAARs for the Financial Industry

The CAARs in Figure 32 for the financial industry show a steady increase for the period [t_{-30},t_{-19}] where after they remains relatively stable up the t_{-10}. Albeit brief, there is evidence of significant CAARs with an 95% confidence interval at t_{-9} and t_{-5} for the Market Adjusted

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Model. Only a 90% confidence interval could be obtained from the CAPM on these event days. The negative market reaction continued for the period [t_0,t_7] followed by a levelling off period up to t_{30}. The CAARs for the financial industry also appear to be more volatile than that of the industrial and recourse industries (Figure 33 and Figure 34). The CAARs decreased by approximately 5.8% during the event window

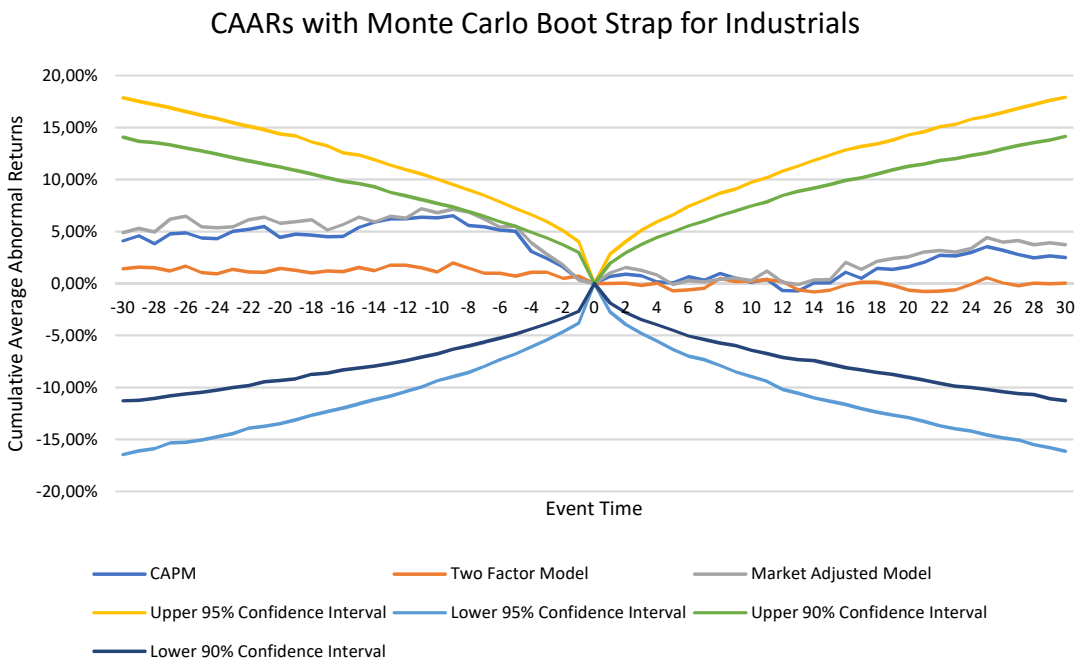

Figure 33: CAARs for the Industrial Industry

The CAARs for the industrial industry appear to follow the same trend as that of financials. In Figure 33 it can be seen that the market remained relatively stable during the period [t_{-30},t_{-17}] where after a small positive market reaction is observed from event time t_{-17} to t_{-10}. At t_{-10} the marked reacted in a negative manner which remained consistent up to t_0 followed by a levelling off period for [t_0,t_{15}]. Significance is only present at t_{-8} and t_{-5} for the Adjusted Market Model with a confidence interval of 90%. The CAARs decreased by approximately 1.56% which is 4.25% less than that observed in the financial industry during the event window. Once again, though with a decreased amplitude, the Two-Factor Market Model displays relatively the same characteristics as the Market Adjusted Model and CAPM.

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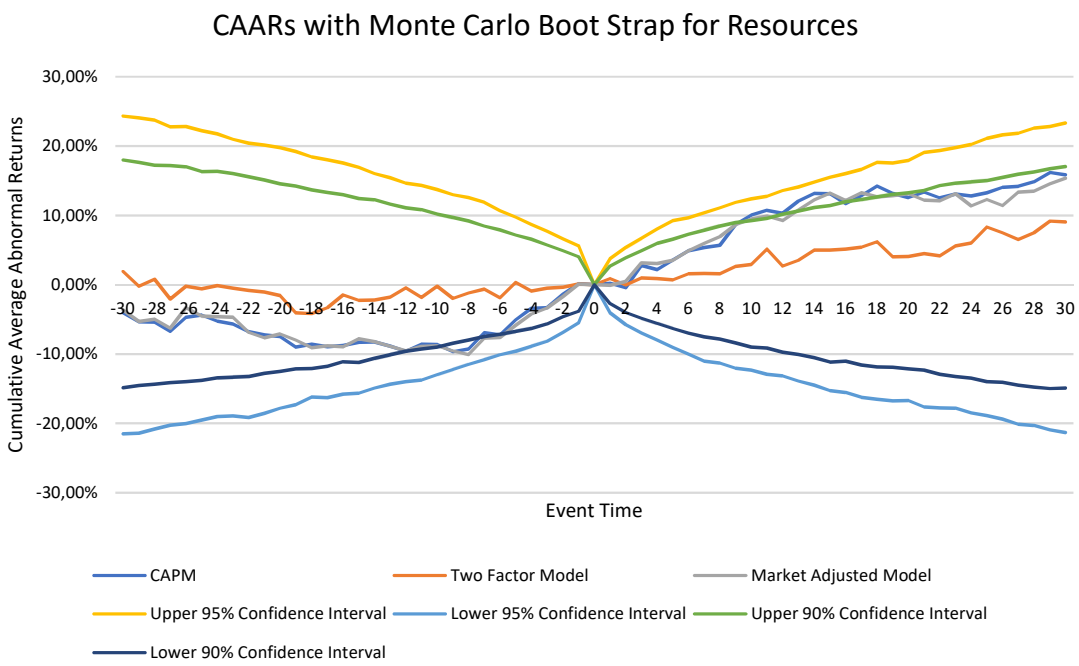

Figure 34: CAARs for the Resource Industry

The CAARs for the resources industry are shown in Figure 34. The trend displays the same characteristics as that of the multinational and non-multinational resource industries. There is an initial negative market reaction for the period [t_{-30},t_{-10}] where after a positive reaction is observed which remains relatively constant for the duration of the event window. Significance with a 90% confidence interval is present during the period [t_{-10},t_{-7}], [t_9,t_{11}] and [t_{13},t_{19}] for both the Market Adjusted Model and CAPM. The Industries CAARs increased by approximately 10.3% during the event and are therefore the only industry that shows an increase in CAARs.

The aggregate industry CAARs are shown in Figure 35. In this one-on-one comparison it is clear that the financial and industrial industry follow a near inverse relationship to that of the resource industry. The median of each industries CAARs is plotted in Figure 36 and displays the same characteristics to that of the CAARs for the ALSI.

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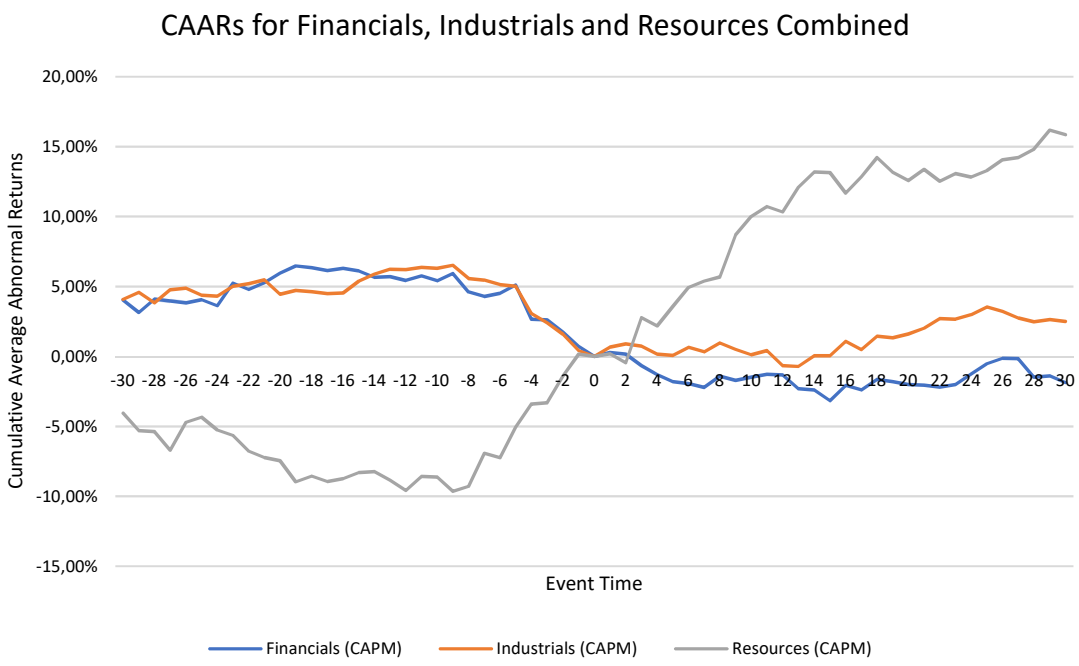

Figure 35: CAARs for Financials, Industrials and Resources Combined

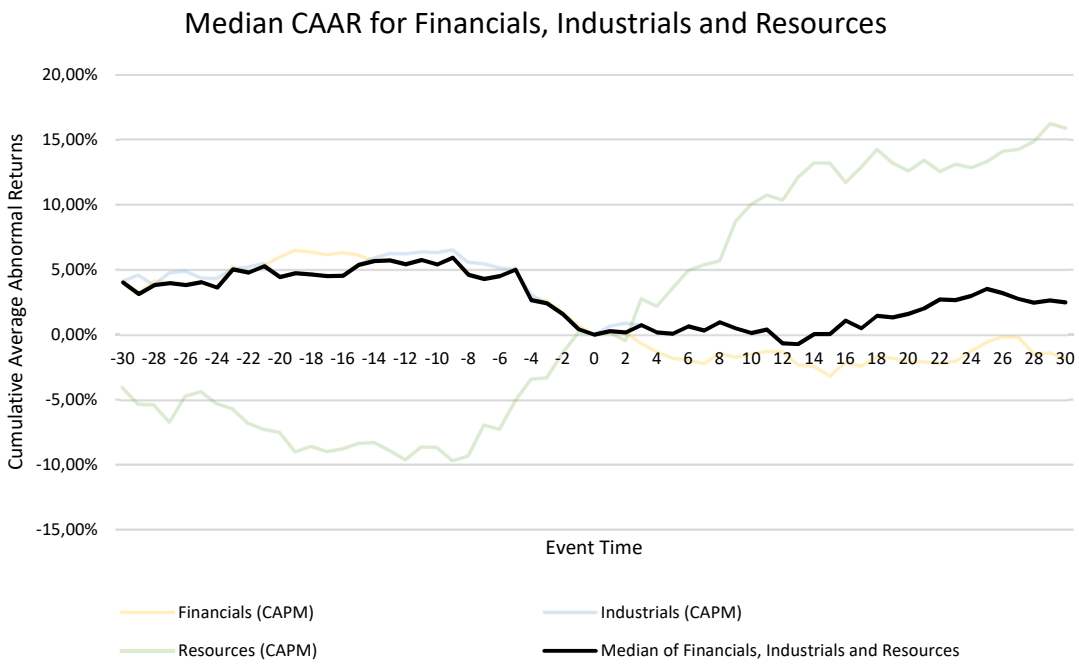

Figure 36: Median CAAR for Financials, Industrials and Resources

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5.10 Proposition 5

Proposition 5 states that from all the sectors within the financial industry, the banking sector was affected to the greatest extent due to the sovereign credit rating downgrade announcement of non-investment status. To evaluate this proposition, the CAARs for each sector within the financial industry had to be tested for significance. Once again, three market models were used to calculate ARs and CAARs. The test results are shown in Figure 37 to Figure 43.

5.10.1 CAARs for Each Sector Within the Financials Industry

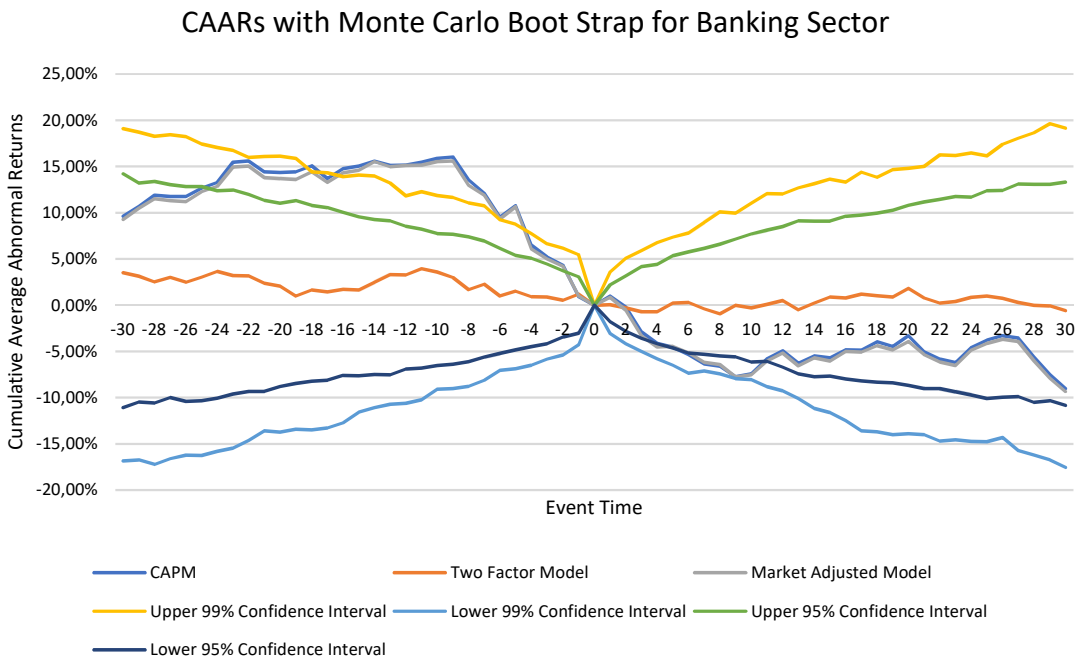

Figure 37: CAARs for Banking Sector

The banking sector shows a positive market reaction for the period [t_{-30},t_{-9}]. Thereafter a negative reaction is observed up to t_9 with a levelling off period up to the end of the event window. The Market Adjusted Model and CAPM shows significance of abnormal CAARs at an confidence interval of 95% for the period [t_{-24},t_{-1}] and at an confidence interval of 99% for the period [t_{-16}, t_{-4}]. Albeit brief, there is also evidence of significance at t_9 with a 99% confidence interval. The CAARs for this sector decreased from 9.28% in event time t_{-30} to -9.34% at t_{30} which brings the total reduction of CAARs to 18.62%. As observed in Figure 37, the Two-Factor Model failed to provide an adequate prediction of the CAARs and its results were therefore omitted.

