UNIVERSITY OF KWAZULU-NATAL

THE EFFECT OF INCLUSIONS AND EXCLUSIONS OF STOCKS FROM THE JSE TOP 40 AND FTSE/JSE MID CAP INDICES ON LIQUIDITY

By

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DEDICATION

For my parents, Jay and Ashley Naicker.

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"On the other side of a storm is the strength that comes from having navigated through it. Raise your sail and begin."

— Gregory S. William

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ABSTRACT

The inclusion and deletions of stock from the equity indices provide an important insight into a company's performance. There is evidence there are no studies on the effects of inclusions and exclusions of liquidity in a South African market as previous studies in such a market relates to price and index rebalancing effects as a result of inclusions and exclusions to the FTSE/JSE and JSE Top 40. The insights that international studies provide are useful and these effects explored in a South African context would be useful and close the gap in this area of research and this is one of the main aims of the study. The lack of studies analysing the impact on liquidity as a result of inclusions and exclusions to the JSE Top 40 and Mid Cap Index is a disadvantage to South African investors, companies, and regulators. Therefore, the primary objective of this study is to investigate the effect of inclusions and exclusions on the Top 40 and Mid Cap Index on liquidity as well as to determine how does the size of a firm impacts the liquidity effects of an index addition or deletion.

The paper seeks to determine these effects by using an event study methodology by regressing a number of different liquidity proxies (turnover, aggregate turnover, bid-ask spread, percentage spread and Amihud Illiquidity measure) using daily data for the companies that have been included and excluded from the indices. This study analyses 44 inclusions and exclusions on the JSE Top 40 and 73 and 81 inclusions and exclusions on the Mid Cap index from January 2010 to December 2020.

The results from this study provide important insights into the effects of index revisions and firm size on liquidity. For stocks that form part of the inclusions to an index, there in an increase in liquidity as a result of the increased trade after the stock was included in the Top 40 and provides support from the Downward Sloping Demand Curve Hypothesis, Price Pressure Hypothesis and Liquidity Cost Hypothesis. For exclusions stocks, shows a decrease in volume traded and increasing spreads for the Top 40 and indicates that this diminished liquidity observed for such companies that find themselves excluded in both the Top 40 and Mid Cap indices which supports the information cost liquidity hypothesis.

Keywords: JSE, Liquidity, South Africa, Indices, Event Study, Liquidity Proxies

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LIST OF ACRONYMS

PPH:	Price Pressure Hypothesis
LCH:	Liquidity Cost Hypothesis
ICH:	Information Content Hypothesis
IRH	Investor Recognition Hypothesis
FTSE:	Financial Times Stock Exchange
JSE:	Johannesburg Stock Exchange
S&P 500:	Standard and Poor's 500
NYSE:	New York Stock Exchange
OTC:	Over the Counter
SEHK:	Hong Kong Stock Exchange
OLS:	Ordinary Least Squares
OBX:	Oslo Børs Total Return Index
CAPM:	Capital Asset Pricing Model
AARs:	Average Abnormal Returns
CAARs:	Cumulative Average Abnormal Returns
RE:	Random Effects
FE:	Fixed Effects

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CHAPTER 1: INTRODUCTION

1.1 Background and Problem Definition

This chapter begins with the discussion of indexing followed by a further look into the index effects. Thereafter the research objectives are outlined, scope and method briefly explained, and the chapter is concluded with an overview of the structure of the remainder of this thesis.

1.1.1 Indexing

The correlation between prices and all of the information available in a market is an important concept used to measure efficiency in the stock market (Rossi, 2018). The Efficient Market Hypothesis (EMH), also known as the Random Walk Theory, holds that the equity value of a publicly traded company reflects all information about the company's value (Kendall, 1953). Eugene Fama proposed the term "efficient market" in 1965. He claimed that stocks are always traded at a fair price. This makes it impossible for investors to buy stocks that are undervalued or sell stocks that are overvalued. When prices react quickly and, on average, without bias to new information, a market is efficient. As a result, there's no reason to conclude that prices are abnormally high or low. So, in an efficient environment, beating the market is impossible. According to this view, an investor's primary concern is deciding on a risk-reward trade-off (Rossi, 2018).

Active investing is a method that entails frequent trading with the goal of outperforming the market index. Every investment in an active fund manager's portfolio is evaluated using a wide range of data. Managers use this data to buy and sell assets in order to profit from short-term price swings and keep the fund's asset allocation on track. Passive investing is a long-term investment approach that focuses on buying and owning assets. Unlike active investing, which focuses on individual stocks, passive investing is acquiring shares of index funds or exchange-traded funds (ETFs) that attempt to replicate the performance of key market indices (indexing) (Napoletano & Schmidt, 2021).

According to the EMH, active portfolio management is ineffective since it is theoretically impossible to consistently time the market and profit from mispriced companies. As a result, there has been a shift in recent years toward passive investment strategies, notably index investing, which enables investors to earn close to the market average while avoiding hefty trading costs and fees (Afego, 2017).

Indexing is a type of passive investing in which a portfolio is built to track the performance of a market index. Index investing is a method of generating returns that are similar to those of a given market index. This is accomplished by purchasing shares of ETF's that reflect an underlying benchmark index. This passive investment strategy has effectively reduced management costs and expense ratios because the holdings in an index investing portfolio do not change regularly.

1.1.2 Indexing Effects

Indexing has become increasingly popular over the last few years (Hayes, 2021). The increased popularity of utilising indices as benchmarks has led to a phenomenon called the index effect. This is described as a market inefficiency whereby stocks experience abnormal returns and trading volumes when added in or deleted from an index. This effect may be positive or negative and there are a few explanations for this anomaly. One such explanation is that the index funds will purchase newly added stocks in order to replicate a change in the index. The increase in demand then leads to price appreciation. Another explanation is that index inclusions lead to growing attention from possible investors, the increased accessibility of information as well as the increased liquidity in the stock which decreases the trading cost and results in higher prices (Blomstrand & Säfstrand, 2010). This effect can be short term or long term.

Multiple hypotheses and studies have been analysed and tested with regard to the index effect. They are the:

- **Downward Sloping Demand Curve (DSDC) hypothesis**

The hypothesis makes the assumption that the differing stocks don't serve as close substitutes in minds of the investors. As a stock encounters increases or decreases in demand shocks, the volume and price tendency to move upwards or downwards until it reaches its new equilibrium. Using this notion towards the index effect, this hypothesis notes a permanent decrease or increase in volume and price can be projected after an index revision (Rahman & Rajib, 2014).

- **Price Pressure Hypothesis (PPH)**

According to Rahman and Rajib (2014) the PPH theorises that increases in price and volume in the short run will be linked to the increased buying of stocks whilst decreases in price and volume in the short run should be linked to the increased selling of stocks. Therefore, volume

and price increases for inclusions and decreases with exclusions. Contrasting this theory is the DSDC hypothesis where a permanent price change is explained where the PPH states a temporary change in price caused by market frictions. However, both assume that information effects possibly do not play a role.

- **Liquidity Cost Hypothesis (LCH)**

The LCH theorises that when there is an addition of stocks to the index they in turn become economical to trade for investors because of the decrease of transactions costs and an increase in liquidity. The addition to the index results in a reduction in trading costs and more frequent trading activity. An exclusion to the index causes the reverse to occur (Rahman & Rajib, 2014).

- **Information Content Hypothesis (ICH)**

The ICH state that the inclusion or deletion to the index discloses advantageous new information to investors which as a result has a permanent effect on the prices of stocks.

- **Market Segmentation/Investor Recognition Hypothesis (IRH)**

The IRH theorises that new knowledgeable investors gravitate towards the firm by market-attracted information which leads to the permanent appreciation of the stock price (Rahman & Rajib, 2014).

Variations in the structure of an index provides a chance to study the volume and price patterns of companies being deleted from or added to an index. Liu (2011) provides evidence of adjustments in share prices when a company is being deleted or added from an index and implies that the index membership will affect how investors will value that share. The effects inclusions and deletions have on volume and price can be explained by the PPH (temporary change in price) and DSDC (permanent change in price) discussed above. The inclusion or deletion of stocks in an index not only provide information around volume and price effects, but also reveal other kinds of information around a company such as effects on price (LCH reveals information around trading activity as a result of inclusions, ICH provides information on advantageous information disclosed by inclusions and exclusions) (Rahman & Rajib, 2014). Studies by Harris & Gurel (1986) and Erwin & Miller (1998) have provided a few explanations for observed increases in price and trading volumes, however, this contradicts the EMH whereby no effect should be noticed when a stock index membership is changed.

The hypotheses offer insight into the effects they have on liquidity. Liquidity should have an impact on stock prices. Liquidity, according to Amihud & Mendelson (2006), is a key component in capital asset price. Investors want to be paid for burdening the expenses of illiquidity, hence they are only willing to pay a lower price for illiquidity equities, according to them. On the stock market, trade volume and liquidity are interconnected terms. Since trade volume is a measure of a commodity's liquidity, it's important to pay attention to it. A higher trade volume shows that a stock or commodity has a stronger overall market interest. Stocks with higher volume are exchanged more frequently and quickly than those with lesser volume. As a result, a large transaction volume usually indicates a high amount of liquidity for a particular security or commodity in the market.

The DSDC, ICH and IRH discuss the volume and price effects of inclusions and exclusions. Whilst the LCH refers to the trading costs and activity effects for inclusions. The DSCD notes that a permanent increase or decrease in price and volume can be observed after the inclusion or exclusion. The increase in price and volume translates to higher liquidity in stocks whilst a decrease in price or volume translates to lower liquidity in stocks. This same observation is noted for the PPH with the only difference being that the effect is temporary and not permanent. The LCH highlights those inclusions of a stock into the index, results in decreased trading costs and increased trading activity resulting in higher liquidity while the opposite holds true for exclusions.

Liquidity is easier to recognise than to define and can be seen as a significant, but abstract, notion in financial markets. Liquidity is described as the ease with which value can be realized from an asset or assets (Crockett, 2008). Liquidity is generally a representative of a desirable function that reflects a well organised market (Gabrielson, Marzo & Zagaglia, 2012). Liquidity can be seen as the ability to transact in a way modifying portfolios and risk profiles without affecting or disturbing the underlying prices (Crockett, 2008).

The importance of liquidity results from the link it has between itself and the markets institutional organisation. According to Crockett (2008, p. 24), the dimensions of market liquidity are:

- **Depth**

  When orders exist both above and below the trading prices of the asset, a market is considered to be deep.

- **Breadth**

  When large volumes of buying and selling orders exist the market is considered to be broad.

- **Immediacy**

  A market's immediacy is the speed with which transactions can be executed.

- **Resiliency**

  When there are multiple orders in response to changes in price, the market is considered as resilient. There is an absence of resiliency when the order flow fails to adjust swiftly in response to price swings.

These dimensions play a vital role in terms of evaluating a financial market's structure by helping to understand what factors affect market liquidity and in turn allows for liquidity in the market to be analysed. The presence of liquidity affects the competition between market actors and the prices of assets (Gabrielsen et al., 2012). Liquid markets are commonly identified as attractive because of the various advantages they provide, including better allocation and information efficiency (McCormack & Burke, 2013). Liquidity in an asset class presents a few benefits to an investor, including:

- Lower transactional costs
- Frequent trading windows
- And a clearing price that is more probable to be close an assets intrinsic value (McCormack & Burke, 2013).