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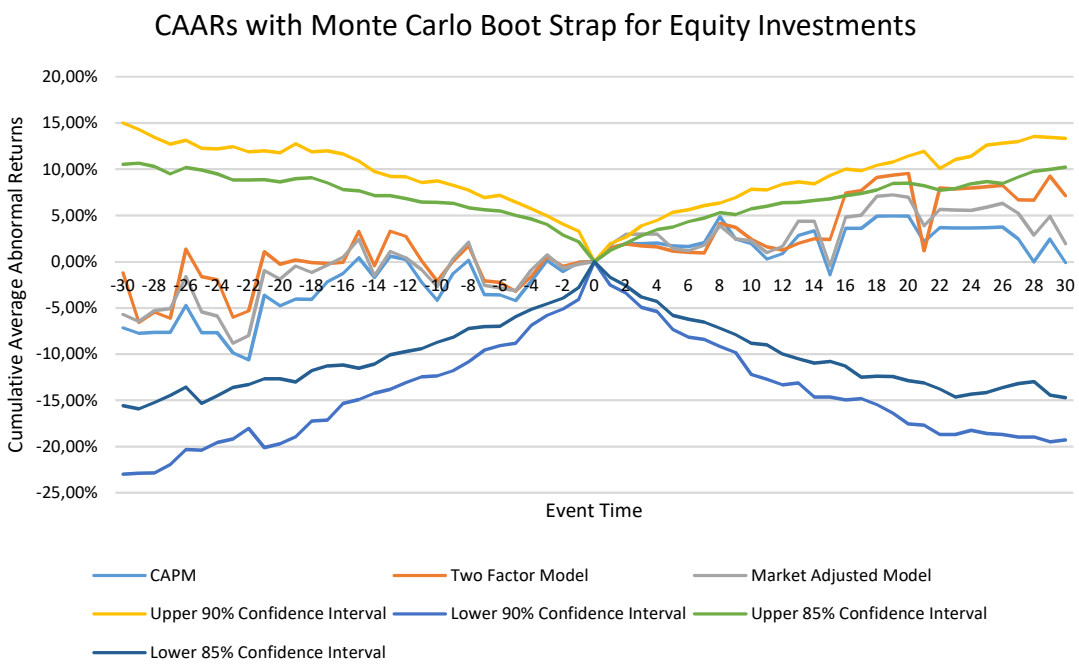

Figure 38: CAARs for Equity Investment Sector

The equity investment sector appears to be more volatile than the Banking sector during the event window as seen in Figure 38. Though more volatile, a general increase in CAARs is observed during this period (an increase of approximately 7.14% from t_{-30} to t_{30}). Significance of abnormal CAARs are noticed for the period $[t_{16},t_{20}]$ at a 85% confidence interval and for the period $[t_0,t_2]$ at a 90% confidence interval.

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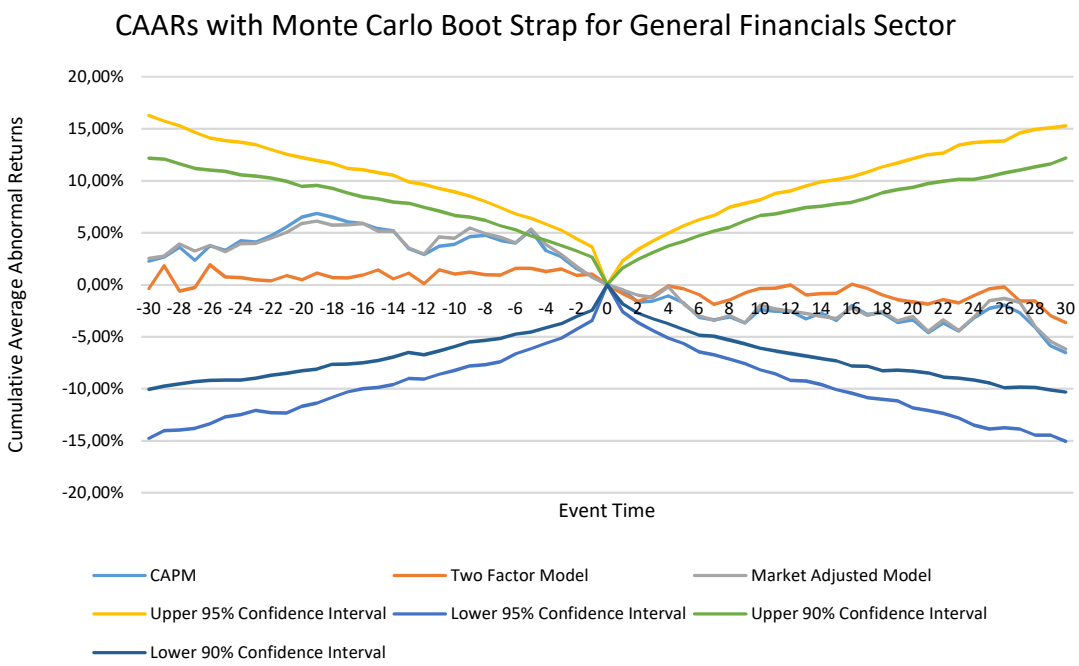

Figure 39: CAARs for General Financials Sector

The CAARs for the general financial sector are shown in Figure 39. In contrast to previous sector and industry CAARs plots, no abrupt changes in the CAARs for the general financial sector are observed at the region of t_{-10}. This indicates that the general financial sector is not influenced in the same manner as other industries and sectors due to some external factor in the region of t_{-10}.

It is apparent that there are no significant positive or negative market reactions for the general financial sector during the period [t_{-30},t_{-5}]. The market reacted in negative manner from event time t_{-5} to t_2 were after it levelled off to t_{30}. Abnormal CAARs in the general financial industry are observed for only a brief period [t_{-4},t_{-5}] with a confidence interval of 90%. Additionally, a decrease in CAARs of approximately 8.70% is observed during the period [t_{-30},t_{30}]. Once again, the Two-Factor Model failed to provide an adequate prediction of the CAARs and its results were therefore omitted.

Unexpectedly, both insurance sectors (life and non-life insurance) show the presence of significant CAARs for a prolonged period prior the rating announcement. The CAARs for each respective industry are shown in Figure 40 and Figure 41.

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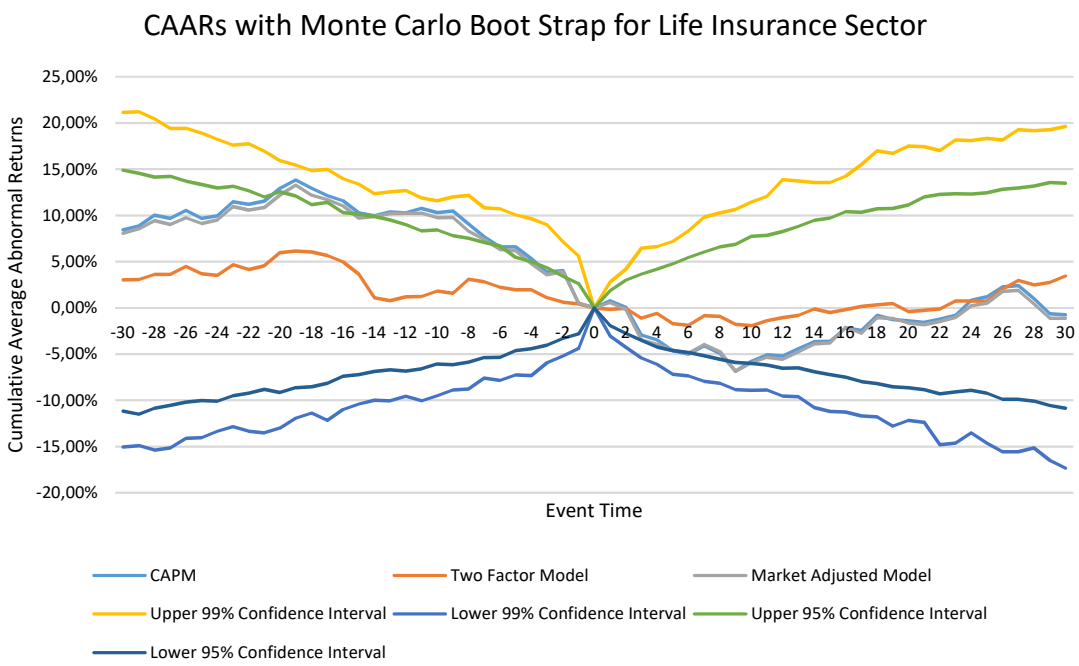

Figure 40: CAARs for Life Insurance Sector

The CAARs for the life insurance sector display a positive market reaction for the period [t_{-30},t_{-19}] where after they declines up to t_{-15}. Little movement is observed up to t_{-10}. As with most other industries and sectors, a sudden market change (CARRs) is present at the region of t_{-10}. The CAARs decrease from thereon up to t_9 where after a slight recovery is observed. The recovery remains steady up to t_{27} followed by another decrease in CAARs. Even though the Two Factor Market Model displays a reduced amplitude, the trend is relatively consistent with that of the other two market models as shown in Figure 40.

Thought not consistent, the presence of significant CAARs are observed from t_{-20} to t_{-1} for the Adjusted Market Model and CAPM with a confidence interval of 95%. After the credit rating announcement, negative abnormal CAARs are observed up to t_{10} (with a confidence interval of 95%). The CAARs for the life insurance industry decreased by approximately 9.17% during the event window.

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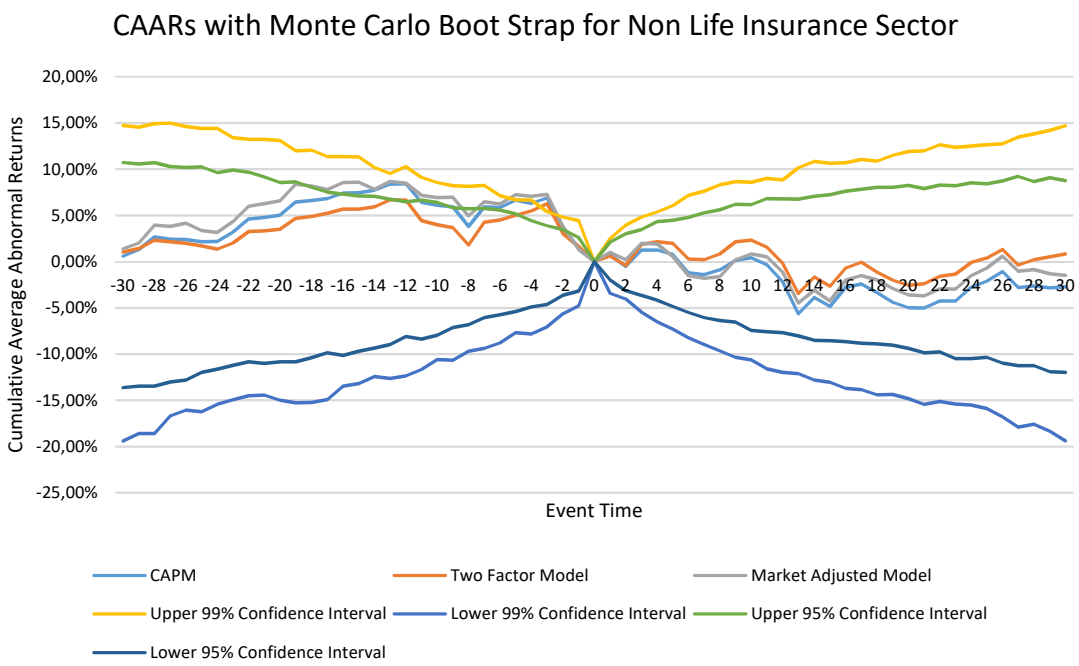

Figure 41: CAARs for Non-Life Insurance Sector

The CAARs for the non-life insurance sector is shown in Figure 41. Even though both insurance industries show a sudden change in CAARs before the credit rating announcement, the non-life insurance industry appears to be delayed by 6 days. Significant CAARs are observed during the period [t_{-5},t_{-2}] with a 99% confidence interval for the Adjusted Market Model and CAPM. An overall decline in CAARs of approximately 3.2% is observed from t_{-30} to t_{30}.

The non-life insurance sector shows an increase in CAARs for the period [t_{-30},t_{-19}] where after it remains relatively stable up to t_{-3}. As with other sectors, there appears to be a fluctuation of CAARs in the region of t_{-9} but to a lesser extent. An abrupt change is visible for the period [t_{-3},t_0] followed by relatively volatile CAARs up to the end of the event window.

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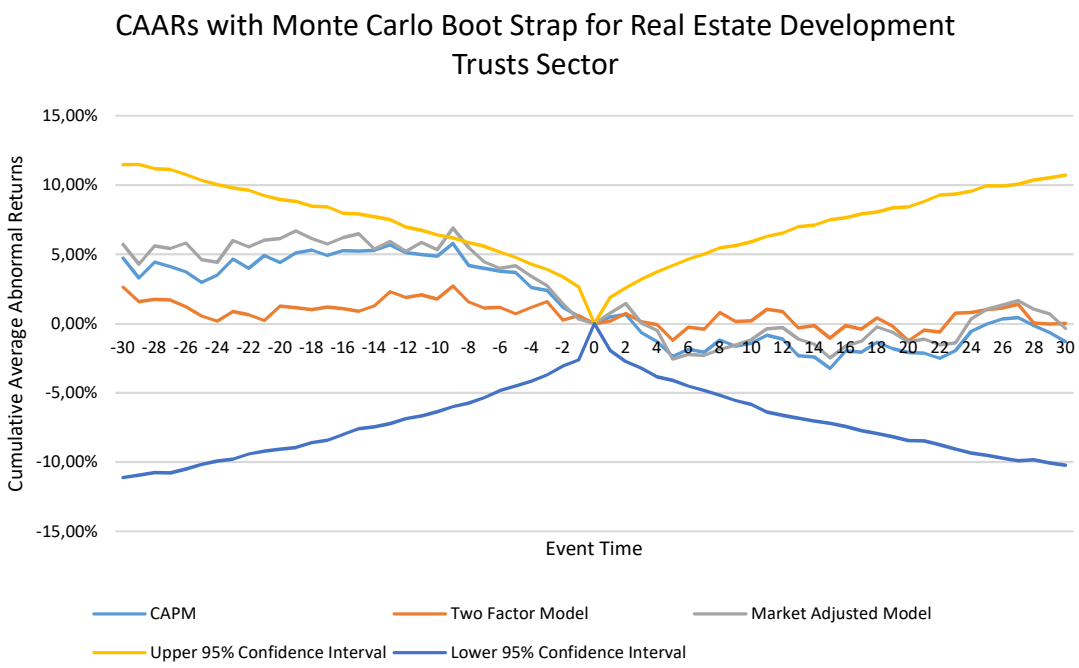

Figure 42: CAARs for Real Estate Development Trusts Sector

The CAARs for the real estate development trust sector remains relatively constant over the period [t_{-30},t_{-10}] where after a sudden change is observed at t_{-9}. As from t_{-9} a negative trend is present up to t_5 followed by a levelling off period for the duration of the event window. Significant CAARs are observed from t_{-9} to t_{-8} with a confidence interval of 95%. The CAARs for this sector decreased by approximately 5.3%.