A market that is liquid is commonly correlated with lower risk, due to the fact that someone is constantly ready to assume the other end of the given position (Sarr & Lybek, 2002). This makes the market attractive to speculators as well as contributes to favourable market conditions. Amihud & Mendelson (1988) proposed that corporate managers should be mindful of and seek out to enhance stock liquidity as they follow the objective of maximizing

shareholder wealth. This notion is also supported by Becker-Blease & Paul (2006). The liquidity of an asset also plays a significant role in deciding the spread which the leveraged trading provider can bid[1]. Since prices are derived from the underlying market, low bid-ask spreads will translate to lower spreads indicating higher liquidity and if the market is illiquid, it could indicate a much wider spread (IG Markets Limited, 2020).

1.4 Research Problem

The inclusion and deletions of stock from indices provides an important insight into a company's performance. These revisions provide detail around share price adjustments and liquidity in the stock market which is a key element for well-functioning stock markets. This is because it has important repercussions for traders, trading venues (stock exchanges or alternative trading systems) and listed firms. Moreover, the stability of the financial system as whole benefits from liquidity and therefore important to have a deeper insight (Wuyts, 2007).

The study of liquidity impacts has mainly been carried out internationally and in developed markets such as the United States and Europe and emerging markets such as Asia. According to Ma, Anderson & Marshall (2016) whilst many early liquidity studies focused on these such markets, worldwide market liquidity research is gaining traction. For a variety of reasons, the rising body of international liquidity research is crucial such as considering the impact of varied legal, economic, and political circumstances it provides a rich environment to consider liquidity in an international setting. As evident further on in the study, there are no studies of liquidity effects in a South African market and the only previous studies in such a market relates to price and index rebalancing effects as a result of inclusions and exclusions to the FTSE/JSE and JSE Top 40. The insight that international studies (reviewed in Chapter 3) provides is insightful and would be useful to understand that in a South African context therefore filling in the gap of this section of research is one of the main aims of the study. The lack of studies analysing the impact on liquidity as a result of inclusions and exclusions to the JSE Top 40 and Mid Cap Index is a disadvantage to South African investors, companies, and regulators.

When it comes to firm size, the larger the firm, the more stocks that circulate in the market. More stockholders increase the depth and breadth of the market. Merton (1987) believed that because larger firms have more corporate information, there will be less information

1 The term "high liquidity" refers to the significant amount of purchase and sell orders. The likelihood of the highest price a buyer is willing to purchase and the lowest price the seller will accept moves closer as a result meaning the bid-ask spread will narrow.

asymmetry and increased stock liquidity. Lesmond, Ogden, & Trzcinka (1999) discovered that larger business size and lower common stock transaction costs suggested increased liquidity in their empirical investigation. The concentration of the JSE results in a handful of large companies dominating the market with respect to size and trading volumes (Bradfield & Munro, 2017; Nogantshi, 2019). The analyses of the impact of this on liquidity is considered and can provide useful information to investors as to the type of index to invest in based on firm size.

1.5 Research Aim, Objectives, and Questions

The aim of this thesis is to analyse and identify the effect that inclusions and exclusions to the Top 40 and Mid Cap indices have on liquidity of the individual stocks. To achieve this aim three research objectives have been defined as follows:

- To examine whether new companies that are included in the JSE Top 40 and Mid Cap indices enjoy greater or diminished liquidity in their shares
- To examine whether existing companies that are excluded from the JSE Top 40 and Mid Cap indices enjoy greater or diminished liquidity in their shares
- To examine whether the size of a firm has any impact on the liquidity changes from an index inclusion or deletion.

To be able to achieve the above objectives the following research questions are formulated of which the study sets out to answer:

- What is the liquidity response to the inclusion of a stock on the JSE Top 40 and Mid Cap Indices?
- What is the liquidity response to the exclusion of a stock on the JSE Top 40 and Mid Cap Indices?
- How does the size of a firm impact on the liquidity effects of an index inclusion or exclusion?

1.6 Scope and Method

1.6.1 Scope

The purpose of this study to evaluate the impact on the liquidity of stocks when deleted from, or added to the JSE Top 40 and FTSE/JSE Mid Cap Index. The sample period runs from January 2010 to December 2020 and daily data observations were utilised.

1.6.2 Methodology

This study utilises an event study methodology. For each index daily data was collected for each company included and excluded from the indices and a univariate and multivariate analysis was carried out. The univariate analysis is the simplest, it attempts to give necessary information regarding the liquidity proxies employed in the study. There is a possibility that the univariate analysis is based on It is possible that the univariate analysis undertaken in the study are based on factors that are unrelated to compositional changes in the indices. To control for this possibility as well as an attempt to improve the effectiveness of the econometric analysis, a multivariate analysis will also be utilised. The multivariate analysis uses panel data. Panel data has significant advantages over cross-sectional or time-series data because it combines inter-individual differences and intra-individual dynamics (inference of model parameters with greater precision, helps control the impact of omitted variables and rather of making forecasts for individual outcomes, more accurate predictions for individual outcomes can be made by pooling data) (Hsiao, 2007).

1.7 Structure of Study

This study consists of six chapters structured as follows:

- **Chapter One: Introduction**

This chapter outlines the background and problem statement that motivates the study, as well as the study's objectives, scope, and method.

- **Chapter Two: Theoretical Review of Liquidity and Index Impacts**

This chapter discusses the theoretical concepts of indexing, liquidity and the relationship between indexing and liquidity.

- **Chapter Three: Literature Review**

This chapter reviews prior research on an international and local front exploring a range of effects from inclusions and exclusions to stock indices as well as their research methods and research findings.

- **Chapter Four: Research Methodology**

This chapter discusses the sample of inclusions and exclusions from the JSE Top 40 and FTSE/JSE Mid Cap indices, sample period and event study, and data description and frequency as well as liquidity proxies (turnover, aggregate turnover, bid-ask spread, percentage spread and Amihud illiquidity measure) and control variables (volume, volatility measures and price) using both univariate and multivariate analysis (using panel data). Thereafter, a comprehensive explanation of how each variable is calculated follows.

- **Chapter Five: Data Analysis and Results**

This chapter summarises t outcomes of the analysis and discusses the conclusions drawn from the models.

- **Chapter Six: Conclusion and Recommendations**

In an attempt to answer the research questions posed, the concluding chapter presents the findings of the study. Chapter 6 ends with a discussion of the ramifications of the findings of this study, as well as recommendations for further research.

CHAPTER 2: THEORETICAL REVIEW OF LIQUIDITY AND INDEX IMPACTS

2.1 Overview

Liquidity is a critical component of well-functioning stock markets because it affects traders, trading venues (stock exchanges or alternative trading systems), and publicly traded companies (Wuyts, 2007). Stock markets are vital to the functioning of our entire economy, as they provide more credit than banks, for example. They are a low-cost way to connect investors with worthwhile businesses and projects. Liquidity in a market is important because it influences investor returns, such as those saving for retirement or college, as well as the costs incurred by corporations, governments, and other borrowers (Elliot, 2015)

Amihud & Mendelson (1988) proposed that corporate managers should be mindful of and seek out to enhance stock liquidity as they follow the objective of maximizing shareholder wealth. This notion is also supported by Becker-Blease & Paul (2006). Brokerage fees/taxes during trading, inventory risk, and private information are generally agreed to be the primary sources of liquidity (Amihud, Mendelson & Pedersen, 2006). The brokerage fees/taxes are exogenous costs and are generally considered on the side of the buyers because they will eventually sell the securities and have to pay the cost. A market that is liquid is commonly correlated with lesser risk, since there is generally someone continuously ready to take the other side of the given position. This attracts speculators and investors into the market as a result contributes to favourable market conditions causing a change in price, volatility or volume introducing the possibility of the Index Effect.

The Index Effect is a phenomenon in which stocks added to an index have positive excess returns in the days leading up to their formal inclusion, and stocks withdrawn from an index have negative excess returns. For large- and mid-cap equities, the Index Effect has weakened significantly (Renshaw, 2020). Several hypotheses have been used to try to explain the dynamics behind the observed index effects, despite the fact that there is no conclusive theory available (Collin, 2018). The price pressure hypothesis, information content hypothesis and liquidity hypothesis and awareness are amongst the few theories that will be discussed in order provide a theoretical explanation for inclusions or deletions of stocks on the JSE Top 40 and FTSE/JSE Mid Cap Indices.

This chapter will cover discussions on indices and their importance in the stock market, liquidity and their role in finance, markets, and companies as well as their sources and hypotheses that aim to explain the effect on liquidity given addition and deletion of stocks from indices.

2.2 Indices

A market index is a number that represents the performance of a group of securities. Since being introduced by Charles Dow in 1884, for years the use of stock market indices in particular has been increasing at an exponential rate (Wurgler, 2010). According to Wurgler (2010), the increasing importance of indices in the investment industry is reflected in their proliferation. Indices are no longer just information carriers; they, and the index-linked investing strategies that go with them, have become so popular that they are spawning new stock market phenomena in their own right. Because so many economic decisions are based on stock prices, these occurrences have an impact on the economy.

They enable managers and investors to calculate "betas" for cost of capital calculations and to learn from indices' information on investment opportunities. Indices are used by policymakers as indicators of future economic conditions and as well as investors having been able to benefit greatly. Actively managed funds typically have higher expenses and costs than index funds. They give you access to specific diversified portfolios, such as international stock portfolios, that would otherwise be difficult to build and monitor for those who delegate investment management. Their primary strategy is to minimise distributions, which makes them tax efficient (Wurgler, 2010).

2.2.1 Advantages of Index Funds

The most obvious advantage of index funds is in terms of total return. In this regard they have consistently outperformed other types of funds (Folger, 2020). There are three base benefits of index funds that investors recognise when investing in an index fund. These benefits include but are not limited to, passive management, low expenses, tax efficiency, and broad diversification (Thune, 2020):

- **Passive Management**

Actively managed mutual funds and passively managed mutual funds are two different types of mutual funds. For example, the manager of an actively managed stock mutual fund actively

buys and sells stocks in order to "beat the market". However, there is a chance the active manager will make bad decisions and underperform in the index (the majority of actively managed funds lose to their respective index, especially over long periods of time, such as three years or more) (Thune, 2020). A manager of a passively managed index fund, alternatively, is simply trying to buy and hold securities that reflect the specific index in order to match, and not to outperform the index's performance (Thune, 2020).

One of the main reasons is that they have much lower management fees than other funds because they are passively managed. Rather than having a manager actively trading and a research team analysing securities and making recommendations, the index fund's portfolio simply replicates that of its designated index. Index funds have lower transaction costs because they hold investments until the index changes. Lower costs can have a significant impact on your profits, especially over time (Folger, 2020).

- **Low Expenses**

The low costs of index funds are due to the fact that they are managed passively. When managers do not invest their time and money studying stocks and/or bonds to buy and sell for the portfolio as seen by actively managed funds, the costs of operating the fund are substantially lower. These cost reducing benefits are passed on to the investor. Therefore, compared to actively managed funds, index funds have a significant cost advantage (Thune, 2020).

- **Tax Advantages of Index Funds**

As index funds are passively managed, they have a low turnover rate, which implies managers only make a few trades per year. When fund managers conduct fewer transactions, fewer capital gains distributions are generated, which are subsequently dispersed to shareholders (Thune, 2020).