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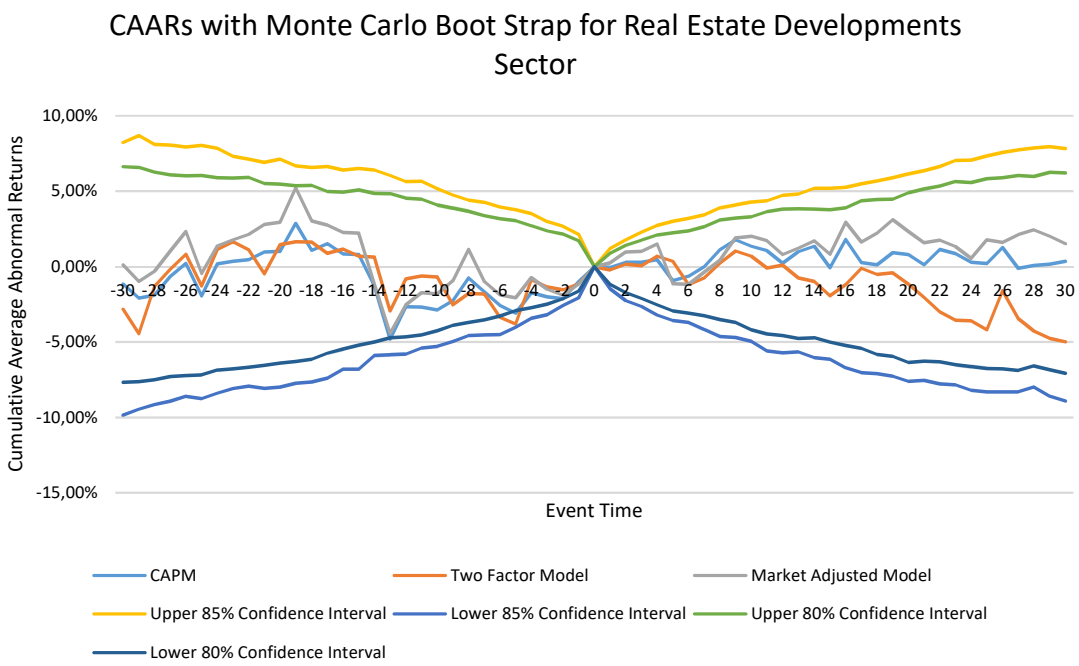

Figure 43: CAARs for Real Estate Developments Sector

The CAARs for the real estate development sector appear to be more volatile than that of the real estate development trust sector. Apart from the volatility, no meaningful trends in the CAARs can be observed. Brief significance in CAARs is present at t_{-13} for the Market Adjusted Model and CAPM with a confidence interval of 80%. The Two Factor model also shows significant CAARs with a confidence interval of 80% for the event period t_{-6} to t_{-4}. The CAARs for the real estate development sector increased by approximately 1.8% during the period $[t_{-30},t_{30}]$.

The CAARs for each sector within the financials industry are also shown in Figure 44 and serves as a medium to gain a better perspective of each sectors changes relative to one another.

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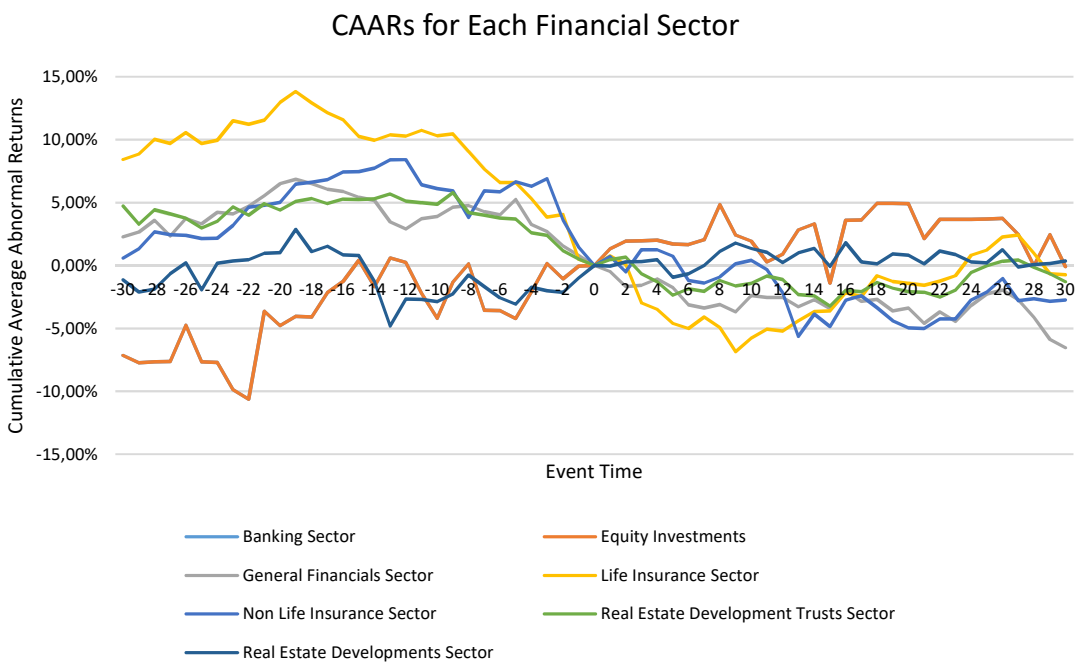

Figure 44: CAARs for Each Sector Within the Financial Industry

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6. Chapter 6: Discussion of Results

6.1 Proposition 1

Before credit ratings are revised, credit rating agencies need to consult with local authorities before it is made public. During this time the confidentiality of information might be jeopardised whereby knowledge about a revised credit rating might be leaked into the public domain.

In a study conducted by Michaelides, Milidonis, Nishiotis and Papakyriakou it was found that there is a correlation between the quality of institutes within a country and the presence of information leakage before a sovereign rating announcement (Michaelides et al., 2015). South Africa ranks 64th out of 176 counties with a score of 45/100 in the Corruption Perception Index (CPI) indicating a relatively moderate possibility for the presence of information leakage prior a credit rating announcement (International Transpayency, 2017). It has also been found that there is a strong correlation between information leakage and developing nations (Michaelides, Milidonis, Nishiotis, & Papakyriacou, 2012). The presence of abnormal returns before a credit rating announcement usually coincides with high insider trading as a result of leakage.

The study takes on the notion that any form of news related to a sovereign downgrade prior the announcement is regarded as information leakage whereas unrelated news to a downgrade is not. It was found that during 400 upgrades and 291 downgrades for 65 countries that 40% of downgrade announcements showed at least one related news headline preceding the rating announcement resulting in a negative market sentiment and thus providing evidence of information leakage. Information leakage is also confirmed in the event of abnormal negative market sentiments in the absence of unrelated bad news and credit rating announcement rumours. It furthermore status that the leakage hypothesis is unlikely to hold in the presence of excessive unrelated bad news preceding the announcement.

In order to prove or disprove Proposition 1 it was necessary to determine whether excessive unrelated bad news preceded the credit rating change announcement. The finds of this investigation are shown in Table 8. From Table 8 it is evident that the announcement was indeed preceded with unrelated bad news. The leakage hypothesis is therefore discarded.

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Event Time	Date	News Headlines
-10	24 Mar 17	• No significant news headlines
-9	27 Mar 17	• On Monday morning President Jacob Zuma ordered Finance Minister Pravin Gordhan and his deputy, Mcebisi Jonas, to return from their trip to Europe where they were meeting with possible investors.
-8	28 Mar 17	• President Jacob Zuma has reportedly informed the ANC's top six leadership that he intends to dismiss Finance Minister Pravin Gordhan. • Gordhan's cancelled trip has put the nation on tenterhooks, with speculation of a Cabinet reshuffle rife. • Malema claims Gordhan will be fired after Kathrada's funeral
-7	29 Mar 17	• No significant news headlines
-6	30 Mar 17	• Finance Minister Pravin Gordhan has been removed from his post and replaced by Malusi Gigaba who previously held the post of Minister of Home Affairs. • News24 understands that nine ministers, including Finance Minister Pravin Gordhan, and six deputy ministers will be affected by the reshuffle. • DA to table motion of 'no confidence' in Zuma. • SACP rubbishes Zuma's claims about Gordhan's road show
-5	31 Mar 17	• High Court dismisses DA bid to halt Cabinet reshuffle. • Only hope for SA now is to remove ANC. • Zuma must go - SACP. • Cope calls for mass Cabinet resignation. • Ramaphosa: 'Totally unacceptable' for JZ to fire Gordhan
-4	03 Apr 17	• S&P has announced the downgrade of South Africa to so-called junk status. • Government not impressed with calls for nationwide shutdown.
-3	04 Apr 17	• No significant news headlines
-2	05 Apr 17	• 70% of South Africans want Zuma to resign - survey. • Motion of no confidence in Zuma to come before Parliament. • Ratings downgrade will be negative for metros. • The Republic of Gupta: A Story of State Capture
-1	06 Apr 17	• Save SA march to go ahead. • S&P downgrades SA banks to junk status.

Table 8: News Headlines Prior Announcement (News 24, 2017)

Any form of rating or outlook change preceding an official credit rating change to non-investment status is regarded as more informative than information soon thereafter (Michaelides et al., 2015). It can therefore be said that the announcement made on the 3rd of April 2017 by S&P sent a strong signal to the market as to what the future might portray. However, in general, significant CAARs result prior to rating announcements is attributed to the effect of information leakage (Michaelides et al., 2012).

It is therefore argued that the market has already anticipated the junk status announcement and that it has already been prices into the market by the time of the announcement. In further support of this notion, no significant CAARs were observed after the announcement and the presence of significance before the announcement can only be made with an 85% certainty. It should also be noted that the magnitude of significant CAARs is not only a function of information leakage but also of the rate at which it is distributed thought the market before the announcement (Goenka, 2003).The individual effect of related and unrelated news on the market cannot be determined and therefore provides no insight as to what caused the significant CAARs before the

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announcement. Proposition 1 can therefore not be proven or disproven and is therefore regarded as inconclusive.

6.2 Proposition 2

There is a strong relationship between the productivity levels of multinational organisations and domestic companies. It is shown that multinational organisations exhibit evidence of higher productivity than those of locals organisations and is attributed to the fact that multinational organisations need to be more competitive in a global front due to the presence of fierce competition (Ferrante & Freo, 2012). In general, a competitive advantage is achieved by the so-called proximity concentration trade-off whereby companies collaborate and concentrate in domestic production within a specific region to achieve economies of scale in order to serve foreign markets. In the absence of a proximity concentration it was found that companies usually enter foreign markets due to high transportation costs, trade barriers and fixed costs within their own country.

The stock returns of multinational organisations are strongly influenced by a company's non-domestic affairs and not only by its domestic affairs as shown in previous studies (Lombard et al., 1999). Evidence has also shown that equity returns of multinational organisations are primarily driven by the geographical location of its headquarters and that the returns for these organisations are country to country dependent.

Unlike domestic organisations, multinational organisations generally derive most of their earnings from international activities and are therefore less subjective to the domestic climate within a specific country. This can be viewed as a form of decentralisation where risk is mitigated due to the fact that earnings are dependent on global instances rather than country specific ones (Elango, 2010). Multinational organisations are also usually larger than domestic organisation and therefore provide better liquidity for investors which deems them more attractive (Lombard et al., 1999). Cross listings, which is usually accompanied with multinational organisations, is another factor that should be considered during the analysis of a company's stock returns. Due to these cross listings stock returns are not only dependent on the country in which their headquarters reside but also on the country in which it is cross listed.

The results obtained from the analysis computed in Chapter 5 indicates that multinationals were indeed affected by the credit rating announcement but not to the same extent as that of local organisations. The reader is reminded that for the purpose

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of this discussion, multinationals are defined as organisations with their headquarters residing abroad. All multinationals in the population are listed on the Johannesburg Stock Exchange (JSE) and therefore, from a headquarter perspective, makes them vulnerable to non-domestic affairs. The diluted effect can be attributed to the fact that multinational organisations are not only dependent on non-domestic affairs but also on the market conditions within their own country. Thus, multinationals are dependent on the economic environment of at least two countries. The quick recovery of both the financial and industrial industry can be viewed as the result of decentralisation where risk is mitigated and earnings dependent on global instances rather than on that of a specific country.

From Figure 27 and Figure 28 it is evident that the financial and industrial industry for multinational and domestic organisations show abrupt changes around the vicinity of the credit rating announcement.

However, unlike that of the domestic companies within the financial industry multinational organisations do not show a decline in CAARs across the event window. The decline of approximately 5% in CAARs for non-multinational organisations is attributed to the absence of the factors that stabilise multinational organisations. The same observation is made for the industrial industry. During the course of the event window non-multinationals showed a decrease of approximately 1% whereas the CAARs for multinationals remained relatively unchanged. From a resource perspective, multinational CAARs increased by approximately 12% and non-multinationals by 20%. It should be noted that from all three industries only the resource industry showed an increase in CAARs for both domestic and multinational organisations.

The aggregate of all three industries is plotted in Figure 30 and displays an increase in CAARs of approximately 2% for multinationals and approximately 3% for domestic organisations. Based on the changes in CAARs for the period $[t_{-30},t_{30}]$ and the quick recovery of CAARs for multinationals in the financial and industrial industry proposition 2 can be confirmed. Multinational organisations listed on the JSE were indeed less affected by the sovereign downgrade than domestic ones in the short term.

6.3 Proposition 3

The effect of a credit rating announcement on the stock-market is highly dependent on its timing as well as the quality of information that is available before the announcement (Holthausen & Leftwich, 1986). The lack of information causes larger significant CAARs

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in stock prices compared to instances where there is an abundance of information available. Significant CAARs are generally observed for negative announcements before the actual announcement and are an indication as to whether the announcement was anticipated or not. The presence of CAARs are more associated with credit rating downgrades as with upgrades. This is found to be quite surprising as there is no rational as to why ARs are mainly present during downgrades. In general credit rating changes are proceeded with either negative CAARs or relatively no movement in CAARs at all (Parnes, 2008). This general trend is also observed during analysis and can be seen in Figure 31.

Today, rating change announcements can be predicted with relatively good accuracy by means of powerful statistical tools as well as more reliable data. Weinstein found that sovereign bond ratings are usually lagged by information already available in the public domain (Weinstein, 1977). It can therefore be argued that due to the information already available in the public domain that the actual credit rating announcement is already anticipated before the official announcement. This phenomenon explains the relatively small change in CAARs prior the non-investment grade announcement in the study at hand. It is also argued that the related and unrelated news (as presented in Table 8) preceding the announcement had a significant influence on the degree of abnormal CAARs observed in Figure 31.

The effect of rating change announcement is found not to be homogeneous across all countries and is also time-dependent. Thus, the same country will respond in a different manner each time a credit rating announcement is made (Holthausen & Leftwich, 1986). It is also argued that credit rating agencies might be in possession of private information not available in the public domain and that their announcements are regarded as less valuable in certain markets. In contrary, Lazareve argues that CRAs only use information publicly available to investors and that CRAs merely confirm what the market has already priced in (Lazareva, 2016). According to this statement, credit rating announcements should not come as a surprise to anyone and therefore the more predictable the event the smaller the market reaction. This notion is supported during the analysis of the Spanish and Indian market (Abad-Romero & Robles-Fernández, 2007)(Lal & Mitra, 2011).

The effect of rating change announcement varies across different industries as well as the sectors within those industries. The study concludes that the effect of abnormal

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CAARs are directly proportional to the degree of anticipation within the market. It was also found that companies that receive individual ratings appear to have somewhat of a diluted responses to government bond rating announcements (Kapoor, Gupta, & Sachdeva, 2013).