Index funds also have the advantage of being tax-deferring. When investors put money into the fund, they are buying new lots of securities in the index, so when it comes time to sell a particular security, they may have hundreds or thousands of lots to choose from. As a result, they will be able to sell the lots with the lowest capital gains and, as a result, the lowest tax bill. (Folger, 2020).

- **Broad Diversification**

An investor can capture the returns of a substantial portion of the market by investing in a single index fund. Index funds may invest in hundreds or even thousands of holdings, whereas

actively managed funds may invest in less than 50. Index funds often offer more securities exposure than actively managed funds, and funds with more holdings have lower relative market risk than funds with fewer holdings (Thune, 2020).

2.1.3 Disadvantages of Index Funds

- **Lack of Downside Protection**

The stock market has proven to be a good long-term investment, but it has had its share of ups and downs throughout the years. When the market is going well, investing in an index fund has an upside, but it also exposes investors to risk on the downside (Pinsent, 2022).

- **Lack of Reactive Ability**

Index investing does not enable advantageous behaviour. When a stock is overvalued, the index begins to assign greater weight. Unfortunately, this is precisely the time when savvy investors would choose to limit their exposure to that stock in their portfolios (Pinsent, 2022).

- **No Control Over Holdings**

Indexes are pre-determined portfolios. When an investor buys an index fund, they have no control over the portfolio's particular assets. There may be some businesses that you prefer, such as a favoured mining company or retail store. As a result, an investor may prefer to invest in that company rather than the chosen companies in the index. (Pinsent, 2022).

- **Limited Exposure to Different Strategies**

There are numerous successful tactics that investors have utilised; however, buying a market index may not provide access to many of these strong ideas and strategies. Investing methods can be integrated to generate higher risk-adjusted returns to investors. Diversification is provided by index investing, although it can be accomplished with as little as 30 stocks instead of the 40 stocks that the Top 40 Index would track (Pinsent, 2022).

- **Indexing Effect**

Equities added to an index have positive excess returns in the days running prior to their formal inclusion, while stocks removed from an index have negative excess returns. The Index Effect has greatly weakened for large and mid-cap businesses, although it may still be found in some small-cap stock indexes (Renshaw, 2020).

2.2 The relationship between indexing and liquidity

Several hypotheses have been used to try to explain the dynamics behind the observed index effects, despite the fact that there is no conclusive theory available (Collin, 2018). The behaviour of stock prices to changes in a company's categorisation as part of an index has been the topic of theoretical studies and are summarised in the following hypotheses. The price pressure hypothesis, information content hypothesis and liquidity hypothesis and awareness are amongst the few theories that will be discussed in order to provide a theoretical explanation for inclusions or deletions of stocks on the JSE stock indices.

2.2.1 Price Pressure Hypothesis (PPH)

The PPH outlines that the additions or deletions of a share off an index may result in temporary fluctuations in its equity pricing. This due to short-term variations in the demand from funds linked to the index (Harris & Gurel, 1986).

This hypothesis is formed on the assumption that demand is still perfectly elastic in the long-run and hence prices will ultimately return to their initial levels (Harris and Gurel, 1986). The long-term demand at the full information price is perfectly elastic. Should the share prices revert to the ex-ante levels following an index change, then any demand shifts that are not motivated by backing information can be extremely costly and this may result in the demand curve being less than perfectly elastic in the short run (Harris & Gurel, 1986).

PPH argues that for any noted effects on volume and price associated with changes to an index is merely the product of temporary price pressure resulting from institutional rebalancing or index-fund trading. This supports the idea that no perpetual shifts should prevail due to the fact that in the long term, any surplus demand should disappear once satisfied, in line with the EMH (Ahmed & Bassiouny, 2018).

Harris and Gurel (1986) conducted what are considered to be one of the earliest studies of price and volume effects surrounding changes in the composition of the S&P 500. They found that the immediate effect of an addition to the S&P 500 being announced, was an increase in prices exceeding three percent. The very same increase was almost completely reversed two weeks later and may be attributed to the short-term price pressures resulting from the index funds rebalances which will result in changes in price linked to large transactions. This then becomes attractive to passive liquidity suppliers who tend to be compensated for their liquidity when

there is a movement in price. The immediate price drop associated with large sales and the rise associated with purchases attract these passive liquidity suppliers. These suppliers are reimbursed for their liquidity service when prices increase or fall to their full information levels (Gregoriou & Ioannidis, 2006)

2.2.2 Information Content Hypothesis (ICH)

The ICH was initially proposed by Jain in 1987. He proposed that any addition to an index may suggest underlying information regarding the company in question which enhances the idea of a stock's reduction in risk, stability, or an improvement on the quality of management (Jain, 1987). The ICH suggests that any effects of additions and or deletions on the stock's price may be credited to the prevalence of material information and consequently such announcements give rise to a new equilibrium price (Ahmed & Bassiouny, 2018).

Chen, Noronha & Singal (2004) examined two distinct areas relating to the liquidity effects caused by changes made to the S&P 500. They separated their analysis into changes in liquidity with information production as well as changes in liquidity without the production of information. As a result of higher interest in S&P 500 companies, this can lead to greater quantities of information being produced, which may lead to decreased amounts of information asymmetry, and ultimately improves liquidity. This notion is further substantiated further by studies conducted by Chordia, Roll & Subrahmanyam (2001) and Hegde & McDermott (2003).

A rise in a stock's attractiveness as a by-product of its addition to an index may occur as a result of increased volumes of information being generated by analysts, financial intermediaries, and the media (Chen et al., 2004). Increases in information produced subsequently leads to a reduction in the level of information asymmetry and underlying uncertainly. This gives rise to improvements in a stock's liquidity caused by lower adverse selection costs. The final result is a positive price response brought about by the market's immediate capitalisation of this improved liquidity in response to the announcement of an addition to the index. Alternatively, deletions of stocks from an index are not assumed to associate with a decreased amount of information produced in equal proportions (Chen, et al., 2004).

Chen et al. (2004) note that trading volumes may lead to an increase in liquidity without the production of information. They suggest increases in trade volumes tend to decrease the cost

of inventory to market makers, thus lowering the total cost of trading. They maintain that indexing may decrease a share's liquidity. Index funds often purchase shares to hold, which then decreases the volume of shares open for trading. Such a decrease may negatively affect liquidity. Results by Chen et al. (2004) suggest that, following additions, there is only a minimal number of permanent increases in turnover volume and no significant decrease that follow deletions. They propose that liquidity that is not created through information production necessitates a symmetric response in price to both index additions as well as deletions.

2.2.3 Liquidity Hypothesis (LH)

The liquidity hypothesis was proposed for the first time by Ogden (1990). The liquidity hypothesis predicts that if a company is added to the index, its stock liquidity will improve, while if it is removed from the index, stock liquidity will decline. Changes to a stock index may impact liquidity as well as the cost of trading shares. Stocks that are added to an index become exposed to increased levels of demand and consequently benefit from lower trading costs.

There is a significant effect on liquidity and bid-ask spreads as a result of the additions to an index (Ahmed and Bassiouny, 2018). The inclusion of a stock to the index is expected to increase volume resulting in the stock being more liquid, and the price increase reflects this assumption. Listed firms may draw more analyst and investor attention, resulting in lower bid-ask spreads, which is predicted to boost liquidity. Several studies have discovered that index inclusion has an impact on liquidity and the bid-ask spread. This claims that including a stock in an index increases market scrutiny and information available, increasing the stock's attractiveness and liquidity and having a positive effect on the price. Becker-Blease and Paul (2010) find a permanent increase in equity value for additions to the S&P Small Cap 600 and Mid Cap 400 indices, primarily attributing the change to liquidity improvements, in support of the liquidity hypothesis.

For deleted stocks, there is also a reduction in liquidity (Ahmed & Bassiouny, 2018). There are a few studies that support this notion. This includes the likes of Beneish & Whaley (1996) and what they observed on the DIJA, Hedge & McDermott (2003) and their observations on the S&P500, the observations on the Danish KFW stock index by Bechman (2004), Gregoriou (2011) on the CAC400.

2.2.4 Awareness Hypothesis

Merton (1987) was the first to acknowledge the possible impact of media power on a certain company's number of investors. He stated that his model is consistent with the view that stock prices can sometimes respond to a widely circulated company report, even if all the substantive information contained in the report has been previously announced. The awareness hypothesis is based on the idea that investors will pay more attention to newly added firms even if no new information is released at the time of the additions (Collin, 2018).

The awareness hypothesis proposes that as more stocks are added to the market, they will receive more media attention, lowering trading costs for investors and, as a result, decreasing bid-ask spreads. More illiquid firms (greater bid-ask spreads) can expect higher average returns, according to Amihud (2002). Beneish & Whaley (1996) studied additions to the S&P 500 index and discovered evidence of temporary liquidity effects. According to studies, the awareness hypothesis is most relevant for larger indices that contain smaller firms that are not yet widely traded (Beneish & Gardner, 1995).

2.3 Liquidity

2.3.1 Importance of Liquidity

Traders should be aware of the concept of stock market liquidity and factors affecting it. They will be in a better position to buy and sell if they know which stocks are the easiest to convert to cash without affecting the price and having better understanding of factors affecting market liquidity increases investor confidence in financial markets (Chordia, Roll & Subrahmanyam, 2001).

Highly liquid stocks can be especially useful for traders because their large trading volume allows positions to be entered and exited quickly without sacrificing price, which is ideal for the fast-paced environment of day trading (Lybek & Sarr, 2002). With highly liquid stocks, traders can stay within their risk management strategy because liquid stocks allow them to open and close positions quickly as compared to trading less liquid stocks, where order execution may take significantly longer due to low share volume.

Stock markets are vital to the functioning of our entire economy, as they provide more credit than banks, for example. They are a low-cost way to connect investors with worthwhile businesses and projects. Liquidity in a market is important because it influences investor returns, such as those saving for retirement or college, as well as the costs incurred by

corporations, governments, and other borrowers. Illiquid markets are also more volatile. Volatility can contribute to the onset or exacerbation of financial crises. Even the average level of volatility is important because it influences the interest rates that investors demand and borrowers pay (Elliot, 2015). Insurers, pension funds, mutual funds, individual investors, and others are among the credit providers. Households are the ultimate source of all of these funds, as they rely on the returns on these securities to fund their retirement, educational expenses, and other needs. As a result, how these markets operate has a significant impact on the economy as a whole.

2.3.2 Sources of Liquidity in the Stock Market

The key sources of liquidity are generally accepted to be brokerage fees/taxes during trading, inventory risk, and private information (Amihud et al., 2006). Brokerage fees/taxes are exogenous costs that are often viewed as being on the buyers' side since they will eventually sell the assets and be responsible for the cost. When a securities owner wants to sell , they must wait for the buyer to approach in order to unwind their position, which means they have to keep the inventory and risk price changes. Inventory risk is linked to investors' risk tolerance and the market environment, which includes interest rates and market volatility (Banks, 2014).

CHAPTER 3: LITERATURE REVIEW

3.1 Focus of prior research: International Studies

The following section covers the prior research on an international front exploring a range of effects from inclusions and exclusions to stock indices as well as their research methods and research findings.

3.1.1 Erwin and Miller (1998)

Erwin & Miller (1998) investigated how stock liquidity changed when a stock was added to the S&P 500 Index, as measured by the bid-ask spread, for a sample of 109 stocks traded on the New York Stock Exchange (NYSE) and Over the Counter (OTC). Using an event research methodology, they examined the behaviour of the bid-ask spread, share price, and trading volume.

Both theoretically and empirically, Erwin and Miller (1998) identified that the bid-ask spread is a function of changes in share price, trading volume, and return variance, and used a multivariate regression model to test for a change in the bid-ask spread when a stock is added to the S&P 500, while controlling for concurrent changes in other variables known to influence the bid-ask spread. The inclusion of the stock was attributed to the residual changes in the spread after the changes for these factors were controlled. Parallel changes in share price, trading volume, and return variance have strong explanatory power with respect to variation in the bid-ask spread, according to theory and empirical evidence (Erwin & Miller , 1998). To adjust for any changes in these variables and isolate the effect of adding a stock to the S&P 500 Index on the bid-ask spread, they used a multivariate regression model. This regression model examined for changes in the bid-ask spread while taking stock price, trade volume, and return variation into consideration. Last, they ran a second regression to check if the bid-ask spread of optioned and non-optioned equities differed before and after the S&P 500 was included.

Even after accounting for changes in share price, trading volume, and return variance, their findings revealed a significant reduction in both the absolute and relative bid-ask spreads, suggesting that stocks are more liquid. They noticed more specific results because their study was divided into optioned and non-optioned stocks (46 and 63 stocks, respectively). The bid-ask spread and share price between additions have a post-addition dramatically differing behaviours between the subsamples.

After the optioned subsample was added to the S&P 500, there was no evidence of a change in the absolute or relative bid-ask spread. According to their findings, these equities likewise demonstrated a significant but only temporary gain in share price and a permanent increase in trading volume. The permanent increase in trading volume is indicative of increased liquidity implying the stock has now become more liquid.

After the inclusion to the S&P 500, the absolute and relative bid-ask spreads in the non-optioned sub-sample both decreased significantly. Increased liquidity was associated with a large and long-term increase in share price and trading volume for these stocks, according to their findings. Despite the fact that the non-optioned stocks' bid-ask spread narrows significantly once they are included in the S&P 500 Index, the non-optioned equities' bid-ask spread remains significantly higher than the optioned stock's.

3.1.2 Gregoriou and Ioannidis (2006)

Gregoriou and Ioannidis (2006) looked at the impact on information costs and liquidity effects of additions and deletions to the FTSE 100 index. They utilised the data from the FTSE 100 index during the period of 1984 – 2001 for inclusions and exclusions to the index.

They gathered daily stock price and trading volume data for a period of 121 trading days around the change date. Daily returns were calculated, and cash and stock dividends, as well as one stock split, were factored in. Using the methodology employed by Beneish and Gardner (1995), calendar time was converted to event time for each sample observation by defining the date on which the London Stock Exchange announced the FTSE 100 list change as event day 0.

To assess if there were any liquidity implications, they looked at the impact of inclusion and exclusion on trading activity. The trade volume was evaluated to see if the liquidity theory could be supported. To see if trading activity changes when a company is added to or removed from the FTSE 100 list, they used trade volumes and adjusted market volumes in event time. The average effective bid–ask spread was also analysed before and after the additions and deletions.

The cross-sectional means were calculated using the Harris and Gurel (1986) estimate technique. The event window's performance was used as the dependent variable to evaluate the

competing explanations at the same time. The changes in the bid-ask spread, abnormal volume, and the amount of publicly available data are all proxies for regressors:

$$CPE_i = \alpha_0 + \alpha_1 \Delta SPREAD_i + \alpha_2 ABVOL_i + \alpha_3 \, (MV_{t+5}/MV_{t-1}) + \varepsilon_i \, ,$$

Where:

- *CPE* = cumulative prediction error on days −2 to +2 relative to the date of the announcement of the FTSE 100 list change. CPE can be calculated as either the difference between measured value and predicted value over measured value or difference between predicted value and measured value over measured value (Guang, Baraldo and Furlanut, 1995).
- Δ*SPREAD* = change in the effective spread (estimated by using the ask price minus the bid price
- *ABVOL* = abnormal volume
- MV_{t+5}/MV_{t-1} = ratio of market value (price × number of common shares) at the end of year $t + 5$ versus market value at the end of year $t - 1$; used as a proxy for future growth.

The results of the study find that, following the additions, the bid–ask spread decreases significantly, indicating the stock is more liquid. This was to be expected, as firms that join the FTSE 100 list operate in a more data-rich environment. The bid–ask spread has widened significantly as a result of the deletions, indicating that the stock is less liquid. They also discovered that newly listed stocks on the FTSE 100 List have higher stock prices and trading activity, indicating better levels of liquidity, while FTSE 100 removals have the opposite effect. (Gregoriou & Ioannidis, 2006).

3.1.3 Brockman and Chung (2006)

Brockman & Chung (2006) examined the effect of equity index inclusion on a firm's liquidity commonality on the Hong Kong Stock Exchange (SEHK). They utilised intra-day data, including bid and ask prices, depths, transaction prices, and trading volumes. The sample period ran from 1 May 1996 to 31 December 1999. During their sample period, they identified all stocks that were included in each of the four stock indices available on Hong Kong's futures exchange.

They used Chordia et al,. (2000) as a guide to estimate liquidity commonality. They combined the results for index and non-index companies using the following firm-by-firm time series regression:

$$\Delta Liquidity_{J,t} = \beta_1 \Delta Liquidity_{M,t} + \beta_2 \Delta Liquidity_{M,t+1} + \beta_3 \Delta Liquidity_{M,t-1} + \delta_1 Return_{M,t} + \delta_2 Return_{M,t+1} + \delta_3 Return_{M,t-1} + \delta_4 \Delta Volatility_{J,t} + \varepsilon_{J,t}$$

The constituent stocks of the four equity indices were more exposed to liquidity commonalities than a control sample that did not belong to any stock index, according to their preliminary empirical findings. The index inclusion hypothesis, which states that a stock's inclusion in an index is associated with significant abnormal returns, was consistently confirmed by their findings for absolute spreads, relative spreads, and depths (Kaptein, 2016).

Their study's key contribution was to confirm that index inclusion should be included in the list of criteria that cause liquidity commonality, especially across equities listed on the SEHK. They discovered that the majority of the liquidity similarity among index firms was due to co-variation with other index constituents rather than market-wide co-variation.

3.1.4 Li and Sadeghi (2009)

The efficiency of the Chinese equities market in response to index inclusions and exclusions was investigated by Li and Sadeghi (2009). More specifically, the effects of this from the S&P/CITIC 300 on the market's price, performance, and liquidity . Between October 2004 and August 2007, they looked at 69 stocks that were included to or excluded from the index. Their analysis was based on an event study. Market liquidity was measured using the bid–ask spread and transaction volume as proxies.

They calculate the percentage change in trading volume and bid–ask spread. The ratio of daily average percentage spreads (i.e., percentage change in percentage bid–ask spread) to their counterparts in the pre-addition/exclusion period were calculated for a range of event intervals. If either the bid or ask prices were less than zero, the quotes were excluded. They conducted a one-tail t-test to examine the statistical significance of this coefficient.

They concluded that a positive market reaction to a stock inclusion was attributable to an increase in return and liquidity when compared to a benchmark, whereas the opposite was observed for exclusions. They observed indications of increased liquidity for stock additions inclusions and exclusions in the long run. They discovered a significant increase in the bid–ask spread before the event and a decline after the event for stock additions, as well as significant increases in trade volume before and after the event.

Despite considerable increases in trade volume, a rise in uncertainty and asymmetric information around their event time was attributed for the observed positive change in the bid–ask spread in the pre-event period. According to adverse selection models, the bid–ask gap increases in response to an increase in asymmetric information if liquidity providers believe that informed traders would gain from superior information they have at their expense. The volume of stock exclusions , on the other hand, grew without a substantial shift in the bid–ask spread. An abnormally liquid market, according to this viewpoint, is dominated by irrational investors who tend to underreact to information contained in order flow or equity concerns (Li & Sadeghi, 2009).

3.1.5 Gregoriou (2011)

Gregoriou (2011) examines how the liquidity of stocks changes as they are added to and removed from the CAC40 stock index from January 1997 to January 2001.

The study calculated ratios of the daily average quoted, relative, and effective bid–ask spreads throughout various time interval event windows during the pre- and post-index revision trading period. Since Branch & Freed (1997) stated that this measure of spread incorporates the economic relevance of the spread to the market-maker, they established the relative bid–ask spread, which is calculated as the ask price minus the bid price divided by the mid-price. It's probable that the univariate analysis used in the study were based on factors unrelated to changes in the composition of the CAC40 stock index. To account for these external influences, a multivariate analysis of the bid–ask spread was used.

With elasticities as regression parameters, the log-linear fixed effects model is calculated as seen below:

$$Liquidity_{jt} = \alpha_j + \beta_1 D_t + \beta_2 Volume_{jt} + \beta_3 (Volume_{jt} \times D_t) + \beta_4 Price_{jt} + B_5 StDev_{jt} + \varepsilon_{jt}$$

for t=1,2

where:

t=1 corresponds to the pre-compositional change period in the CAC40 stock index, [0,-90], and t=2 corresponds to the post-compositional change period, [0,+90]. The dependant variable, $Liquidity_{jt}$ corresponds to either the quoted, relative, or effective bid–ask spread for stock j at time period t. *Volume, Price* and *StDev* represent the traded volume in shares, closing price and return volatility for stock j at time period t. The dummy variable, D_t is equal to 1 in the post-index revision period and is equal to 0, otherwise α_j captures the time-invariant unobserved stock-specific fixed effects. He noted that Ordinary Least Squares (OLS) can be used to estimate the fixed effects panel estimator shown in the above equation. The issue with OLS is that it fails to account for endogeneity in trading volume, stock price, and return volatility.

According to his findings, changes in the CAC40 stock index's composition had permanently changed trading volume and stock price liquidity. His empirical findings supported up the information cost liquidity theory, indicating that index inclusions (exclusions) result in a long-term increase (reduction) in CAC40 stock liquidity over a 3-month trading interval.

3.1.6 Biktimirov and Li (2014)

Biktimirov & Li (2014) study examined market reactions to changes in the FTSE SmallCap Index membership. Their results have provided support for the liquidity and price hypotheses.

They employed four metrics to determine stock liquidity: dollar volume, illiquidity ratio, relative spread, and zero returns ratio. The natural logarithm of daily trading volume in dollars is used to calculate dollar volume. The illiquidity ratio, abbreviated as ILLIQ, is the daily average of the absolute stock return to the daily trading volume in dollars:

$$ILLIQ_i = \frac{1}{T_i}\sum_{t=1}^{T_i}\frac{|R_{i,t}|}{VOLD_{i,t}}$$

where $R_{i,t}$ is the return of stock *i* on day *t*, $VOLD_{i,t}$ is the daily trading volume in dollars for stock *i*, and T_i is total number of days for stock *i* during the pre-event and post-event periods. As a measure of price impact, Amihud (2002) proposes the illiquidity ratio. The illiquidity ratio of a more liquid stock is predicted to be lower.

To prevent the confounding effects of another index change on liquidity measurements, they omitted equities that had an additional index change during the 180-day pre-change or post-change periods. To examine the difference between the pre-change and post-change levels for each group, they used a parametric paired t test and two nonparametric tests, Wilcoxon signed rank sum and sign tests.