Another explanation for the abnormal CAARs might be the presence of insider trading (Brandeis, 1992). After an investigation by the Security and Exchange Commission (SEC) it was found that insider trading soared prior to four credit rating announcements during the course of November 1990 and January 1991. The presence of insider trading can however not be proven or disproven in the current study as it would require an in-depth investigation to determine its contribution to CAARs.

For years it has been apparent that stock prices, bond prices and trading volumes significantly fluctuate during the course of a credit rating announcement (Parnes, 2008). This is contributed to the fact that investors rely primary on the credit ratings assigned to bonds by Credit Rating Agencies (CRAs). Credit rating announcements do not add any further specific information to the market but rather triggers investors' expectations. The increase in volume is therefore contributed to a combination of idealistic and risk aversive investors. International investors tend to buy during upgrade announcements whereas domestic institutions tend to sell during this period (Ahn et al., 2016).

Even though the effect of a rating downgrade announcement results in above average fluctuation in ARs (and trading volume) within the stock market it is not to the same extent as that observed of a non-investment grade announcement. The bond market reacts more positively with significant numbers as a result of an upgrade announcement then that of the stock market. Furthermore, bond markets are also more affected by an outlook announcement as to a credit rating announcement. According to Pukthuanthong, Elayan and Rose upgrade announcements do not significantly affect the bond and stock market whereas downgrades show significance for both (Pukthuanthong-Le, Elayan, & Rose, 2007).

It can therefore be argued that the significance, with only an 85% confidence interval, can be attributed to the fact that the market has anticipated a downgrade and that the junk status announcement was already priced into the market. Nevertheless, abnormal CAARs were observed with a decrease of approximately 1% during the period $[t_{-30}, t_{30}]$ and can be attributed to a variety of factors. These factors include market anticipation, insider training and investor sentiment to name a few.

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In order to gain a better understanding as to how the JSE reacted to the non-investment grade announcement further investigations were conducted on an industry level. The financial industry displayed significance in abnormal CAARs at 95% with the industrial and resource industry at 90% as shown in Figure 32 to Figure 34. It is also apparent that the financial and industrial industry follows a relatively inverse function to that of the resource industry. An aggregate plot, as shown in Figure 36, is therefore a diluted representation of the CAARs as positive and negative CAARs cancel out one another.

The correlation coefficients of the ALSI against other major Indices also indicated that there were indeed changes in the market and that the ALSI portrayed different characteristics during the training period to that of the event window. Apart from one coefficient, all other coefficients showed a decrease in correlation as shown in Table 7.

Based on the correlation coefficients, abnormal CAARs for the ALSI and each respective industry proposition 3 is affirmed and it can therefore be concluded that the JSE was indeed affected by the sovereign downgrade to non-investment status.

6.4 Proposition 4

Credit rating announcements do not only affect the instrument that is being evaluated but also other financial instruments. Even though a non-investment grade status announcement is anticipated in the market they may still cause havoc and instability. This is due to the fact that most institutional investors may only invest in investment-grade instruments (Kaminsky & Schumklar, 2002). Due to the frequent occurrence of currency crashes in recent times research regarding credit rating announcements tend to focus more on the financial industry than on any other industry.

The effect of credit rating announcements is especially stronger during crisis times accompanied by political instability (Kaminsky & Schumklar, 2002). It is also found that credit rating agencies contribute to instability as a result of their announcements during these times. In other words, they provide good news during good times and bad news during bad times. As the credit rating occurred during political instability within South Africa whereby uncertainty arose regarding the stance of finance minister Pravin Gordhan one would expect to see significant abnormal CAARs during the course of the announcement.

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According to the sovereign ceiling doctrine all financial instruments and institutes need to be regraded accordingly as a result of the junk bond status rating. Therefore, the effect of a sovereign downgrade to non-investment status has a direct impact upon all sectors within the financial industry. This is evident in the study at hand as the financial industry displays abnormal CAARs at a higher significance level than any other industry.

Rating change announcements can be broken up into two categories. The announcement can be either classified as “anticipated” or “unanticipated” in the market. In the case of being unanticipated the market reflects with excessive abnormal returns when compared to an anticipated announcement. Furthermore, it is found that the change to speculative status is also accompanied with greater abnormalities compared to a mere investment rating change (Lal & Mitra, 2011).

Credit rating announcements also have an effect on the local countries exchange rate accompanied with a spill over effect whereby neighbouring countries are also affected by the announcement (Alsakka & Ap Gwilym, 2013). Alsakka and Gwilym also found that the impact of an outlook change has a greater effect on the market than that of a rating change itself and that the financial industry of highly rated countries are more affected by these rating changes than those with lower ratings. The effect of rating and forecast change announcement also appear to be agency depended whereby the market is more affected by some CRAs than others. The severe effect of rating changes also contribute to the fact that an assigned rating is based on the credit risk of a country with a long term outlook (Lobo et al., 2017). It is therefore not a report on the current economic environment in isolation but rather on the expectations of what the future may hold.

One would have expected higher significance levels of CAARs due to the political instability during the credit rating announcement but as a result of the markets anticipation of the announcement and an already low credit rating a deflated reaction was observed. Even though the evaluation was done on government bonds the effect thereof is evident on the financial industry as a whole. The financial industry was affected the most severely during the announcement and is contributed to the fact that financial institutions as well as other financial instruments needed to be revaluated after the announcement and downgraded as a result of the ceiling act. This is not mandatory for the industrial and resource industry and thus shows less of a reaction to the announcement. It is also quite interesting to note that the financial and industrial industry follow a relative inverse relationship to that of the resource industry during the event

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window. This raises the question as whether investors prefer to invest in more "tangible" goods during the time of economic instability? The literature on the effects of credit rating changes on the capital market is relatively recent and to the best of my knowledge no research has explicitly been done to determine the relationship between industries during credit rating announcements to junk status (Michaelides et al., 2015).

Only the financial industry showed significant abnormal CAARs at an 95% confidence interval followed by the industrial and resource industry at 90%. Table 9 is given below and serves as a summary of the results obtained from the analysis done in Chapter 5.

Industry	Max Confidence Interval	Max Duration (Event Days)	Δ CAARs
Financials	95%	5	-5.80%
Industrials	90%	4	-1.56%
Resources	90%	7	10.30%

Table 9: Summery of Industry Results

As the presence of abnormal CAARs can be made at a higher confidence interval it can be concluded that the financial industry was the most severely affected by the credit rating announcement. Proposition 4 can therefore be affirmed.

6.5 Proposition 5

Real estate investment trusts only capture half the effect of market news within their returns whereas the full effect is captured into the equity market (Füss, Mager, & Zhao, 2014). This is attributed to the fact that real estate investments take on more of a long-investment approach as that of the stock market. Changes in returns for the real estate sector is primary determined by expected dividends, interest rates, consumer price index (CPI), producer price index (PPI), gross domestic product (GDP), personal income and the expected equity risk premium. Interestingly, the market tends to show positive response to the announcement of higher inflation rates (Ramchander, Simpson, & Webb, 2003). Stability is also attributed to the fact that this sector is traded infrequently compared to other sectors within the financial industry deeming them less volatile and dependant to new information circulating the market (Guttery, Ghosh, & Sirmans, 1998). Public and private real estate displays the same characteristics during macro news announcements even though the response of private real estate is somewhat delayed. This is due to its lack of liquidity, transaction costs and transparency. The industry also displays a greater response to positive news than that of the stock market. The above

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factors explain the deflated response observed in the results of the real estate development sector during the event window.

Abnormal CAARs are usually observed prior the announcement of a credit grade announcement for the real estate industry but surprisingly no evidence of abnormal CAARs are observed after an announcement (Gyamfi-Yeboah, Ling, & Naranjo, 2012). The literature is supported by the findings of the current study and it is evident from Figure 42 and Figure 43 that no significant CAARs are present after the announcement has been made.

In general, it is found that CRAs provide accurate predictors for default risk in both corporate and government bonds. The insurance sector is therefore especially volatile to credit rating announcement as they need to be regarded sufficiently solvent in order to comply with their obligations (Burton et al., 2003). Therefore, any downgrade in credit rating will have a direct and severe impact on the markets perspective regarding this ability. Managers of insurance companies regularly make use of credit ratings to provide insight to external investors regarding the company's financial position, internal control, efficiency and general managerial competence. This is evident in the study at hand as Figure 40 and Figure 41 provide proof of significant abnormal CAARs for both life and non-life insurance sectors during the course of the event window. Apart from the banking sector, only the insurance sectors (life and non-life insurance) showed significant abnormal CAARs at a confidence interval of 95% and 99%. It can therefore be concluded that the insurance sectors are more affected by the announcement than the equity investment, general financial and real estate sectors.

Unlike any other sector, the general financial sector is the only sector that reacted as late as 4 event days prior the official announcement. This indicates that the external factors that influenced all the other sectors are not as relevant to the general financial sector. As the change in CAARs are observed on the downgrade announcement of S&P to non-investment grade one might raise the question as to whether foreign direct investors (FDIs) started to sell their positions? Credit rating downgrades to non-investment status reduces financial and non-financial corporations access to debt capital and FDIs (Nguyen & zu Knyphausen-Aufseb, 2014)

It is particular important for the banking sector to avoid sovereign downgrades it is accompanied with a scared reputation, increased borrowing costs and a reduction in its

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loan portfolio. After the examination of six comprehensive banks around the globe who received sovereign downgrades it was found that the banking sector still showed signs of financial and other real estate losses one year after the initial announcement. After a 2-year horizon, financial losses increased for the sector but managed to show signs of better liquidity. It is therefore evident that a sovereign downgrade to junk status has a particularly long lasting and unforgiving effect on the banking sector (Apergis, Payne, & Tsoumas, 2012).

Due to the failure of Enron and Lehman Brothers, investors are particularly sensitive to credit rating downgrades within the banking sector. One can therefore say that the market tends to overreact due to the history of financial meltdowns (Habib, 2015). Credit rating downgrades on a specific financial instrument indicates that the probability of default increases for that instrument and that any company or sector associated with that instrument pays the consequences of such an announcement.

Evidence from the Pakistani banking sector shows sovereign downgrades are associated with positive abnormal significant CAARs prior the announcement (Habib, 2015). It was found that the banking sector did not fully anticipate the downgrade announcement as negative significant abnormal CAARs were observed in their study after the announcement. The same observation was made during the current study. In Figure 37 it can be seen that the banking sector shows significance at a 99% confidence interval prior (positive abnormal CAARs) and post (negative abnormal CAARs) the announcement. As this aligns with the findings of literature one can infer that the South African banking sector did not fully anticipate the downgrade announcement.

The event study conducted by Ghosh, Guttery and Sirmans finds that announcements made by one company within a sector affected the stock prices of other companies within that sector as well (Guttery et al., 1998). This phenomenon is not only confined to companies within a single sector but is also observed between sectors. It should therefore be noted that an overreaction in each sector within the financial industry might exist in the current study due to this effect and that its contribution is primarily a function of risk adverse investors. The findings of Ghosh, Guttery and Sirmans are supported in the insurance sector as the announcement of poor annual earnings for First Executive Corporation, one of the largest insurance failures in history, affect the stock prices of other insurers within the sector as well (Burton et al., 2003).

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Table 10 provides a summary of the results obtained during analysis. With significant abnormal CAARs for 13 consecutive event days at a confidence interval of 99% it is evident that the Banking sector was the most severely affected by the junk status announcement. Proposition 5 can therefore be affirmed.

Sector	Max Confidence Interval	Max Duration (Event Days)	Δ CAARs
Banking	99%	13	-18.62%
Equity Investments	90%	3	7.14%
General Financials	90%	2	-8.70%
Life Insurance	95%	20	-9.17%
Non-life Insurance	99%	4	-3.20%
Real Estate Dev. Trusts	95%	2	-5.30%
Real Estate Developments	80%	3	1.80%

Table 10: Summery of Sector Results

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7. Chapter 7: Conclusion

This report examined the effect on share prices listed on the JSE due to a sovereign downgrade announcement to non-investment status in the short term. More specifically, it investigated the Index response to such an announcement. Various studies around the globe have been conducted to determine the effect of a sovereign grade rating change on the equity market (Ballester & González-Urteaga, 2016).

Unfortunately, none of these have explicitly focused on the transition from an investment status to non-investment status, let alone in the South African context (Michaelides et al., 2015). Thus, the aim of this report is to provide insight as to how the JSE as a whole and its constitutes, within the South African context reacted to such an announcement.

7.1 Primary Data Compliance

In order to increase the credibility of the study at hand, it was required to do additional statistical analysis to ensure the validity and reliability of the historical data used to compute ARs, AARs, CARs and CAARs.

The data was tested for serial correlation by means of the Durbin Watson test. This required the computation of actual returns from the daily closing prices for the training period as well as the event window. The data showed no evidence of serial correlation.

As the Monte Carlo bootstrap simulation was used to construct confidence intervals it was required to model the ε over the training period. The plot of the moral ε followed the distribution pattern of a normal distribution. This eliminated any suspicion as to whether the distribution might be skewed in any form.

In order to determine whether the actual time series were stationary or not, the returns were plotted for the training period as well as the event window and showed no significant deviation from the mean, variance or standard deviation. It could therefore be confirmed that the time series were indeed stationary.

As a last and final measure, an autocorrelation test was conducted up to the 5th order. The data showed no sign of correlation during analysis.

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The statistical analysis conducted on the historical data complied with all the requirements needed to use various market models for the computation of ARs.

7.2 Principal Findings

The objective of this report was to determine the effect on share prices listed on the JSE due to a sovereign downgrade announcement to non-investment status in the short term. An in-depth literature study was conducted to determine the key findings in the field to date. The findings obtained from the literature review was then used to formulate five propositions which would address the research objective.

Historical data in the form of daily closing prices were collected for the JSE which rendered the primary source of data used for analysis. The daily closing prices were then used to compute actual returns requited to address the five propositions. All data was tested statistically to ensure the reliability and validity thereof.

The methodology followed an event study approach whereby abnormal CAARs were tested for significance at various confidence intervals. The event window was defined as from 30 days prior to 30 days after the announcement date with confidences intervals constructed by means of a Monte Carlo bootstrap simulation. The findings were then used to address each of the five propositions which in turn addressed the research objective. The key findings of the propositions are discussed next.

To determine the presence of information leakage it was necessary to investigate whether the announcement was preceded with related news, unrelated news or a combination of both. It was discovered that the credit rating announcement was indeed preceded with an abundance of unrelated news showing signs of political instability. This was accompanied by related news whereby S&P downgraded South Africa's government bonds to junk status on the 30th of May 2017, 6 event days prior to the announcement. The individual effect of each news event (related and unrelated) cannot be separated from one another, and it can therefore not be concluded as to what caused the abnormal CAARs observed during analysis. This renders proposition one inconclusive as it cannot be proven or disproven.

Stock returns of multinational organisations are less influenced by non-domestic affairs. However, a strong correlation is observed between equity returns and the economic environment of the country in which the headquarters reside. The combination of stock

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liquidity and earnings obtained from international activities also make them more attractive to investors. During analysis it was found that multinationals maintained the same level of CAARs at the end of the event window as at the start, indicating a quick recovery to the non-investment announcement. This was not observed for non-multinational organisations. It is however interesting to note that the financial and industrial industry follows a relatively inverse relationship to that of the resource industry. Analysis provides proof to support proposition two and it can therefore be affirmed that multinationals are indeed less affected by the junk status announcement then domestic organisations.