The major findings were asymmetric price and liquidity reactions between companies that had switched between FTSE indexes and firms that were new to FTSE indexes. Firms that were included from a smaller-cap to a larger-cap FTSE index showed a constant increase in stock price as well as increased liquidity. Firms who were excluded from a larger-cap to a smaller-cap FTSE index saw their stock price fall permanently, as well as its liquidity. Firms who were previously not in FTSE indexes, on the other hand, witnessed a temporary boost in stock price and a fall in liquidity after being included to the FTSE SmallCap index.

3.1.7 Collin (2018)

Collin (2018) investigated whether or not revisions of the Oslo Børs Total Return Index (OBX) affect the prices, traded volumes, and liquidity of the stocks added to or deleted from the index using an event study methodology for the period of June 1999 to June 2017.

To gain a better understanding of the liquidity effects caused by OBX revisions, bid-ask spreads for stocks added to and deleted from the index have been investigated. A bid-ask spread is the difference between the prices quoted by the selling and purchasing parties of a stock (Berk & DeMarzo, 2014). The spread can be viewed as a transaction cost paid to market intermediaries for facilitating the trade. Higher spreads indicate lower liquidity, whereas lower spreads point to greater liquidity. Hence, if price pressures were created by index funds tracking the OBX,

one would expect to find lower spreads following an index addition and greater spreads following a deletion. The proxies used were percentage spread, average spread as well as spread and average spread ratios. They observed that Bid-ask spreads decreased for added stocks and increased considerably for deleted stocks around the same day.

3.1.8 Aboud and Karlsen (2019)

Aboud & Karlsen (2019) examined the changes in liquidity as a result of companies being excluded from the FTSE 100 index. Their sample period for companies that had been excluded from the FTSE 100 index runs from 2008 to 2016. An event study methodology was used in their study and to identify the date of removal, they employed a testing window that began –12 event days exclusion removal and ended +30 days following exclusion.

The results were tested using pooled regression with the relative bid-ask spread as the dependent variable, controlling for price, volume, and return variation, as well as the financial crisis. A linear regression model was used to examine their changes in bid-ask spreads, similar to Rokhmawati et al. (2017).

A panel data regression model is constructed as follows to test for substantial changes in the bid-ask spread of the excluded companies:

$$\frac{Bid}{Ask}Spread_{it} = \alpha + \beta_1 PRICE_{it} + \beta_2 VOLUME_{it} + \beta_3 VARIANCE_{it} + \beta_4 POSTREMOVAL_{it} + \beta_5 FC + YEAReffect + \epsilon$$

Their above formula shows that for bid-ask spread for deleted company *i* on event day *t*, the dependent variable and POST is the main variable of interest. *POST* was used as a dummy variable to test for the difference of changes in bid-ask spreads that occurs after the company is removed, this is equal to 1 if time *t* is post removal and 0 otherwise. They controlled for the changes in share price (*PRICE*), trading volume (*VOLUME*) and return variance (*VARIANCE*). The regression was running over a time interval that begins –12 event days before removal and ends +30 event days after. Because their data sample includes enterprises that were shuttered during the financial crisis, this was included as a control variable (*FC*).

The relative bid-ask spread supported their theory that the excluded companies' bid-ask spreads increased after they were excluded. Their result is that when companies are excluded from the index, they become less liquid, with possible explanations including a decrease in the number of investor analysts following their stocks and a large number of passive index trackers removing the companies from their portfolios and funds when they are removed from the index.

3.2 Focus of prior research: South African Evidence

The following section discusses effects of inclusions and exclusions to the JSE. The lack of liquidity impacts on such a movement is one of the main motivations for this study. The three studies by Miller & Ward (2015), Katzke & Van Tiddens (2019) and Pholohane, Ajuwon & Wesson (2020) investigate the price effects on the FTSE/JSE and JSE Top 40 Index (Miller & Ward, 2015; Pholohane et al., 2019) and the impact of index rebalancing on stocks that enter or exit the JSE Top 40 (Katzke & Van Tiddens, 2019).

3.2.1 Miller and Ward (2015)

Miller & Ward (2015) study the effects of company additions and deletions from various JSE indices on the share price of these firms. The ALSI Top 40, RAFI 40 Resources 20, and Financial and Industrial 30 are among these indices. Between September 2002 and June 2011, all companies that were added to or removed from these four main indices formed the study's population. Miller & Ward (2015) used an event study with a pre-event window of -20 days and a post-event window of +200 days. To calculate abnormal returns, a control portfolio model was used since it provided the most accurate measurement over a broad event window. A bootstrap strategy was employed for statistical testing.

In the pre-event window, all indices demonstrated statistically significant increases/reductions. This was especially true when it came to index exclusions, which declined on average. The share prices of firms that are included to market cap weighted indices showed a long-term growing trend in the pre-event window 70 trading days prior to the effective date, this trend begins. The share price drops steadily over the next 120 days after the effective date. For index removals, the inverse was true, with some fluctuation in the timing. As a result, it is demonstrated that share price movements are only temporary.

They make an interesting discovery in terms of how quickly these companies' stock prices began to respond to future index changes. Future index adjustments appear to be reacting much

faster on the JSE indices. While it's possible that arbitrage and opportunistic traders who anticipate these moves influence the JSE, it's also possible that it's a product of the data. The findings show that share returns in the post-event window have an asymmetric reaction, with shares entering the index underperforming and those exiting the index outperforming. Although the results were not significant for all of the indices tested, they do support the assumption that the majority of share movement occurs before the event, and that this can be increased and reversed afterwards (Miller & Ward, 2015).

3.2.2 Katzke and Van Tiddens (2019)

The study by Katzke & Tiddens (2019) aims to determine the impact of index rebalancing on stocks that enter or exit the JSE Top 40. The study's study is premised on a significant increase in passive fund assets under management in South Africa in recent years.

Their research employs an event study methodology, and their data covers the period from December 2002 to March 2018, covering all equities in the FTSE/JSE Top 40 Index. Their data set is a thoroughly produced collection of essential market capitalization and free-float information available to the market at each previous date, with total returns taken into account throughout. They took into account the consequences of business actions, stock splits, and other potentially price-distorting factors. In the review months, they used the 55 additions to and 54 exclusions from the FTSE/JSE Top 40 Index (Katzke & Van Tiddens, 2019).

They discover that the support for the long-short trading signal is often only obvious after the JSE shifted the rank-cut (or constituent calculation) date back to 19 trading days prior to the rebalancing date. According to them, this means that fund managers with the ability to take short positions could make profitable returns if they can properly estimate additions and deletions. They also show that for the six and twelve months following rebalancing, the returns distribution of both equities entering and exiting the Index tends to be lower than the benchmark. Finally, they stated that after the rebalancing date, volatilities remain comparable. Stocks that are included and excluded from the index, on the other hand, experience much higher (lower) levels of traded volume indicating that stocks entering the index experienced increased liquidity and the opposite for stocks deleted from the index (Katzke & Van Tiddens, 2019).

3.2.3 Pholohane, Ajuwon and Wesson (2020)

Pholohane et al. (2020) investigated the price reactions of stocks that entered and exited JSE Top 40 Index. Their research looks for any prospective investment possibilities that may arise as a result of the stock's movement within the FTSE/JSE Top 40 Index.

The anomalous returns of the stocks were calculated using three models: the market model, the Capital Asset Pricing Model (CAPM) with leveraged betas, and the CAPM without leveraged betas. The abnormal returns around the event date windows were measured using an event study methodology. Their sample size was reduced to 56 after numerous companies were removed due to corporate actions such as mergers and acquisitions or companies that changed their name. Their entire event window was set to be -20 days before the event to +200 days after the event (Pholohane, et al., 2020).

The statistical significance of average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) for multiple periods was examined. When examining CAARs for additions (deletions) over longer time windows, the three models utilized exhibit growing (decreasing) CAARs; however, CAARs for short-term cumulative windows produced inconsistent results. Prior and post-event stock prices showed price reversal over a longer time horizon, according to the study. Stock price AARs for the pre-announcement date were found as statistically significant for stocks to be removed from the index, but this does not hold true for additions. The study also discovered that the exclusion from the index and inclusion to the index had positive and negative AARs on the change day of the event, respectively (Pholohane, et al., 2020).

3.3 Conclusion

The preceding sections 3.1 and 3.2 cover a multitude of studies that seek out explore the various effects that may occur when a stock is included or excluded from an index or indices. All studies provide informative insights to the effects observed, research methodology used and data sets utilised. A few studies provide a deeper look into liquidity effects whilst others explore various other variables that are affected. The dominant effects observed were around volume, price and bid-ask spreads. For inclusions the most common trend is that volume and price increased and as a result higher liquidity observed (Erwin & Miller, 1998 and Gregoriou & Ioannidis, 2006). Decreases in bid-ask spreads which result in higher liquidity was also observed and dominant (Erwin & Miller, 1998; Gregoriou & Ioannidis, 2006; and Collin,

2018). For exclusions the most prominent was the increase in bid-ask spreads (Gregoriou & Ioannidis, 2006; Collin, 2018; and Aboud & Karlsen, 2019). The research methods and data set usage has been looked into in detail as provided by the various studies and provide the foundation for the methodology used in the following chapter. The most dominant method used was an event study methodology as used (Erwin & Miller, 1998; Li & Sadeghi, 2009; and Collin, 2018), and the univariate and multivariate (Erwin & Miller, 1999 and Gregoriou, 2011). The most popular proxies that were used were bid-ask spreads, share price and volume (Erwin & Miller, 1998; Gregoriou & Ioannidis, 2006; Brockman & Chung, 2006; Li & Sadeghi, 2009; Gregoriou, 2011; Biktimirov & Li, 2014; Collin, 2018; and Aboud & Karlsen, 2019). The lack of liquidity effects from inclusions and exclusions in a South African context is evident in the studies above and provide further backing for the objective and aim for this study.

CHAPTER 4: RESEARCH METHODOLOGY

This section gives an overview of the research techniques and methodologies that were used to assess the study's three research questions:

1. What is the liquidity response to the inclusion of a stock on the JSE Top 40 and FTSE/JSE Mid Cap Indices?
2. What is the liquidity response to the exclusion of a stock on the JSE Top 40 and FTSE/JSE Mid Cap Indices?
3. What is the impact of a firm's size on the liquidity effects of and inclusion and exclusion of the stock on the JSE Top 40 and FTSE/JSE Mid Cap Indices?

The first and second research questions of this thesis aims to analyse the impact of stock inclusions and deletions to the JSE Top 40 and Mid Cap Indices, on the liquidity of the underlying stock. The third research question sets out to analyse and discuss the effect of the firm size on the liquidity effects.

This chapter sets out to investigate the above areas of question for 44 inclusions and exclusions on the JSE Top 40 and 73 and 81 inclusions and exclusions on the Mid Cap index between January 2010 and December 2020 by employing an event study methodology. After discussing the sample period and data collection, the research methodologies carried out to evaluate the data are addressed.

4.1 Data Description

4.1.1 Sample Period and Event Study

The purpose of this study to evaluate the impact on the liquidity of stocks when deleted or added to the JSE Top 40 and FTSE/JSE Mid Cap Index. First introduced by Dolley (1933), the applicability of the event study methodology exhibits a long history and has become frequently used as an analytical tool in financial research. In the finance field, this methodology has been applied to various economy wide and firm specific events (Campbell, Lo & Mackinlay, 1997). While the first event studies focused on calculating abnormal returns, later studies, such as Hegde & McDermott (2003), employed this method to assess various other microstructure factors including liquidity.