Literature suggests that credit rating announcements are usually preceded by negative or positive abnormal CAARs and proceeded with negative or no abnormal CAARs at all. This observation was also made during analysis whereby positive CAARs preceded the announcement with neglectable abnormal CAARs thereafter. Significance of abnormal CAARs could only be achieved at a confidence interval of 85% which supports the notion that the market anticipated the announcement to a degree. The anticipation could be attributed to the following:

- The presence of related and unrelated news prior to the announcement.
- By means of powerful statistical tools and reliable data sovereign ratings can be predicted to a relatively accurate degree.
- Credit rating agencies only confirm to what the current market conditions are.

To gain a better understanding, an analysis was conducted on each industry constitute. The financial sector showed significance at a 90% confidence interval with the industrial and resource industry at 90% each. It was also found that the correlation coefficient of the ALSI against other major Indices decreased from the training period to the event window supporting the notion that the JSE was affected by the sovereign downgrade. Although only an 85% confidence interval could be achieved, supplementary evidence supports proposition three.

Credit rating announcements do not only influence the financial instruments that are being evaluated but also other financial instruments within the market. This creates a spill over effect whereby one financial instrument bears the consequences of another. The financial industry is also subjective to the fact that Institutional investors may only invest in investment grade instruments deeming a non-investment grade announcement

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more severe to the industry than that of a rating change that remains within investment grade. Furthermore, due to the sovereign ceiling doctrine, other financial instruments need to be re-evaluated after a credit rating change. As with multinationals the industrial and financial industry followed a relatively inverse relationship to that of the resource industry.

Significant abnormal CAARs were observed within the financial industry during the time former finance minister, Pravin Gordhan, were instructed to return from his trip to Europe and during the announcement of his removal. Only the financial industry showed significance at a confidence interval of 95% and it can therefore be confirmed that the financial industry was the most severely affected by the credit rating announcement. Proposition four is therefore affirmed, and it can be concluded that the financial industry was the most severely affected by the credit rating announcement to non-investment status.

The Real Estate Investment Trust (REIT) sector takes on more of a long-term investment horizon and therefore shows less volatility to macroeconomic news. This is partially due to the fact that this sector trades less frequently compared to other sectors and is attributed to investment horizon. It is also found that this sector is more sensitive to expected dividends, interest rates, consumer price index (CPI), producer price index (PPI), gross domestic product (GDP) and personal income. Abnormal CAARs for the sector is only significant prior the credit rating announcement.

The insurance sector is found to be extremely sensitive to credit rating announcements as these announcements have a direct influence on the public's perception regarding their solvency. Any doubt regarding the solvency of the insurance company raises doubt as to whether they will be able to meet their obligations. Furthermore, managers rely on credit ratings to attract external investors. Both insurance sectors showed significance in abnormal CAARs prior the credit rating announcement. The life insurance sectors showed significance at a 95% confidence interval whereas the non-life insurance sector showed significance at 99%. It can therefore be concluded that apart from the banking sector, the insurance sector is the most severely affected by the credit rating announcement of non-investment status.

Unlike any other sectors, the general financial sector is the only sector that showed abrupt changes in abnormal CAARs returns four event days prior to the rating announcement. This indicates that the external factors that influenced all other sectors

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are not applicable to this sector. Further investigation showed that these abrupt changes occurred during the time of S&P's downgrade announcement. The question therefore arises as to whether FDIs started to sell their positions in order to comply with their investment policies.

Credit ratings are particularly important for the banking sector as they are accompanied by brand reputation, borrowing costs and risk portfolio adjustments. The downgrade to non-investment status therefore had a particular harsh effect on the sector. It should also be noted that a downgrade in investment grade status indicates that the probability of default increases. In comparison to all financial sectors the banking sector is the only sector that displays significance for abnormal CAARs at a 99% confidence interval before and after the credit rating announcement. Due to the negative abnormal CAARs after the announcement one can infer that the sector did not anticipate the credit rating announcement. It can therefore be concluded that from all sectors within the financial industry that the banking sector was affected to the greatest extent affirming proposition five.

It was found that the banking sector was indeed affected to the greatest extent when compared to other sectors within the financial industry. The same observation was made during the industry analysis whereby the financial industry displayed greater abnormal CAARs when compared to the industrial and resource industry. During the evaluation of proposition two it was found that multinationals are less affected by a sovereign downgrade announcement to non-investment status than domestic companies. Even though the proposition is affirmed, multinationals still showed a reaction to the announcement. Is can therefore be concluded and said that the JSE was indeed affected by the credit rating announcement and that it is evident that some sectors and industries were more affected by the announcement than others.

7.3 Implications for Investors

The aim of this study was therefore to inform investors as to how the South African market reacted to a non-investment credit grade announcement. The analysis was not only conducted on the market as a whole, but also on an industry and sector level giving investors a better perspective as to how each of these were influenced by the announcement. Investors will therefore be able to mitigate their investment portfolio risk by knowing which industries and sectors portray excessive volatility during the anticipation and announcement of a credit downgrade to non-investment status.

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7.4 Limitations of the research

The study at hand is based on a single once off event and its conclusions can by no means be used as a generalisation as to how markets around the globe will respond to a non-investment grade announcement. One can therefore not expect other markets to show the same characteristics during such an event.

Cofounding events during the event study might render abnormal CAARs. During analysis it might not always be possible to determine or isolate these cofounding events rendering the study meaningless.

As the event window of the study increases the possibility of including undesired occurrences increase as well. These occurrences might produce excessive abnormal CAARs that could lead to inaccurate conclusions. It is therefore not always possible to extend the time horizon of the event study as desired.

7.5 Suggestions for Future Research

It is suggested that more analysis should be conducted on the explicit downgrade from investment status to non-investment status. This would require multiple samples of countries around the globe. It should however be noted that as a result no conclusions can be made as to how a particular market within a country will react to such an announcement. This would be a mere generalisation as to what can be expected in general to such an announcement.

It would also be beneficial to repeat this study in the event of a non-investment grade announcement for South African government bonds in the future. Additional data will provide more insight as to how the South African equity market responds.

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7.6 Conclusion

The findings show that the JSE was indeed affected by the non-investment grade credit rating announcement during the event window. No concrete evidence could be found for the presence of information leakage prior to the event and it is due to the occurrence of various related and unrelated news events preceding the announcement. The study furthermore indicates that in comparison to other industries that the financial industry was affected the most severely. The analysis concludes by investigating each sector within the financial industry and finds that the banking sector was affected to the greatest extend. It can therefore be concluded and said that the JSE was indeed affected by the credit rating announcement and that it is evident that some sectors and industries were more affected by the announcement than others.

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APPENDIX A

Agency	Rating	Outlook	Date
Moody's	Baa3	Negative	Jun 09 2017
Fitch	BB+	Stable	Apr 07 2017
Moody's	Baa2	Negative Watch	Apr 03 2017
S&P	BB+	Negative	Apr 03 2017
Fitch	BBB-	Negative	Nov 25 2016
Moody's	Baa2	Negative	May 06 2016
Moody's	Baa2	Negative Watch	Mar 08 2016
Fitch	BBB-	Stable	Dec 04 2015
S&P	BBB-	Negative	Dec 04 2015
Moody's	Baa2	Negative	Nov 06 2014
Moody's	Baa2	Stable	Nov 06 2014
S&P	BBB-	Stable	Jun 13 2014
Fitch	BBB	Negative	Jun 13 2014
Fitch	BBB	Stable	Jan 10 2013
S&P	BBB	Negative	Oct 12 2012
Moody's	Baa1	Negative	Sep 27 2012
S&P	BBB+	Negative	Mar 28 2012
Fitch	BBB+	Negative	Jan 13 2012
Moody's	A3	Negative	Nov 09 2011
S&P	BBB+	Stable	Jan 25 2011
Fitch	BBB+	Stable	Jan 17 2011
Moody's	A3	Stable	Jul 16 2009
S&P	BBB+	Negative	Nov 11 2008
Fitch	BBB+	Negative	Nov 09 2008
Fitch	BBB+	Stable	Jun 17 2008
Fitch	BBB+	Positive	Jul 25 2007
Moody's	Baa1	Positive	Jun 05 2007
Fitch	BBB+	Stable	Aug 25 2005
S&P	BBB+	Stable	Aug 01 2005
Moody's	Baa1	Stable	Jan 11 2005
Fitch	BBB	Positive	Oct 21 2004
Moody's	Baa2	Positive Watch	Oct 14 2004
S&P	BBB	Stable	May 07 2003
Fitch	BBB	Stable	May 02 2003
Fitch	BBB-	Positive Watch	Mar 11 2003
Moody's	Baa2	Positive	Feb 26 2003
S&P	BBB-	Positive	Nov 12 2002
Fitch	BBB-	Positive	Aug 20 2002
Moody's	Baa2	Stable	Nov 29 2001
Moody's	Baa3	Positive Watch	Oct 12 2001
Fitch	BBB-	Stable	Sep 21 2000
Fitch	BBB-	N/A	Jun 27 2000
Fitch	BB+	N/A	May 19 2000
S&P	BBB-	Stable	Feb 25 2000
Moody's	Baa3	Positive	Feb 07 2000
Moody's	Baa3	Stable	Oct 08 1998
Moody's	Baa3	Negative Watch	Jul 17 1998
Fitch	BB	N/A	May 28 1998
Fitch	BB	Positive Watch	Feb 17 1998
S&P	BB+	Stable	Nov 20 1995
S&P	BB	Stable	Oct 03 1994
Moody's	Baa3	Stable	Oct 03 1994
Fitch	BB	N/A	Sep 22 1994

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APPENDIX B

Financial Listings

J203	Company	2016 Daily Beta's	2017 Daily Beta's	5 Year Monthly Beta's	2016-2017 Daily Beta's
BGA	Barclays Africa Grp Ltd	1.20	0.95	1.14	0.76
CPI	Capitec	0.94	0.76	0.90	0.25
FSR	Firstrand	1.29	1.01	1.23	0.76
NED	Nedbank	1.19	0.99	1.14	0.66
RMH	RMB Holdings	1.28	0.93	1.20	0.83
SBK	Standard Bank	1.32	1.05	1.26	0.94
BRN	Brimstone	0.20	-0.44	0.06	0.13
NIV	Niveus Investments Ltd	0.07	0.09	0.07	0.46
REI	Reinet	0.56	0.49	0.55	0.83
AFH	Alexander Forbes Grp Hld	0.41	-0.06	0.31	0.41
BAT	Brait SA	0.99	0.35	0.85	0.50
CML	Coronation Fund Managers	1.23	0.76	1.12	0.89
HCI	Hosken	0.31	0.43	0.34	0.93
INL	Investec Ltd	1.32	0.89	1.22	1.22
INP	Investec Plc	1.22	0.81	1.13	1.21
JSE	JSE Ltd	0.73	0.55	0.69	0.54
KST	PSG Konsult Limited	0.07	0.24	0.11	0.50
PGR	Peregrine	0.71	0.42	0.65	0.40
PSG	PSG Group	1.18	0.57	1.05	0.51
RMI	Rand Merchant Insurance	1.03	0.78	0.97	0.66
TCP	Transaction Capital Ltd	0.41	-0.13	0.30	0.13
TTO	Trustco Group	0.00	-0.08	-0.01	1.70
ZED	Zeder Investments	0.90	0.80	0.87	1.19
DSY	Discovery	1.10	0.95	1.07	0.55
LBH	Liberty	0.96	0.84	0.93	0.74
MMI	MMI Holdings	1.17	1.11	1.16	0.82
OML	Old Mutual Plc	1.28	0.76	1.17	1.25
SLM	Sanlam	1.38	0.99	1.29	1.06
SNT	Santam	0.45	0.33	0.42	0.48
ATT	Attacq Limited	0.46	0.27	0.42	0.52
BWN	Balwin Properties Ltd	0.69	0.01	0.54	1.16
CCO	Capital & Counties	0.88	0.18	0.73	0.59
MSP	MAS PLC	0.34	0.06	0.28	-0.57
SRE	Sirius Real Estate Ltd	0.08	0.19	0.11	0.14
STP	Stenprop Limited	0.14	0.15	0.14	-0.15
TDH	Tradehold Ltd	0.12	-0.22	0.05	0.11
APF	Accelerate Prop Fund Ltd	0.28	0.15	0.25	0.09
AWA	ARROWHEAD PROP LTD A	0.22	0.05	0.19	0.28

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CRP	Capital & Regional PLC	0.26	0.21	0.25	0.23
DLT	Delta Property Fund Ltd	0.38	0.44	0.39	0.60
EMI	Emira	0.54	0.02	0.43	0.23
EQU	Equites Property Fund Ltd	0.23	0.00	0.18	0.25
FFA	Fortress Income Fund	0.39	0.49	0.41	0.10
FFB	Fortress B	0.70	0.48	0.65	0.36
GRT	Growthpoint	0.66	0.44	0.61	0.01
HYP	Hyprop	0.76	0.28	0.65	0.03
IAP	Investec Australia Prop	0.18	0.29	0.20	0.15
IPF	Investec Property Fund	-0.02	0.08	0.00	-0.06
ITU	Intu Properties plc	0.85	0.28	0.73	0.80
OCT	Octodec	0.49	0.35	0.46	0.20
RDF	Redefine	0.71	0.60	0.68	0.24
REB	REBOSIS PROPERTY FUND LT	0.48	0.05	0.39	0.32
RES	Resilient	0.75	0.18	0.63	-0.12
RPL	Redefine International P	0.48	0.13	0.40	0.77
SAC	SA Corp Real Estate	0.43	0.14	0.37	0.07
TEX	Texton Property Fund Ltd	0.29	0.14	0.26	0.27
VKE	Vukile	0.47	0.19	0.41	0.24

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Industrial Listings

J203	Company	2016 Daily Beta's	2017 Daily Beta's	5 Year Monthly Beta's	2016-2017 Daily Beta's
MTA	Metair	0.05	0.20	0.08	0.79
CVH	Capevin Holdings Ltd	0.26	0.23	0.25	0.24
DST	Distell Group Ltd	0.41	0.39	0.41	0.47
AFT	Afrimat Ltd	0.24	0.35	0.26	0.26
PPC	PPC	1.14	0.88	1.09	0.33
RBX	Raubex	0.24	0.23	0.24	0.13
WBO	WBHO	0.46	0.02	0.36	0.17
CIL	Cons Infrastructure Grp	0.49	0.30	0.45	0.47
RLO	Reunert	0.54	0.31	0.49	0.17
TKG	Telkom SA	1.00	0.64	0.92	1.16
CHP	Choppies Enterprises Ltd	0.08	-0.69	-0.08	0.27
CLS	Clicks	0.67	0.51	0.63	0.61
PIK	Pick 'n Pay	0.89	0.92	0.89	0.82
SHP	Shoprite	0.92	1.04	0.95	0.33
SPP	Spar	0.78	0.60	0.74	0.58
ARL	Astral Foods	0.79	0.22	0.67	0.54
AVI	AVI	0.64	0.35	0.58	0.21
CLR	Clover Industries	0.49	0.07	0.40	0.70
OCE	Oceana	0.46	0.24	0.41	0.62
PFG	Pioneer Foods	0.95	0.77	0.91	0.65
RCL	RCL Foods Limited	0.16	0.14	0.16	0.57
RFG	Rhodes Food Grp Hldg Ltd	0.24	0.18	0.22	0.20
TBS	Tiger Brands	0.92	0.67	0.86	0.57
TON	Tongaat Hulett	0.75	0.33	0.66	0.48
BAW	Barloworld	1.38	0.70	1.23	0.32
BVT	Bidvest	0.61	0.89	0.67	0.48
KAP	KAP International	0.45	0.33	0.43	0.38
MPT	Mpact Limited	0.37	0.02	0.29	0.54
MUR	Murray & Roberts	1.03	0.42	0.90	0.47
NPK	Nampak	1.05	0.16	0.86	0.79
REM	Remgro	1.10	0.75	1.03	0.83
ADH	Advtech Ltd	0.26	0.34	0.27	-0.21
COH	Curro Holdings Limited	0.56	0.37	0.52	0.02
CSB	Cashbuild	0.72	0.07	0.58	0.15
HSP	Holdsport Limited	0.23	0.23	0.23	1.06
ITE	Italtile Ltd	0.06	-0.14	0.02	0.41
LEW	Lewis Group	0.49	-0.34	0.30	0.68
MRP	Mr Price Group Ltd	1.41	0.89	1.30	0.79
MSM	Massmart	1.24	0.67	1.11	1.00
TFG	Foschini	1.41	0.84	1.28	0.61
TRU	Truworths	1.16	0.87	1.10	0.68
WHL	Woolworths	1.08	0.81	1.02	1.02
ACT	AfroCentric Inv Corp Ltd	0.17	-0.01	0.13	0.31

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LHC	Life Healthcare	0.72	0.82	0.74	0.56
NTC	Netcare	0.84	0.33	0.73	0.83
SNH	Steinhoff Int Hldgs N.V.	1.23	1.12	1.21	0.81
IVT	Invicta	0.39	-0.28	0.24	0.41
GND	Grindrod	0.91	0.27	0.77	0.79
IPL	Imperial	1.66	1.07	1.53	0.84
SPG	Super Group	0.46	0.11	0.38	0.39
TRE	Trencor	0.66	0.25	0.58	1.27
CAT	Caxton	-0.20	0.53	-0.04	0.03
NPN	Naspers	1.42	1.61	1.46	1.39
BLU	Blue Label Telecoms	0.35	0.33	0.34	0.29
MTN	MTN	1.49	0.94	1.37	0.63
VOD	Vodacom	0.42	0.56	0.45	1.01
CFR	Richemont	0.75	0.83	0.77	1.43
AIP	Adcock Ingram	0.36	-0.15	0.25	0.75
APN	Aspen	0.81	0.72	0.79	0.61
ASC	Ascendis Health Ltd	0.34	0.52	0.38	1.12
AEL	Allied Electronics Corp Ltd	0.09	0.22	0.12	0.70
DTC	Datatec	0.67	0.02	0.53	0.38
EOH	EOH	0.76	0.38	0.67	0.43
HDC	Hudaco	0.38	0.16	0.33	0.35
NT1	Net 1 Ueps Tech Inc	0.24	-0.15	0.15	-0.05
NVS	Novus Holdings Limited	0.09	0.57	0.19	-0.09
BTI	British American Tobacco	0.34	0.44	0.36	0.72
CLH	City Lodge Hotels	0.36	0.35	0.36	0.40
FBR	Famous Brands	0.40	0.20	0.36	0.05
SUI	Sun International	0.61	0.08	0.50	0.59
SUR	Spur	0.11	0.10	0.10	0.58
TSH	Tsogo Sun	0.70	0.59	0.67	0.48

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Resource Listings

J203	Company	2016 Daily Beta's	2017 Daily Beta's	5 Year Monthly Beta's	2016-2017 Daily Beta's
ACL	ArcelorMittal SA Ltd	1.59	1.41	1.54	1.32
AFE	AECI	0.46	0.40	0.45	0.57
AFX	Afrox	0.35	-0.23	0.23	0.48
OMN	Omnia	0.65	0.30	0.57	0.75
SOL	Sasol	1.36	1.11	1.31	1.29
MND	Mondi Ltd	0.82	0.82	0.82	1.20
MNP	Mondi Plc	0.81	0.84	0.82	1.27
SAP	Sappi	0.73	0.71	0.72	0.64
KIO	Kumba Iron Ore	1.93	2.37	2.02	0.94
AGL	Anglo American	2.69	1.96	2.53	1.71
AMS	Anglo Platinum	1.38	1.02	1.30	1.30
ANG	Anglogold Ashanti	-0.18	-0.16	-0.18	1.08
ARI	African Rainbow Minerals	1.45	1.88	1.54	1.08
ASR	Assore Ltd	1.77	1.56	1.72	1.33
BIL	BHP Billiton	1.96	1.76	1.92	1.82
EXX	Exxaro	1.56	1.66	1.58	1.17
GFI	Gold Fields	-0.14	0.13	-0.08	0.29
GLN	Glencore PLC	2.16	1.83	2.09	1.84
HAR	Harmony	-0.35	0.11	-0.25	0.64
IMP	Impala Platinum	1.82	1.21	1.68	1.37
LON	Lonmin Plc	2.44	1.50	2.23	3.75
NHM	Northam Platinum	0.60	1.25	0.74	1.79
PAN	Pan African Resources	-0.39	-0.03	-0.31	0.93
RBP	Royal Bafokeng Platinum	0.84	0.14	0.69	0.98
S32	South32 Ltd	1.35	1.22	1.32	1.28
SGL	Sibanye Gold Limited	-0.10	0.85	0.10	2.59

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APPENDIX C

Financials	Training Period (2016)				Event Period (2017)			
	$\tilde{x}$	σ	σ^2	Δ	$\tilde{x}$	σ	σ^2	Δ
BGA	0.05%	0.023	0.001	0.000	-0.04%	0.018	0.000	0.000
CPI	0.08%	0.018	0.000	0.000	0.38%	0.016	0.000	0.000
FSR	0.13%	0.022	0.000	0.000	0.08%	0.016	0.000	0.000
NED	0.13%	0.020	0.000	0.000	0.00%	0.018	0.000	0.000
RMH	0.05%	0.021	0.000	0.000	-0.08%	0.014	0.000	0.000
SBK	0.15%	0.022	0.000	0.000	0.31%	0.019	0.000	0.000
BRN	0.00%	0.024	0.001	0.000	0.00%	0.055	0.003	0.000
NIV	0.00%	0.035	0.001	0.000	0.00%	0.025	0.001	0.000
REI	-0.14%	0.014	0.000	0.000	0.00%	0.011	0.000	0.000
AFH	0.00%	0.025	0.001	0.000	-0.14%	0.018	0.000	0.000
BAT	-0.19%	0.020	0.000	0.000	0.12%	0.012	0.000	0.000
CML	0.00%	0.023	0.001	0.000	-0.25%	0.019	0.000	0.000
HCI	0.00%	0.016	0.000	0.000	-0.01%	0.013	0.000	0.000
INL	-0.01%	0.019	0.000	0.000	0.38%	0.013	0.000	0.000
INP	0.00%	0.018	0.000	0.000	0.37%	0.012	0.000	0.000
JSE	0.01%	0.018	0.000	0.000	-0.37%	0.019	0.000	0.000
KST	0.00%	0.018	0.000	0.000	0.13%	0.016	0.000	0.000
PGR	0.04%	0.019	0.000	0.000	0.00%	0.018	0.000	0.000
PSG	0.04%	0.021	0.000	0.000	0.11%	0.020	0.000	0.000
RMI	0.08%	0.017	0.000	0.000	-0.05%	0.014	0.000	0.000
TCP	0.00%	0.021	0.000	0.000	-0.07%	0.018	0.000	0.000
TTO	0.00%	0.039	0.002	0.000	0.00%	0.080	0.006	0.000
ZED	0.00%	0.020	0.000	0.000	0.00%	0.018	0.000	0.000
DSY	0.15%	0.020	0.000	0.000	-0.07%	0.013	0.000	0.000
LBH	0.00%	0.018	0.000	0.000	-0.03%	0.016	0.000	0.000
MMI	0.02%	0.019	0.000	0.000	-0.42%	0.015	0.000	0.000
OML	-0.04%	0.018	0.000	0.000	-0.21%	0.010	0.000	0.000
SLM	0.15%	0.022	0.000	0.000	0.01%	0.015	0.000	0.000
SNT	0.00%	0.018	0.000	0.000	0.02%	0.012	0.000	0.000
ATT	-0.08%	0.015	0.000	0.000	-0.29%	0.009	0.000	0.000
BWN	-0.17%	0.026	0.001	0.000	-0.24%	0.022	0.000	0.000
CCO	-0.23%	0.024	0.001	0.000	-0.04%	0.018	0.000	0.000
MSP	0.00%	0.019	0.000	0.000	0.00%	0.012	0.000	0.000
SRE	0.00%	0.018	0.000	0.000	0.13%	0.015	0.000	0.000
STP	0.00%	0.021	0.000	0.000	0.00%	0.017	0.000	0.000
TDH	0.00%	0.036	0.001	0.000	0.00%	0.018	0.000	0.000
APF	0.00%	0.029	0.001	0.000	0.00%	0.014	0.000	0.000
AWA	0.12%	0.019	0.000	0.000	0.00%	0.010	0.000	0.000
CRP	0.00%	0.021	0.000	0.000	0.00%	0.016	0.000	0.000
DLT	0.00%	0.019	0.000	0.000	0.11%	0.013	0.000	0.000
EMI	0.07%	0.019	0.000	0.000	0.00%	0.009	0.000	0.000

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EQU	0.00%	0.015	0.000	0.000	0.00%	0.014	0.000	0.000
FFA	0.00%	0.014	0.000	0.000	0.00%	0.011	0.000	0.000
FFB	0.00%	0.017	0.000	0.000	0.00%	0.010	0.000	0.000
GRT	0.08%	0.015	0.000	0.000	0.00%	0.010	0.000	0.000
HYP	0.03%	0.019	0.000	0.000	-0.05%	0.015	0.000	0.000
IAP	0.00%	0.021	0.000	0.000	0.00%	0.009	0.000	0.000
IPF	0.00%	0.018	0.000	0.000	0.00%	0.008	0.000	0.000
ITU	-0.17%	0.021	0.000	0.000	-0.23%	0.016	0.000	0.000
OCT	0.00%	0.019	0.000	0.000	0.00%	0.017	0.000	0.000
RDF	0.10%	0.017	0.000	0.000	0.00%	0.011	0.000	0.000
REB	0.00%	0.018	0.000	0.000	-0.16%	0.011	0.000	0.000
RES	-0.05%	0.017	0.000	0.000	-0.03%	0.010	0.000	0.000
RPL	-0.19%	0.016	0.000	0.000	-0.15%	0.012	0.000	0.000
SAC	0.09%	0.014	0.000	0.000	0.00%	0.010	0.000	0.000
TEX	-0.05%	0.018	0.000	0.000	0.00%	0.014	0.000	0.000
VKE	0.11%	0.016	0.000	0.000	0.00%	0.011	0.000	0.000

$\tilde{x}$	Median
σ	STDev
σ^2	Variance
Δ	Trend (Slope)

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Industrials	Training Period (2016)				Event Period (2017)			
	$\tilde{x}$	σ	σ^2	Δ	$\tilde{x}$	σ	σ^2	Δ
MTA	-0.05%	0.022	0.001	0.000	-0.21%	0.018	0.000	0.000
CVH	-0.11%	0.013	0.000	0.000	-0.24%	0.009	0.000	0.000
DST	-0.08%	0.016	0.000	0.000	-0.11%	0.012	0.000	0.000
AFT	-0.04%	0.026	0.001	0.000	0.00%	0.024	0.001	0.000
PPC	-0.46%	0.043	0.002	0.000	-0.14%	0.022	0.001	0.000
RBX	0.00%	0.023	0.001	0.000	-0.04%	0.013	0.000	0.000
WBO	0.00%	0.022	0.000	0.000	0.11%	0.015	0.000	0.000
CIL	-0.02%	0.016	0.000	0.000	-0.47%	0.016	0.000	0.000
RLO	0.00%	0.014	0.000	0.000	0.00%	0.013	0.000	0.000
TKG	-0.02%	0.024	0.001	0.000	0.05%	0.017	0.000	0.000
CHP	-0.18%	0.027	0.001	0.000	0.00%	0.047	0.002	0.000
CLS	0.00%	0.018	0.000	0.000	0.18%	0.011	0.000	0.000
PIK	-0.03%	0.019	0.000	0.000	-0.37%	0.015	0.000	0.000
SHP	-0.05%	0.020	0.000	0.000	0.32%	0.014	0.000	0.000
SPP	0.02%	0.018	0.000	0.000	-0.18%	0.013	0.000	0.000
ARL	-0.01%	0.020	0.000	0.000	0.00%	0.017	0.000	0.000
AVI	0.06%	0.016	0.000	0.000	0.09%	0.010	0.000	0.000
CLR	0.00%	0.018	0.000	0.000	-0.42%	0.018	0.000	0.000
OCE	0.00%	0.021	0.000	0.000	0.05%	0.016	0.000	0.000
PFG	-0.02%	0.020	0.000	0.000	0.19%	0.020	0.000	0.000
RCL	0.00%	0.023	0.001	0.000	0.00%	0.022	0.000	0.000
RFG	0.00%	0.021	0.000	0.000	-0.21%	0.019	0.000	0.000
TBS	0.11%	0.018	0.000	0.000	-0.13%	0.012	0.000	0.000
TON	0.04%	0.018	0.000	0.000	-0.32%	0.013	0.000	0.000
BAW	0.27%	0.030	0.001	0.000	0.20%	0.019	0.000	0.000
BVT	0.12%	0.075	0.006	0.000	0.14%	0.017	0.000	0.000
KAP	0.00%	0.018	0.000	0.000	0.00%	0.012	0.000	0.000
MPT	0.00%	0.027	0.001	0.000	0.03%	0.014	0.000	0.000
MUR	0.12%	0.029	0.001	0.000	-0.07%	0.021	0.000	0.000
NPK	-0.15%	0.027	0.001	0.000	0.18%	0.016	0.000	0.000
REM	-0.07%	0.018	0.000	0.000	0.02%	0.011	0.000	0.000
ADH	0.00%	0.013	0.000	0.000	-0.16%	0.016	0.000	0.000
COH	0.00%	0.020	0.000	0.000	0.00%	0.015	0.000	0.000
CSB	0.00%	0.020	0.000	0.000	0.07%	0.016	0.000	0.000
HSP	-0.04%	0.023	0.001	0.000	-0.02%	0.016	0.000	0.000
ITE	0.00%	0.020	0.000	0.000	-0.07%	0.017	0.000	0.000
LEW	-0.32%	0.030	0.001	0.000	-0.66%	0.020	0.000	0.000
MRP	0.12%	0.030	0.001	0.000	-0.45%	0.018	0.000	0.000
MSM	-0.16%	0.027	0.001	0.000	-0.34%	0.027	0.001	0.000
TFG	0.05%	0.025	0.001	0.000	-0.16%	0.022	0.000	0.000
TRU	0.00%	0.024	0.001	0.000	-0.34%	0.021	0.000	0.000
WHL	-0.02%	0.020	0.000	0.000	0.03%	0.015	0.000	0.000
ACT	0.00%	0.022	0.000	0.000	0.00%	0.028	0.001	0.000
LHC	0.00%	0.015	0.000	0.000	-0.10%	0.022	0.000	0.000