According to Peterson (1989), an event study's objective is to evaluate whether abnormal (excess) returns are earned by the stockholders when accompanying a specific event such as stock splits, mergers or in this study an addition or deletion from an index. The date of the deletion and addition of stocks to the index is deemed a specific event and therefore an event study methodology will be employed.

The event study methodology has no unique structure, but can be reviewed as having the following seven steps, for the purpose of this study steps have been merged to form a five-step method (Campbell, et al., 1997):

1. Defining the event
2. Identifying the event window
3. Identifying the selection criteria for the sample
4. Defining the testing and estimation procedure
5. Calculating and interpreting the empirical results

The first and second task of performing and event study is to describe the event of interest as well as the period over which the stocks liquidity of firms participating in this event, which is referred to as the event window, will be evaluated.

The first step has been identified as the day the stock has either been included or excluded onto either the JSE Top 40 or Mid Cap Index. The second step calls for the identification of the event window. The JSE rebalances[3] on a quarterly basis in March, June, September, and December in South Africa, and this study assumes that by the time the indices rebalance, the influence would have now been absorbed into the individual stocks (Old Mutual, 2020). As a result, the shorter event windows of 60 and 30 before and after the event were also chosen. It should be noted that the data and analysis do not include the day on which the stock is added or omitted from the index. This time period allows to be long enough to discover the influence while also being short enough to exclude any impact of other changes or causes in the index's rebalancing affecting the liquidity of the other components.

3 The rebalancing ensures that all shares still meet all required criterion of the index.

This is examined for a period of 11 years, running from January 2010 to December 2020 which provides 44 event dates in the sample period. This period excludes the 2008 financial crisis, during which liquidity effects dried up, which is preferred to be exclude for the purpose of this research (Dombret, Foos, Pliszka & Schulz, 2018). Other studies utilise other variants of event windows such as Erwin & Miller (1998) where they utilise 30 days pre and post windows and Aboud & Karlsen (2019) who utilise a 12-day pre and 31-day post event windows.

The normal length of an estimation window is 252 trading days (Benninga, 2014). He provided a guideline whereby a minimum of 126 observations should be used. They state that if there were less than 126 observations in the estimation window there lies a possibility that the parameters of the model will not show the true stock liquidity effects. This will therefore distort the relationship between the stock liquidity and the additions and deletions within the indices. Using a shorter window reduces the chance of other control factors having an impact (Hegde & McDermott, 2004). Longer event windows, on the other hand, ensure that long-term changes in liquidity are captured. This study has more than 1 calendar in the period and thereby mitigates such a risk. This study uses 125, 30, and 60 days pre and post event date. This allows for analyses both in short, medium, and long term and because this time will allow to minimise any confounding effects that may occur and a balance between the long and short is achieved.

Neither of the authors provide a specific reason for the window used and Peterson (1989) shares that the length should be left up to the researcher but that the researcher should also weigh the benefits of a longer period for an improved prediction model or incur the cost of the longer period with model parameter instability. On the other hand, evidence exists that a shorter period minimises the chance of non-controlled misperceived results such as the general increase in liquidity over time (Hedge & McDermott, 2004).

The third part of the event study approach entails determining the selection criteria, which was is covered in section 4.1.2.1. Steps 4 and 5, which cover the estimating procedure as well as the findings, are covered in more detail in sections 4.2 and 4.3 below. This research employs both univariate and multivariate testing.

4.1.2 Data Description

The two indices which will be included in this study's sample are the FTSE/JSE Top 40 index, and the Midcap index. The Headline Category is made up of five indices: The All-Share Index (J203), Top 40 Index (J200), Mid Cap Index (J201), Small Cap Index (J202), and Fledgling

Index (J203) (J204). These indices are made up of eligible instruments that are listed on the JSE Main Board and divided into categories market capitalisation (SA Shares, 2021).

The Mid Cap consists of the 60 largest companies that rank after the Top 40. The index was designed to track index tracking funds, derivatives, and serve as a performance benchmark. Stocks are chosen and weighted to guarantee that the index is investable. To ensure that the index can be traded, the equities are reviewed for liquidity (SA Shares, 2021).

Index rules govern index changes. The methodology and calculation method of an index are specified by the index provider (e.g., FTSE/JSE, MSCI, S&P Dow Jones). Rebalancing occurs on a quarterly basis in March, June, September, and December for the FTSE/JSE indices (Satrix, 2019).

The rules for adding and removing companies at the review are intended to maintain consistency in the selection of Index Series constituents while ensuring that the Index remains representative of the market by including or excluding companies that have increased or decreased significantly (JSE, 2021). According to the JSE (2021) at the review, a security will be added into the FTSE/JSE Top 40 Index if it were to rise to position 35 or above at the periodic review when the eligible securities for each index are ranked by investable market capitalisation. The security will be excluded from the FTSE/JSE Top 40 Index if it happens falls to position 46 or below at the periodic review when the eligible securities for each index are ranked by investable market capitalisation (JSE, 2021).

The JSE Top 40 index is a decent representation of what happens to the South African stock market as a whole, despite the fact that it only contains 40 out of the nearly 400 shares listed on the JSE. The index reflects over 80% of the total market cap of all JSE listed enterprises.. Using the JSE Top 40 allows the study to fill in the missing gap of liquidity effects in a South African context. The majority of corporations that are classified as mid cap companies are there for a specific reason, which is capital. The performance of mid-cap stocks on the Johannesburg Stock Exchange has been fascinating and successful. Using the Mid Cap index allows more room to be able to answer the third objective this study by being able to analyse varying market capital categories to assess the effect, if any, on liquidity effect of inclusions and exclusions.

FTSE's products are used by market participants all around the world for investment analysis, performance evaluation, asset allocation, and hedging. Pension funds, asset managers, ETF providers, and investment banks utilize FTSE indices to assess their investment performance by creating ETFs, index tracking funds, structured products, and index derivatives. FTSE is used by many exchanges throughout the world for their domestic indices. (SA Shares, 2021).

4.1.2.1 Selection criteria

The study will utilise the following criteria for selection:

(a) The firm has not participated in a merger that has instantaneously preceded its inclusion to the JSE Top 40 and FTSE/JSE Mid Cap Index.

(b) The firm must have available historical data on the Bloomberg, Yahoo Finance and IRESS database for 125 trading days before and ending 125 trading days following the effective inclusion and exclusion dates.

(c) The firm's common stock did not split in the period 130 trading days before and ending 130 trading days after the effective inclusion and exclusion dates.

Criteria (a) and (d) will be used to minimise effects of confounding actions or events (Hedge and McDermott, 2003). In addition, any firms which met the above criteria, but had insufficient data in the sample period, were excluded from the analysis (Appendix A-1 outlines companies that were included and excluded that formed part of the sample).

4.1.3 Data Frequency

The choice of the frequency of data to utilise while conducting liquidity studies is extensive and has numerous ramifications. According to Ma et al., (2016), low frequency data (daily/weekly/monthly) is adequate provided that the accuracy of the proxies the study utilises is guaranteed. Furthermore, many of the proxies used later on require daily data in order to be calculated. As a result, although studies like Hegde & McDermott (2004) and Brockman and Chung (2006) use intraday data, this chapter uses daily data in accordance with Gregoriou and Ioannnidis (2006), Gregoriou (2011), and Biktimirov and Li's methodologies (2014).

4.1.4 Liquidity Proxies

There have been many studies whereby varying measurements and alternatives available for liquidity. Each measure, as discussed in 1.1.2, correspond to the depth, breadth, tightness, immediacy, and resiliency. This chapter uses 5 proxies:

- Turnover
- Aggregate Turnover
- Bid-Ask Spread
- Percentage Spread
- Amihud Illiquidity Measure

While turnover and aggregate turnover reflect the market's depth, bid-ask spread and percentage spread captured the market's tightness by accounting for trading costs. The Amihud illiquidity index analyses price effect, which can be a measure of tightness and depth because it is a traded share's ability to have a minimal impact on its price. Table 4.1 provides a more more in-depth look at these proxies.

Table 4.1 Liquidity Proxies

Variable	**Definition**
Turnover	Trading volume measure is trying to capture the quantity of shares per time to measure the depth dimension of liquidity $$\boldsymbol{VK = \sum_{n=1}^{N_t} P_n * V_n}$$
Aggregate Turnover	The total number of stocks traded divided by the total number of issued stocks $$\boldsymbol{AT_{it} = \frac{V_{it}}{I_i}}$$
Bid-Ask Spread	Natural measure of liquidity $$\boldsymbol{S_t = A_t - B_t}$$
Percentage Spread	The bid-ask spread of the share expressed as a percentage $$\boldsymbol{pS_t = \frac{A_t - B_t}{M_t}}$$
Amihud Illiquidity Measure	The illiquidity index delivers only a rough measure of the price impact $$\boldsymbol{ILLIQ_T^i = \frac{1}{D_T}\sum_{t=1}^{D_T}\frac{\left\|R_{t,T}^i\right\|}{V_{t,T}^i}}$$

4.1.4.1 Trading Volume

Trading volume is one of the most important factors of a stock's overall pricing structure. Volume traded generates information that can't be derived from alternative statistics, according to Blume, Easley, & O'Hara (1994).

Trading volume is an increasing function of liquidity that attempts to capture the amount of shares per time to quantify the depth dimension of liquidity. Stocks with a higher volume are more liquid, and their spreads are lower (Bogdan, Bareša & Ivanovic 2012)

Turnover (VK) is calculated for every day for each stock by the given equation:

$$\boldsymbol{VK} = \sum_{\boldsymbol{n=1}}^{\boldsymbol{N_t}} \boldsymbol{P_n} * \boldsymbol{V_n}$$

(4.1)

The total number of stocks exchanged divided by the total number of issued stocks is a formula for calculating turnover, known as aggregate turnover(AT) (Lo i Wang 2000), However, other experts believe that trade volume is an insufficient liquidity indicator. The cause for this is due to a problem with double counting. A buy-side transaction can also be documented as a sell-side transaction. As a result, the ratio of trading volume to market capitalisation is a more appropriate metric (Gabrielsen, et al., 2012). The higher value of this indicator, the higher the liquidity will be.

$$\boldsymbol{AT_{it}} = \frac{\boldsymbol{V_{it}}}{\boldsymbol{I_i}}$$

(4.2)

Where:

Vit is the traded stock volume

Ii is the total number of issued stocks

This measure also displays each stocks free float, or how much of the total issued stock is traded on a daily basis throughout the year, or it can be calculated for a single year. The higher the proportion, the more liquid the stock is (Bogdan, et al., 2012) .

4.1.4.2 Illiquidity Measure

The importance of traded volume has been increasingly important in recent years as liquidity measures have been advocated. The illiquidity index was created by Amihud (2002) to explore the impact of market conditions on stock returns, and it is a useful illiquidity measure:

$$ILLIQ_T^i = \frac{1}{D_T} \sum_{t=1}^{D_T} \frac{\left|R_{t,T}^i\right|}{V_{t,T}^i} \qquad (4.3)$$

where

D_T is the available data length,

R is the return on day t of year T

V is the daily volume.

The day-t impact on the price of one currency unit of volume traded is given by the ratio. The illiquidity measure is the average of the daily impacts over a given sample period. Amihud's illiquidity measure is similar to the liquidity ratio. The latter clarifies the relationship between volume and price changes. The price impact is only approximated by the illiquidity index. In contrast to the bid-ask spread, the main advantage of this measure is that it can be computed with a large amount of data.

The Amihud measure, according to Lesmond (2005), is the best accurate liquidity estimator for capturing effects inside a single country, which is useful in this study because it exclusively examines liquidity effects in the South African market.

4.1.4.3 Bid-Ask Spreads

A commonly utilised measure of liquidity is the spread between the bid and ask price. According to Amihud & Mendelson (1986) one of the best measures of liquidity is the bid–ask spread (quoted or effective), about liquidity.

A market bid is the price at which a dealer is willing to purchase a stock and an investor is willing to sell it. The lowest price at which the dealer is willing to sell the shares is known as the market ask. The term "highest price" refers to the "best market offer." Because the dealer posts both the bid and ask quotes, the difference between them can be thought of as the price the market pays for the dealer's liquidity services (Gabrielsen, et al., 2012) .

The bid-ask spread and its variants are the most often used indicators of market liquidity. This is because these measures provide insight into market information exchange. The use of the bid-ask spread is based on the idea that market prices are determined by which side of the market initiates the trade. Trades initiated by buyers are completed at the ask price, while trades conducted by sellers are completed at the bid price. The bid-ask spread is the difference between the lowest ask price and the highest bid price (Gabrielsen, et al., 2012). An average spread ratio of one should reflect a normalized liquidity situation. A more liquid market is recognized by spread ratios less than one, whereas values beyond unity reflect greater illiquidity (Collin, 2018).

Typically, a quote is disseminated in the market by the specialist. Market orders are then compared to limit orders that were previously made on the specialist's quote. Let A_t denote the ask price, B_t the bid price, and S_t the spread at time t.
The quoted absolute bid-ask spread is defined as follows:

$$\boldsymbol{S_t = A_t - B_t}$$

(4.4)

It is clear from the equation above that more liquid markets result in lower quoted spreads. This demonstrates that the spread and asset prices have a negative relationship, as explicitly discussed by Amihud & Mendelson (1991).

Additional indices that are commonly used to model market liquidity can be built using this measure. One of these is the percentage term. Assuming the quote's midpoint is $Mt = (At + Bt)\ /2$, measure of the percentage spread pSt is given by:

$$\boldsymbol{pS_t = \frac{A_t - B_t}{M_t}}$$

(4.5)

In a strict sense, the spread is a measure of transaction costs rather than a liquidity index. High transaction costs, on the other hand, indicate a lack of liquidity.

4.1.5 Control Variables

The utilisation the multivariate method of analysis within the event research necessitates the selection of control variables. Something that is kept constant or limited is referred to as a control variable. It's a variable that has nothing to do with the study's objectives, but it's kept under control as it could influence the results (Bhandari, 2021). As a result, these control factors

may have an impact on the liquidity of the underlying assets, and failing to account for these impacts may result in skewed results that are misattributed to liquidity effects (Allen, 2017).

Identification of the determinants of the liquidity proxies utilised is a key step in defining the control variables in this study, which focuses on liquidity. The trading volume is one the most important factor in influencing the width of the bid-ask spread (Pan & Misra, 2021). Market volatility and price are another important aspect that influences the bid-ask spread. The spreads on thinly traded stocks are usually greater. Moreover, during periods of extreme volatility, the bid-ask spread widens.

The first control variable used, is the price of stock *i* at time *t*. According to Stoll (2000), a higher volume of shares traded lowers the dealer's inventory risk and lowering the bid-ask spread. According to Chordia et al., (2001) changes in price has affects a dealer's capability to modify their levels of inventory and results in impacting the bid-ask spread.

The bid-ask spread is mostly determined by liquidity, and the tighter the spread, the more liquid the stock. Demsetz (1968) and Stoll (1978) propose that liquidity is influenced by factors that affect the risk of keeping inventory, as well as extreme events that cause order imbalances and, as a result, inventory overload. The second variable is therefore the market volatility of the asset. During instances of fast market fall or advancement, volatility tends to rise. The bid-ask spread is substantially greater at these times because market makers are looking to profit from it. When the value of securities rises, investors are ready to pay more, allowing market makers to demand larger premiums. The bid-ask spread is narrow when volatility is low and uncertainty and risk are low.

Many studies discuss various possible variables that could have an impact on liquidity. This includes market competition and transaction rate (Demsetz, 1968), number of dealers (Stoll, 1968) interest rates, market volatility and effects of holidays (Chordia et al., 2001), Arbitrage risk (Wurgle & Zhuravskaya, 2002), stock returns, capital expenditure momentum, and financial slack (Becker-Blease and Paul, 2006), firm size (Biktimirov & Li, 2014) and lastly changes in stock price (Gregoriou, 2011; Aboud & Karlsen, 2019). Despite the forenamed variables having support and credibility to them the most popular variables in previous literature volume, volatility measures and price (Brockman & Chung, 2006; Li & Sadeghi, 2009; Gregoriou, 2011; Aboud & Karlsen, 2019; Hegde & McDermott, 2003).

The stock's price ($Price_{it}$) is calculated using the natural log of each firm's closing price at time t, and the stock's trading volume ($Volume_{it}$) is calculated using the natural log. The $StdDev_{it}$ measures the stock's volatility, which is calculated using Parkinson's (1980) extreme value technique. Parkinson (1980) devised a method for calculating risk that uses the high and low prices from each day's trading rather than the method of moments from daily returns. This estimate of volatility outperforms the standard measure of volatility. This estimate of volatility is proven to be more efficient than the traditional measure, which utilises closing prices, because it analyses the range of prices over the trading day. As a result, volatility is calculated as:

$$\boldsymbol{volatility^2 = \frac{[ln(High) - ln(Low)]^2}{4ln(2)}} \quad (4.6)$$

4.2 Univariate Analysis

While a univariate analysis is the simplest, it attempts to give necessary information regarding the liquidity proxies employed in the study. The liquidity ratio is calculated using the liquidity proxies explained in section 4.1.4, as seen in equation 4.7 below:

$$\boldsymbol{Liquidity\ Ratio_{it} = \frac{LV_{it}^{Post}}{LV_{it}^{Pre}}\ for\ i = 1 \ldots n} \quad (4.7)$$

Where $\boldsymbol{LV_{it}^{Post}}$ is the daily average of the liquidity variable of interest for a stock in the Top 40 or Mid Cap Index during the period after stock inclusion/exclusion, and $\boldsymbol{LV_{it}^{Pre}}$ refers to the is the daily average of the liquidity variable of interest for a stock in the Top 40 or Mid Cap Index during the period before stock inclusion/exclusion (Hegde & McDermott 2003; and Gregoriou 2011). This ratio is determined from each of the five liquidity proxies discussed in section 4.1.4 A liquidity ratio greater than one implies that liquidity has increased since the stocks inclusion, whereas a ratio less than one suggests that liquidity has declined. While a pre/post ratio of more than 1 indicates enhanced liquidity for the trade volume variable, a value of less than 1 for the turnover, aggregate turnover, bid-ask spread, percentage spread, and Amihud measure

indicates lower spreads and hence higher liquidity. The standard t-test is used to examine the statistical significance of the liquidity ratio.

4.3 Multivariate Analysis

It's likely that the study's univariate analysis was influenced by factors unrelated to the index's compositional changes. A multivariate analysis will be performed to account for these external factors and improve the effectiveness of the analysis (Gregoriou, 2011; Hegde & McDermott, 2003).

$$\ln(\boldsymbol{Liquidity\ Proxy_{it}}) = \boldsymbol{\alpha_0} + \boldsymbol{\beta_1}\ln(\boldsymbol{Volume_{it}}) + \boldsymbol{\beta_2}\ln(\boldsymbol{StdDev_{it}}) + \boldsymbol{\beta_3}\ln(\boldsymbol{Price_{it}}) + \boldsymbol{\beta_4 Dummy_{it}} + (\boldsymbol{\beta_5 Dummy_{it}} \times \boldsymbol{Market\ Cap}) + \boldsymbol{\varepsilon_{it}}$$

I = 1 …….n, t= 1 …….t

(4.8)

Where:

$Liquidity\ Proxy_{it}$ is the measure of the proxies used in this study turnover, aggregate turnover, bid-ask spread, percentage spread, and Amihud measure for each company *i* at time *t*.

$Volume_{it}$ is the natural logarithm of the daily traded volume for each company *i* at time *t*.

$StdDev_{it}$ is the natural logarithm of of $StdDev$ using the Parkinson's (1980) value method for each company *i* at time *t*.

$Price_{it}$ is the natural logarithm of the daily closing price of stock for each company *i* at time *t*.

$Dummy_{it}$ is the dummy variable which takes on 0 for pre-inclusion/exclusion and for post-inclusion/exclusion.

This equation will be estimated separately for inclusions and exclusions to the index.

Table 4.2 Control Variables

Variable	**Definition**
Volume	Standardised trading volume of asset *i* at time *t* ***=ln(Daily Volume Traded extracted from Bloomberg)***
Price	the price of stock *i* at time *t* ***=ln (Closing Price)***
Volatility	Standard deviation of asset *i* at time *t*, as measured by Parkinson's (1980) extreme value method $$\boldsymbol{volatility^2 = \frac{[ln(High) - ln(Low)]^2}{4ln(2)}}$$
Dummy Variable	A dummy variable which takes the value of 1 for the period post-inclusion/exclusion and 0 otherwise pre-inclusion/exclusion

Research questions 1 and 2 will be the answered by evaluating the coefficient of the statistically significant $dummy$ variable (β_4) in equation 4.8 as shown in Table 4.3 below:

Table 4.3 Liquidity Proxies Coefficient Interpretation

Liquidity Proxy	**Coefficient**	**Implication**
Turnover	+(-)	Improved (Reduced) liquidity
Aggregate Turnover	+(-)	Improved (Reduced) liquidity
Bid-Ask Spread	+(-)	Reduced (Improved) liquidity
Percentage Spread	+(-)	Reduced (Improved) liquidity
Amihud Illiquidity Measure	+(-)	Reduced (Improved) liquidity

Source: Own compilation (2021)

The third question can be answered by evaluating the coefficient of the $dummy\ x\ market$ (β_5) in equation 4.8, following guide to interpreting the coefficients as seen above.

The following coefficients on the control variables are also expected to follow the guide as seen table 4.4 below:

Table 4.4 Control Variable Coefficient Interpretation

Liquidity Proxy	**Control Variable**	**Coefficient**
Turnover and Aggregate Turnover	Price	+
	StDev	-
Bid-Ask Spread, Percentage Spread and Amihud Illiquidity Measure	Volume	-
	Price	-
	StDev	+

Panel data is made up of observations that are collected on a regular basis and in a chronological order. Panel data, like cross-sectional data, provides observations from a group of categories, more specifically companies. Due to the several advantages of panel data examined by Erica (2020) this will be employed in this study.

- Panel data can model both the common and individual behaviours of groups.
- Panel data contains more information, more variability, and more efficiency than pure time series data or cross-sectional data.
- Panel data can detect and measure statistical effects that pure time series or cross-sectional data cannot.
- Panel data can minimise estimation biases that may arise from aggregating groups into a single time series (Erica, 2020).

The Random Effects (RE) and Fixed Effects (FE) models are two estimation approaches for panel data regressions. Since in a RE model, the intercepts are considered to be constant, any variation in errors across time periods or cross sections are due to fluctuations in the error term's variance (Brooks, 2014).