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NTC	0.00%	0.017	0.000	0.000	0.00%	0.020	0.000	0.000
SNH	0.09%	0.021	0.000	0.000	-0.25%	0.019	0.000	0.000
IVT	0.00%	0.025	0.001	0.000	0.00%	0.016	0.000	0.000
GND	-0.04%	0.028	0.001	0.000	-0.17%	0.015	0.000	0.000
IPL	0.20%	0.030	0.001	0.000	0.12%	0.021	0.000	0.000
SPG	0.08%	0.015	0.000	0.000	0.29%	0.012	0.000	0.000
TRE	-0.17%	0.030	0.001	0.000	0.00%	0.023	0.001	0.000
CAT	0.00%	0.027	0.001	0.000	-0.17%	0.023	0.001	0.000
NPN	-0.01%	0.020	0.000	0.000	0.30%	0.013	0.000	0.000
BLU	-0.03%	0.019	0.000	0.000	-0.39%	0.017	0.000	0.000
MTN	-0.07%	0.029	0.001	0.000	-0.01%	0.018	0.000	0.000
VOD	-0.07%	0.011	0.000	0.000	0.05%	0.010	0.000	0.000
CFR	-0.12%	0.018	0.000	0.000	-0.02%	0.015	0.000	0.000
AIP	0.00%	0.019	0.000	0.000	-0.16%	0.015	0.000	0.000
APN	-0.04%	0.019	0.000	0.000	0.33%	0.014	0.000	0.000
ASC	-0.02%	0.020	0.000	0.000	0.08%	0.021	0.000	0.000
AEL	0.00%	0.045	0.002	0.000	0.10%	0.031	0.001	0.000
DTC	0.07%	0.022	0.000	0.000	-0.09%	0.019	0.000	0.000
EOH	0.00%	0.016	0.000	0.000	-0.34%	0.020	0.000	0.000
HDC	0.00%	0.020	0.000	0.000	-0.03%	0.012	0.000	0.000
NT1	0.00%	0.036	0.001	0.000	0.00%	0.027	0.001	0.000
NVS	0.00%	0.027	0.001	0.000	0.00%	0.064	0.004	0.000
BTI	-0.08%	0.013	0.000	0.000	0.28%	0.012	0.000	0.000
CLH	0.00%	0.019	0.000	0.000	-0.13%	0.016	0.000	0.000
FBR	0.17%	0.017	0.000	0.000	-0.11%	0.017	0.000	0.000
SUI	-0.01%	0.024	0.001	0.000	-0.07%	0.026	0.001	0.000
SUR	0.00%	0.020	0.000	0.000	-0.03%	0.013	0.000	0.000
TSH	-0.02%	0.017	0.000	0.000	0.00%	0.018	0.000	0.000

$\tilde{x}$	Median
σ	STDev
σ^2	Variance
Δ	Trend (Slope)

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Resources	Training Period (2016)				Event Period (2017)			
	$\tilde{x}$	σ	σ^2	Δ	$\tilde{x}$	σ	σ^2	Δ
ACL	0.00%	0.049	0.002	0.000	-0.70%	0.034	0.001	0.000
AFE	0.02%	0.016	0.000	0.000	-0.11%	0.012	0.000	0.000
AFX	0.00%	0.026	0.001	0.000	-0.10%	0.012	0.000	0.000
OMN	-0.03%	0.019	0.000	0.000	-0.01%	0.018	0.000	0.000
SOL	-0.11%	0.022	0.001	0.000	-0.19%	0.014	0.000	0.000
MND	0.03%	0.015	0.000	0.000	-0.08%	0.011	0.000	0.000
MNP	-0.07%	0.015	0.000	0.000	0.16%	0.011	0.000	0.000
SAP	-0.01%	0.022	0.000	0.000	0.09%	0.016	0.000	0.000
KIO	0.25%	0.052	0.003	0.000	-0.82%	0.040	0.002	0.000
AGL	0.50%	0.043	0.002	0.000	-0.25%	0.022	0.000	0.000
AMS	-0.13%	0.037	0.001	0.000	0.05%	0.030	0.001	0.000
ANG	-0.11%	0.036	0.001	0.000	-0.47%	0.027	0.001	0.000
ARI	0.12%	0.038	0.001	0.000	-0.25%	0.036	0.001	0.000
ASR	0.48%	0.044	0.002	0.000	0.48%	0.032	0.001	0.000
BIL	0.12%	0.029	0.001	0.000	-0.16%	0.019	0.000	0.000
EXX	0.37%	0.036	0.001	0.000	-0.19%	0.032	0.001	0.000
GFI	-0.14%	0.040	0.002	0.000	0.05%	0.031	0.001	0.000
GLN	0.25%	0.036	0.001	0.000	-0.12%	0.022	0.000	0.000
HAR	-0.03%	0.043	0.002	0.000	-0.36%	0.037	0.001	0.000
IMP	-0.10%	0.044	0.002	0.000	-0.39%	0.030	0.001	0.000
LON	-0.51%	0.059	0.003	0.000	-0.50%	0.057	0.003	0.000
NHM	0.06%	0.030	0.001	0.000	-0.19%	0.025	0.001	0.000
PAN	0.00%	0.032	0.001	0.000	0.00%	0.018	0.000	0.000
RBP	-0.09%	0.031	0.001	0.000	-0.09%	0.020	0.000	0.000
S32	0.17%	0.029	0.001	0.000	-0.22%	0.024	0.001	0.000
SGL	-0.26%	0.039	0.002	0.000	-0.37%	0.064	0.004	-0.001

$\tilde{x}$	Median
σ	STDev
σ^2	Variance
Δ	Trend (Slope)

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APPENDIX D

Autocorrelation coefficients of sample constitutes and Indices over training period (2016)

Ticker	Industry	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
BGA	Financials	0.02	-0.15	-0.05	-0.06	0.02
CPI	Financials	0.07	-0.11	-0.08	-0.02	0.11
FSR	Financials	0.13	-0.24	-0.15	-0.07	0.01
NED	Financials	0.03	-0.11	-0.08	-0.06	-0.03
RMH	Financials	0.02	-0.16	-0.08	-0.12	0.07
SBK	Financials	0.08	-0.06	-0.06	-0.08	-0.07
BRN	Financials	-0.10	-0.12	-0.05	-0.06	0.01
NIV	Financials	-0.14	-0.04	-0.11	0.04	-0.08
REI	Financials	-0.01	-0.07	0.01	-0.05	-0.06
AFH	Financials	0.00	0.02	0.02	-0.08	-0.05
BAT	Financials	0.02	-0.10	-0.02	-0.06	-0.07
CML	Financials	0.00	-0.06	-0.02	-0.05	-0.05
HCI	Financials	-0.10	0.03	0.03	-0.08	0.06
INL	Financials	0.03	-0.10	-0.03	-0.11	-0.07
INP	Financials	0.04	-0.07	0.00	-0.14	-0.08
JSE	Financials	-0.04	-0.06	-0.06	-0.03	0.03
KST	Financials	-0.27	-0.04	0.00	0.01	-0.07
PGR	Financials	-0.06	-0.06	0.00	0.04	-0.04
PSG	Financials	0.00	-0.14	0.01	-0.04	0.12
RMI	Financials	-0.04	-0.06	-0.11	-0.01	-0.08
TCP	Financials	-0.22	-0.09	0.02	0.03	0.08
TTO	Financials	-0.15	-0.11	0.02	-0.06	0.08
ZED	Financials	0.06	-0.04	-0.10	0.01	0.06
DSY	Financials	-0.04	-0.16	-0.08	0.07	-0.08
LBH	Financials	-0.04	-0.09	0.01	-0.08	-0.10
MMI	Financials	0.08	-0.17	-0.08	-0.14	-0.04
OML	Financials	0.08	-0.13	-0.04	-0.17	-0.10
SLM	Financials	0.00	-0.12	-0.08	-0.07	0.00
SNT	Financials	-0.18	-0.09	0.06	-0.06	0.02
ATT	Financials	-0.06	-0.11	-0.03	-0.10	-0.03
BWN	Financials	0.07	0.03	0.09	-0.03	0.03
CCO	Financials	0.28	-0.10	-0.12	-0.14	0.00
MSP	Financials	-0.03	-0.01	0.03	0.06	-0.05
SRE	Financials	-0.14	0.06	0.08	-0.02	-0.06
STP	Financials	-0.17	-0.03	-0.01	0.04	-0.09
TDH	Financials	-0.26	-0.01	-0.07	-0.01	0.04
APF	Financials	-0.27	-0.15	-0.11	0.20	-0.17
AWA	Financials	-0.21	0.11	-0.16	-0.02	-0.01
CRP	Financials	-0.04	0.04	-0.11	-0.14	0.04
DLT	Financials	-0.27	0.06	-0.07	-0.04	0.06

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EMI	Financials	-0.07	-0.07	0.11	-0.02	0.04
EQU	Financials	-0.32	0.01	-0.02	-0.01	-0.01
FFA	Financials	-0.23	-0.11	-0.01	0.01	-0.06
FFB	Financials	-0.08	0.06	-0.13	-0.03	0.05
GRT	Financials	-0.08	-0.11	-0.04	-0.04	0.04
HYP	Financials	-0.07	-0.12	-0.07	-0.05	0.09
IAP	Financials	-0.25	-0.08	0.00	0.06	-0.03
IPF	Financials	-0.29	-0.13	0.03	0.01	-0.03
ITU	Financials	0.20	-0.07	-0.16	-0.19	0.00
OCT	Financials	-0.16	-0.02	-0.02	-0.04	-0.06
RDF	Financials	-0.05	-0.12	-0.05	-0.02	0.01
REB	Financials	-0.14	0.02	-0.08	-0.05	0.02
RES	Financials	-0.10	0.00	-0.02	-0.02	0.09
RPL	Financials	0.15	-0.01	-0.04	-0.16	0.05
SAC	Financials	-0.17	0.00	0.05	-0.09	0.06
TEX	Financials	-0.15	-0.01	0.00	0.08	-0.04
VKE	Financials	-0.19	0.01	0.01	-0.02	-0.07
MTA	Industrials	-0.04	0.00	-0.04	-0.06	-0.01
CVH	Industrials	-0.12	-0.01	-0.08	0.09	-0.15
DST	Industrials	-0.12	-0.08	-0.01	0.04	-0.01
AFT	Industrials	-0.06	-0.01	-0.06	0.09	-0.04
PPC	Industrials	0.06	-0.08	0.01	0.06	0.01
RBX	Industrials	0.00	-0.02	-0.08	-0.10	-0.01
WBO	Industrials	-0.15	0.00	0.10	-0.01	-0.07
CIL	Industrials	-0.13	0.02	0.16	-0.15	0.12
RLO	Industrials	-0.09	-0.01	-0.01	0.02	-0.06
TKG	Industrials	-0.01	-0.13	-0.03	-0.09	-0.04
CHP	Industrials	-0.19	-0.06	0.06	0.00	-0.03
CLS	Industrials	-0.08	-0.11	-0.06	0.02	-0.01
PIK	Industrials	-0.01	-0.10	-0.04	0.01	0.03
SHP	Industrials	-0.07	-0.04	-0.02	0.00	0.08
SPP	Industrials	-0.08	-0.11	-0.15	0.01	0.06
ARL	Industrials	0.14	-0.03	-0.06	-0.07	-0.02
AVI	Industrials	-0.16	-0.03	-0.06	-0.09	-0.01
CLR	Industrials	-0.14	0.01	0.08	-0.06	-0.02
OCE	Industrials	-0.10	-0.05	-0.14	-0.03	-0.10
PFG	Industrials	-0.11	-0.01	-0.11	0.00	0.09
RCL	Industrials	-0.18	-0.07	0.08	0.00	-0.07
RFG	Industrials	-0.12	-0.05	-0.06	0.07	0.02
TBS	Industrials	-0.13	-0.05	0.00	-0.10	0.04
TON	Industrials	0.07	0.01	-0.11	-0.02	-0.14
BAW	Industrials	-0.09	-0.11	0.01	-0.03	0.05
BVT	Industrials	-0.08	-0.04	-0.03	-0.01	0.01
KAP	Industrials	-0.11	0.08	-0.08	-0.09	0.11
MPT	Industrials	0.03	-0.16	-0.07	0.01	0.07
MUR	Industrials	0.03	0.03	0.05	-0.06	-0.09

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NPK	Industrials	0.05	-0.04	-0.06	-0.06	-0.05
REM	Industrials	-0.02	-0.14	-0.07	-0.04	0.01
ADH	Industrials	-0.17	0.02	-0.15	0.12	-0.08
COH	Industrials	0.17	-0.02	0.06	0.03	-0.09
CSB	Industrials	-0.09	-0.01	-0.02	-0.13	0.04
HSP	Industrials	-0.21	0.05	-0.06	0.03	0.02
ITE	Industrials	-0.40	0.12	-0.15	0.07	0.00
LEW	Industrials	-0.03	0.02	0.10	-0.12	0.06
MRP	Industrials	0.10	-0.06	-0.02	0.00	0.01
MSM	Industrials	0.02	-0.14	0.05	0.02	0.03
TFG	Industrials	0.06	-0.11	-0.12	-0.12	-0.04
TRU	Industrials	0.06	-0.13	-0.10	-0.02	0.05
WHL	Industrials	-0.07	-0.14	-0.02	-0.03	0.04
ACT	Industrials	-0.12	-0.09	-0.11	0.06	0.11
LHC	Industrials	-0.03	-0.13	-0.02	0.13	-0.03
NTC	Industrials	0.03	-0.09	-0.05	-0.07	0.06
SNH	Industrials	0.02	-0.04	-0.13	0.04	-0.06
IVT	Industrials	0.12	0.12	0.11	0.00	0.01
GND	Industrials	0.03	-0.09	0.00	0.04	0.05
IPL	Industrials	-0.01	-0.16	-0.01	-0.18	-0.04
SPG	Industrials	-0.11	0.06	-0.04	0.03	-0.04
TRE	Industrials	-0.09	0.08	0.06	-0.13	0.02
CAT	Industrials	-0.43	0.05	-0.04	-0.06	0.05
NPN	Industrials	0.01	-0.03	0.03	-0.03	0.01
BLU	Industrials	0.00	-0.08	-0.06	0.07	0.00
MTN	Industrials	0.01	-0.16	-0.09	0.05	-0.04
VOD	Industrials	0.01	-0.06	-0.02	-0.07	0.09
CFR	Industrials	-0.07	-0.08	-0.11	-0.03	0.00
AIP	Industrials	-0.13	0.06	-0.05	-0.02	0.06
APN	Industrials	-0.06	-0.10	0.08	-0.04	-0.03
ASC	Industrials	0.02	-0.08	0.06	0.10	-0.05
AEL	Industrials	-0.33	-0.04	0.06	-0.04	-0.02
DTC	Industrials	0.09	-0.04	0.10	0.04	-0.10
EOH	Industrials	0.07	-0.16	0.00	0.12	-0.06
HDC	Industrials	-0.09	0.11	-0.13	0.09	-0.15
NT1	Industrials	-0.25	0.01	0.06	0.06	0.01
NVS	Industrials	-0.25	0.02	-0.02	-0.07	-0.05
BTI	Industrials	-0.09	-0.02	0.01	-0.04	0.03
CLH	Industrials	-0.14	-0.07	0.07	0.05	-0.08
FBR	Industrials	-0.12	0.00	0.00	0.00	0.05
SUI	Industrials	0.00	-0.06	0.04	-0.05	-0.12
SUR	Industrials	-0.46	0.14	-0.12	-0.06	0.22
TSH	Industrials	-0.10	-0.01	-0.08	-0.09	0.07
ACL	Resources	0.08	-0.07	-0.08	-0.04	-0.05
AFE	Resources	-0.14	-0.01	0.05	0.01	-0.02
AFX	Resources	-0.18	0.01	-0.16	0.02	0.12

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OMN	Resources	-0.13	0.04	0.03	-0.10	0.06
SOL	Resources	-0.02	-0.10	0.04	-0.01	-0.03
MND	Resources	0.04	-0.07	0.00	-0.03	-0.11
MNP	Resources	0.08	-0.03	-0.02	-0.08	-0.09
SAP	Resources	-0.04	-0.12	0.07	0.03	-0.04
KIO	Resources	0.04	0.03	-0.05	0.04	0.06
AGL	Resources	0.06	-0.15	-0.09	-0.12	0.01
AMS	Resources	-0.14	-0.01	0.01	0.01	0.08
ANG	Resources	-0.04	-0.09	0.10	-0.03	0.04
ARI	Resources	0.13	-0.05	0.05	0.04	-0.03
ASR	Resources	0.00	-0.10	0.06	0.02	-0.06
BIL	Resources	0.07	-0.13	0.00	-0.09	-0.05
EXX	Resources	0.12	-0.07	0.02	0.00	0.01
GFI	Resources	-0.15	-0.04	0.07	-0.08	0.05
GLN	Resources	0.09	-0.15	-0.03	-0.16	-0.13
HAR	Resources	0.03	0.00	0.13	-0.07	0.15
IMP	Resources	-0.02	-0.04	-0.04	0.03	0.06
LON	Resources	0.18	0.07	-0.02	-0.05	-0.03
NHM	Resources	0.13	0.16	-0.10	-0.04	-0.04
PAN	Resources	0.06	-0.12	0.00	-0.02	0.06
RBP	Resources	0.14	-0.01	0.06	-0.08	0.04
S32	Resources	0.03	0.00	-0.06	-0.05	-0.02
SGL	Resources	0.01	-0.03	0.06	-0.02	0.12
J203	Index	0.08	-0.18	-0.05	-0.08	-0.10
J212	Index	0.11	-0.16	-0.09	-0.14	-0.07
J211	Index	0.02	-0.14	0.02	-0.03	-0.10
J210	Index	0.04	-0.17	-0.05	-0.09	-0.03
STX40	Index	0.06	-0.18	-0.03	-0.07	-0.11

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Autocorrelation coefficients of sample constitutes and Indices during event period (2017).

Ticker	Industry	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
BGA	Financials	-0.09	-0.21	0.15	0.14	-0.14
CPI	Financials	-0.03	-0.08	-0.11	0.13	-0.03
FSR	Financials	0.11	0.11	0.09	0.15	0.07
NED	Financials	0.07	-0.03	0.01	0.05	-0.02
RMH	Financials	0.02	0.27	0.00	0.19	-0.01
SBK	Financials	0.00	0.16	-0.08	0.00	-0.11
BRN	Financials	-0.15	-0.33	0.17	-0.07	-0.25
NIV	Financials	-0.08	-0.23	0.08	-0.10	0.20
REI	Financials	0.01	0.11	0.08	0.01	0.11
AFH	Financials	-0.21	-0.04	-0.02	0.03	-0.29
BAT	Financials	-0.13	0.01	-0.20	-0.03	-0.16
CML	Financials	-0.16	0.06	-0.11	-0.16	0.14
HCI	Financials	-0.24	-0.04	-0.29	-0.33	0.10
INL	Financials	-0.13	-0.05	-0.08	-0.01	-0.04
INP	Financials	-0.11	0.01	-0.17	-0.04	-0.08
JSE	Financials	0.12	0.15	0.00	0.01	0.12
KST	Financials	-0.51	0.09	0.03	-0.01	-0.22
PGR	Financials	0.10	0.01	-0.11	-0.28	-0.23
PSG	Financials	0.21	-0.03	0.12	0.12	-0.11
RMI	Financials	0.00	-0.23	-0.04	0.03	0.14
TCP	Financials	-0.31	-0.19	-0.07	0.12	-0.24
TTO	Financials	-0.50	0.00	-0.03	0.06	-0.03
ZED	Financials	-0.10	-0.16	0.09	0.00	-0.03
DSY	Financials	0.16	0.01	-0.01	-0.07	0.03
LBH	Financials	0.05	-0.02	0.13	-0.31	-0.12
MMI	Financials	0.05	0.21	0.03	-0.10	0.02
OML	Financials	-0.13	0.09	0.11	-0.27	0.08
SLM	Financials	-0.12	0.01	0.18	-0.13	-0.04
SNT	Financials	0.04	0.15	-0.18	-0.11	-0.16
ATT	Financials	-0.08	-0.02	0.05	-0.02	-0.05
BWN	Financials	-0.28	-0.11	-0.02	0.12	-0.05
CCO	Financials	0.02	0.18	0.01	0.09	0.12
MSP	Financials	-0.20	0.03	0.12	0.07	-0.14
SRE	Financials	-0.08	0.03	-0.13	0.10	0.10
STP	Financials	-0.16	0.15	0.12	-0.08	0.11
TDH	Financials	-0.11	0.01	-0.03	-0.25	0.00
APF	Financials	-0.33	0.06	-0.25	0.14	-0.04
AWA	Financials	0.19	-0.08	-0.18	-0.22	0.11
CRP	Financials	-0.02	-0.12	0.06	0.20	-0.09
DLT	Financials	-0.17	0.04	-0.03	0.19	-0.04
EMI	Financials	-0.03	-0.07	-0.12	0.03	-0.04

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EQU	Financials	-0.29	0.08	0.01	-0.06	0.02
FFA	Financials	-0.19	0.06	-0.05	-0.12	0.17
FFB	Financials	-0.20	0.01	-0.09	-0.02	-0.12
GRT	Financials	-0.14	0.28	-0.06	-0.10	-0.02
HYP	Financials	-0.05	0.15	-0.05	-0.08	0.10
IAP	Financials	-0.08	-0.03	-0.18	-0.18	0.25
IPF	Financials	-0.26	0.12	-0.03	-0.02	-0.18
ITU	Financials	0.00	0.03	0.14	0.13	-0.20
OCT	Financials	-0.13	0.04	0.00	-0.01	-0.02
RDF	Financials	0.02	-0.05	-0.02	-0.11	-0.23
REB	Financials	-0.07	0.07	-0.20	0.09	-0.09
RES	Financials	-0.08	0.08	0.11	0.07	-0.18
RPL	Financials	0.22	-0.19	0.05	0.04	-0.13
SAC	Financials	-0.08	-0.07	0.11	-0.09	0.16
TEX	Financials	-0.10	-0.24	0.12	-0.11	-0.01
VKE	Financials	0.00	0.04	-0.12	-0.09	-0.06
MTA	Industrials	-0.19	0.11	-0.02	-0.43	0.09
CVH	Industrials	-0.32	0.12	-0.34	0.03	0.00
DST	Industrials	-0.38	0.16	-0.28	0.20	-0.17
AFT	Industrials	0.02	-0.33	-0.01	0.05	-0.12
PPC	Industrials	-0.23	0.04	0.07	-0.22	0.01
RBX	Industrials	-0.17	-0.09	-0.20	0.09	0.10
WBO	Industrials	0.22	0.09	-0.12	-0.13	-0.08
CIL	Industrials	-0.29	0.06	-0.25	0.30	-0.07
RLO	Industrials	0.11	-0.30	-0.22	-0.08	0.02
TKG	Industrials	0.05	-0.25	-0.01	-0.01	-0.13
CHP	Industrials	-0.48	0.14	0.10	-0.18	0.01
CLS	Industrials	-0.13	0.02	-0.03	0.00	-0.13
PIK	Industrials	-0.15	0.03	-0.34	0.16	0.02
SHP	Industrials	-0.01	-0.02	-0.14	0.00	0.05
SPP	Industrials	-0.16	-0.05	0.06	0.01	-0.04
ARL	Industrials	0.11	-0.26	0.15	0.26	-0.04
AVI	Industrials	-0.02	0.04	0.06	-0.01	0.15
CLR	Industrials	0.01	-0.15	0.07	0.00	-0.02
OCE	Industrials	-0.04	-0.11	-0.06	-0.25	-0.21
PFG	Industrials	-0.15	0.00	0.28	-0.01	0.11
RCL	Industrials	-0.30	0.00	0.12	-0.21	0.23
RFG	Industrials	-0.39	-0.16	0.13	0.00	-0.12
TBS	Industrials	0.02	-0.04	0.00	-0.05	0.08
TON	Industrials	0.06	0.01	0.13	-0.08	0.18
BAW	Industrials	-0.10	-0.17	-0.10	-0.06	0.27
BVT	Industrials	-0.09	-0.08	0.14	0.09	-0.10
KAP	Industrials	0.18	0.08	0.06	-0.20	0.02
MPT	Industrials	-0.01	0.02	-0.02	0.19	-0.05
MUR	Industrials	0.17	-0.04	-0.25	-0.35	0.00
NPK	Industrials	-0.15	-0.08	-0.25	0.08	-0.03

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REM	Industrials	0.05	0.02	0.07	-0.09	-0.12
ADH	Industrials	0.04	-0.02	0.17	0.07	-0.08
COH	Industrials	0.00	0.06	0.07	-0.10	0.01
CSB	Industrials	0.08	-0.06	-0.13	-0.24	0.00
HSP	Industrials	-0.40	-0.05	0.14	0.05	-0.22
ITE	Industrials	-0.02	-0.19	0.12	0.30	-0.05
LEW	Industrials	-0.01	-0.04	-0.01	-0.11	-0.02
MRP	Industrials	0.08	-0.03	0.04	0.09	-0.06
MSM	Industrials	-0.05	0.09	-0.03	0.04	0.02
TFG	Industrials	0.04	-0.15	0.24	0.20	-0.04
TRU	Industrials	-0.23	0.08	0.01	0.04	0.16
WHL	Industrials	-0.07	-0.18	-0.04	0.15	0.03
ACT	Industrials	-0.29	-0.04	0.08	-0.03	-0.11
LHC	Industrials	0.12	0.14	0.19	0.22	0.04
NTC	Industrials	0.27	-0.13	0.00	0.11	0.28
SNH	Industrials	0.18	0.10	-0.05	-0.13	-0.07
IVT	Industrials	-0.30	0.17	0.00	-0.07	0.12
GND	Industrials	0.12	-0.08	0.00	0.09	0.19
IPL	Industrials	-0.10	0.04	0.07	-0.16	-0.03
SPG	Industrials	0.11	-0.08	0.16	0.04	-0.05
TRE	Industrials	0.17	-0.23	-0.16	-0.11	-0.12
CAT	Industrials	-0.24	-0.15	0.05	-0.22	0.26
NPN	Industrials	-0.16	-0.15	0.00	-0.02	0.05
BLU	Industrials	0.02	0.14	-0.20	-0.14	0.03
MTN	Industrials	-0.13	-0.23	-0.03	-0.13	-0.16
VOD	Industrials	0.00	-0.03	0.19	0.25	-0.06
CFR	Industrials	0.18	0.00	0.03	0.00	-0.08
AIP	Industrials	0.04	-0.14	-0.16	0.03	-0.08
APN	Industrials	-0.14	0.18	-0.02	-0.12	-0.17
ASC	Industrials	0.04	0.06	-0.16	0.02	-0.10
AEL	Industrials	-0.28	-0.23	-0.04	0.17	-0.19
DTC	Industrials	0.11	-0.07	-0.10	-0.01	-0.32
EOH	Industrials	-0.04	-0.01	0.04	-0.11	0.00
HDC	Industrials	-0.11	0.00	-0.11	0.05	-0.02
NT1	Industrials	0.06	-0.26	-0.30	-0.11	0.25
NVS	Industrials	-0.51	0.02	-0.02	0.02	0.00
BTI	Industrials	0.00	0.05	0.11	0.02	-0.09
CLH	Industrials	0.09	0.04	-0.21	-0.46	-0.29
FBR	Industrials	0.32	0.03	0.03	0.06	-0.07
SUI	Industrials	0.11	-0.15	-0.15	-0.12	-0.04
SUR	Industrials	0.06	-0.03	-0.09	-0.01	-0.18
TSH	Industrials	-0.27	0.01	-0.20	0.01	-0.07
ACL	Resources	0.15	-0.27	-0.11	0.01	0.24
AFE	Resources	-0.03	-0.02	-0.03	0.00	0.08
AFX	Resources	-0.02	-0.14	-0.10	0.19	0.01
OMN	Resources	-0.43	0.06	-0.10	0.09	-0.15

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SOL	Resources	0.05	0.05	0.11	-0.06	0.05
MND	Resources	0.01	0.15	0.16	0.00	0.02
MNP	Resources	0.09	0.12	0.25	-0.03	0.01
SAP	Resources	-0.10	-0.04	0.19	-0.15	-0.01
KIO	Resources	-0.01	0.18	-0.02	-0.03	-0.18
AGL	Resources	0.07	-0.01	0.15	0.00	-0.14
AMS	Resources	-0.11	0.12	-0.01	0.15	-0.08
ANG	Resources	0.10	0.20	0.09	0.04	0.18
ARI	Resources	-0.16	0.13	-0.16	0.08	-0.13
ASR	Resources	0.02	0.06	-0.10	0.01	-0.21
BIL	Resources	0.15	0.07	0.15	-0.15	-0.18
EXX	Resources	-0.26	0.16	-0.02	0.07	-0.27
GFI	Resources	-0.04	0.26	0.15	0.05	-0.08
GLN	Resources	0.15	0.01	-0.06	-0.19	-0.19
HAR	Resources	-0.03	0.08	0.18	0.10	0.08
IMP	Resources	-0.09	0.30	-0.03	0.15	-0.03
LON	Resources	0.18	0.00	-0.15	-0.06	0.02
NHM	Resources	0.14	0.03	-0.02	-0.08	-0.08
PAN	Resources	0.20	0.10	-0.05	-0.16	-0.18
RBP	Resources	0.09	0.02	0.00	-0.07	-0.12
S32	Resources	0.20	0.03	-0.07	0.01	-0.19
SGL	Resources	0.07	0.07	0.17	0.09	-0.01
J203	Index	0.06	-0.04	-0.14	-0.22	-0.15
J212	Index	0.00	0.11	0.09	0.00	0.00
J211	Index	0.05	-0.03	-0.15	-0.16	-0.14
J210	Index	0.21	0.14	0.23	-0.07	-0.13
STX40	Index	0.06	-0.03	-0.11	-0.22	-0.14

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