The RE model can be seen as equation 4.2 rewritten:

$$\ln(\boldsymbol{Liquidity\ Proxy_{it}}) = \boldsymbol{\alpha_0} + \boldsymbol{\beta_1}\ln(\boldsymbol{Volume_{it}}) + \boldsymbol{\beta_2}\ln(\boldsymbol{StdDev_{it}}) + \boldsymbol{\beta_3}\ln(\boldsymbol{Price_{it}}) + \boldsymbol{\beta_4 Dummy_{it}} + (\boldsymbol{\beta_5 Dummy_{it}} \times \boldsymbol{Market\ Cap}) + (\boldsymbol{v_i} + \boldsymbol{u_{it}})$$

I = 1 …….n, t= 1 …….t

(4.9)

Because the FE model allows for changes in the intercepts of the model across time periods, cross-sections, or both, any variation in the errors is attributed to changes in the intercept component (Brooks, 2014). Equation 4.10 below represents the estimation equations for a FE model based on equation 4.8.

$$\ln(\boldsymbol{Liquidity\ Proxy_{it}}) = (\boldsymbol{\alpha_0 + v_i}) + \boldsymbol{\beta_1}\ln(\boldsymbol{Volume_{it}}) + \boldsymbol{\beta_2}\ln(\boldsymbol{StdDev_{it}}) + \boldsymbol{\beta_3}\ln(\boldsymbol{Price_{it}}) + \boldsymbol{\beta_4 Dummy_{it}} + (\boldsymbol{\beta_5 Dummy_{it}} \times \boldsymbol{Market\ Cap}) + (\boldsymbol{\lambda_t + \varepsilon_{it}})$$

I = 1 …….n, t= 1 …….t

(4.10)

In contrast to the random effects model, the time-invariance of the intercept permits $\boldsymbol{v_i}$ to be associated with the explanatory variables. The variable $\boldsymbol{\lambda_t}$ in equation 4.10 represents the time-fixed impact that can fluctuate over time but not within cross-sections (Brooks, 2014). The fixed effect accounts for variances in each stock's initial liquidity level in the sample (Gregoriou, 2011).

The decision to utilise fixed or random effects is could be based on theoretical justification. They are statistical strategies for determining which of the two effects to use. The Hausman test compares the FE and RE specifications to find which one is best suited to the dataset (Brooks, 2014). This study uses the Hausman test which detects endogenous regressors (predictor variables) in a regression model.

4.4 Summary

This chapter set out to describe the methodologies used to evaluate the impact on the liquidity of stocks when deleted or added to the JSE Top 40 and FTSE/JSE Mid Cap Index. This chapter makes use of 44 inclusions and exclusions on the JSE Top 40 and 73 and 81 inclusions and exclusions on the Mid Cap index between January 2010 and December 2020 by employing an event study methodology. The multivariate analysis is used to answer all the 3 research questions. The equation utilised (as seen in table 4.5 below) is run twice for both inclusions and exclusions to be able to analyse the effects the different revisions may have on liquidity. The next chapter discusses the results collected.

Table 4.5 Summary of Empirical Methods Used to Answer Research Questions:

Research Question	**Method Utilised**	**Regression**
What is the liquidity response to the inclusion of a stock on the JSE Top 40 and Mid Cap Indices?	Multivariate Analysis	$\ln(\boldsymbol{Liquidity\ Proxy_{it}}) = (\boldsymbol{\alpha_0 + v_i}) + \boldsymbol{\beta_1}\ln(\boldsymbol{Volume_{it}}) + \boldsymbol{\beta_2}\ln(\boldsymbol{StdDev_{it}}) + \boldsymbol{\beta_3}\ln(\boldsymbol{Price_{it}}) + \boldsymbol{\beta_4 Dummy_{it}} + (\boldsymbol{\beta_5 Dummy_{it}}\ \boldsymbol{Market\ Cap}) + (\boldsymbol{\lambda_t + \varepsilon_{it}})$ - $\boldsymbol{\beta_4}$ analysed to determine effects of inclusions
What is the liquidity response to the exclusion of a stock on the JSE Top 40 and Mid Cap Indices?	Multivariate Analysis	$\ln(\boldsymbol{Liquidity\ Proxy_{it}}) = (\boldsymbol{\alpha_0 + v_i}) + \boldsymbol{\beta_1}\ln(\boldsymbol{Volume_{it}}) + \boldsymbol{\beta_2}\ln(\boldsymbol{StdDev_{it}}) + \boldsymbol{\beta_3}\ln(\boldsymbol{Price_{it}}) + \boldsymbol{\beta_4 Dummy_{it}} + (\boldsymbol{\beta_5 Dummy_{it}}\ \boldsymbol{Market\ Cap}) + (\boldsymbol{\lambda_t + \varepsilon_{it}})$ - $\boldsymbol{\beta_4}$ analysed to determine effects of exclusions
How does the size of a firm impact on the liquidity effects of an index inclusion or exclusion?	Multivariate Analysis	$\ln(\boldsymbol{Liquidity\ Proxy_{it}}) = (\boldsymbol{\alpha_0 + v_i}) + \boldsymbol{\beta_1}\ln(\boldsymbol{Volume_{it}}) + \boldsymbol{\beta_2}\ln(\boldsymbol{StdDev_{it}}) + \boldsymbol{\beta_3}\ln(\boldsymbol{Price_{it}}) + \boldsymbol{\beta_4 Dummy_{it}} + (\boldsymbol{\beta_5 Dummy_{it}}\ \boldsymbol{Market\ Cap}) + (\boldsymbol{\lambda_t + \varepsilon_{it}})$ - β_5 analysed to determine effects of firm size

CHAPTER 5: DATA ANALYSIS AND RESULTS

The below two sections covers the results and analysis of both the univariate and multivariate analysis results. Starting with the univariate analysis and then preceding to the multivariate analysis, the testing has been carried out via EViews and Excel data analysis and follows the method described in the section above.

5.1 Univariate Analysis

Table 5.1 and 5.2 summarises the data looking at the impact of the liquidity proxies in the 125/60/30 event period pre- and post- inclusions/exclusions. Within the table the post/pre ratio has been calculated accompanied by its associated t-statistic at the 1%, 5% and 10% levels, using a two-tailed test of significance. The last column indicates the proportion of companies within the index that have post/pre ratios higher than 1, therefore indicative of higher liquidity as a result of increased volume.

In the analysis if turnover and aggregate turnover have a post/pre ratio higher than 1, it indicates increased liquidity, but the opposite for bid-ask spread, percentage spread and Amihud illiquidity measure. For the latter measures, a post/pre ration less than 1 indicates increased liquidity as it is indicative of narrower spreads.

Table 5.1 Results of univariate analysis for inclusions for each liquidity proxy, over the 125, 60 and 30 day event periods

	Turnover		Aggregate Turnover		Bid-Ask Spread		Percentage Spread		Amihud Illiquidity Measure	
Index	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**
Panel A Top 40										
Inclusions 125	**1.21*** **	40.91%	**1.03**	45.45%	**0.97**	54.55%	**0.83****	70.45%	0.32	75.00%
Inclusions 60	1.03	50.00%	0.98	38.64%	**0.90*****	63.64%	**0.90*****	72.73%	**0.63****	65.91%
Inclusions 30	**0.81****	70.45%	**0.76***	68.18%	**0.86***	77.27%	**0.93**	79.55%	0.89	47.73%
Panel B Mid Cap										
Inclusions 125	**0.85*****	59.72%	0.96	56.94%	**0.81****	70.83%	**0.92***	56.94%	0.76	40.28%
Inclusions 60	0.96	52.78%	0.98	48.61%	**0.61*****	70.83%	**0.78****	54.17%	1.40	33.33%
Inclusions 30	**0.78***	70.83%	**0.80***	70.83%	**0.67*****	69.44%	**0.79****	61.11%	1.24	25.00%

'*', '**' and '***' represent statistical significance at the 1%, 5% and 10% levels respectively, using a two-tailed test of significance. Green highlight shows increased liquidity and yellow highlight shows decreased liquidity.

Source: Own estimation (2021)

Table 5.2 Results of univariate analysis for exclusions for each liquidity proxy, over the 125, 60 and 30 day event periods

	Turnover		Aggregate Turnover		Bid-Ask Spread		Percentage Spread		Amihud Illiquidity Measure	
Index	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**	**Post/Pre-Ratio**	**Proportion of Companies with a Post/Pre-Ratio > 1**
Panel A Top 40										
Exclusions 125	**0.76****	79.55%	0.94	75.00%	**0.84****	68.18%	**1.17****	36.36%	2.16	6.82%
Exclusions 60	**0.77***	88.64%	**0.85*****	77.27%	**0.92**	61.36%	1.07	43.18%	1.29	18.18%
Exclusions 30	0.66	90.91%	**0.69***	88.64%	1.05	50.00%	1.10	52.27%	1.13	15.91%
Panel B Mid Cap										
Exclusions 125	**1.10****	49.38%	**1.02**	37.04%	**0.92**	66.67%	1.05	61.73%	2.12	0.00%
Exclusions 60	**1.02**	46.91%	**1.18**	40.74%	**0.83**	66.67%	1.02	61.73%	3.88	50.62%
Exclusions 30	**0.90*****	58.02%	0.99	53.09%	**0.74**	70.37%	**0.95**	66.67%	1.57	0.00%

'*', '**' and '***' represent statistical significance at the 1%, 5% and 10% levels respectively, using a two-tailed test of significance. Green highlight shows increased liquidity and yellow highlight shows decreased liquidity.

Source: Own estimation (2021)

Inclusions

For the inclusion of companies to the Top 40 an overall increase in all liquidity measures can be observed. For turnover, the 125 and 30 day event periods are statistically significant where the 125 event day period experiences an increase in liquidity of which 40.91% companies have a post/pre ratio of higher than 1 and for the 30 day event period experiences a decrease in liquidity where 70.45% of companies have a post/pre ratio of lower than 1. Aggregate turnover is statistically significant for the 30 day event period where 68.18% of companies has a post/pre ratio of less than 1 indicating a decrease in liquidity. For the remainder of the measures there can be an overall increase in liquidity observed. The bid-ask spread's increase in liquidity is seen whereby the statistically significant 60 and 30 day event periods have 63.64% and 77.27% of companies with post/pre ratios of less than 1. The percentage spread's increase in liquidity is seen whereby the statistically significant 125 and 60 day event periods have 70.45% and 72.73% of companies with post/pre ratios of less than 1. The Amihud Illiquidity Measure's increase in liquidity is seen whereby the statistically significant 60 day event period have 65.91% of companies that have post/pre ratios of less than 1.

For the inclusion of companies to the Mid Cap an overall increase in liquidity can be observed. For turnover, the 125 and 30 event day periods are statistically significant where 59.72% and 70.83% of companies have post/pre ratios of less than 1. Similarly for aggregate turnover, a decrease in liquidity is observed where the statistically significant 30 event day period have 70.83% of companies with post/pre ratios of less than 1. The bid-ask spread's increase in liquidity is seen whereby the statistically significant 125, 60 and 30 day event periods have 70.83% (125 and 60 day) and 69.44% of companies with post/pre ratios of higher than 1. The percentage spread's increase in liquidity is seen whereby the statistically significant 125, 60 and 30 day event periods have 56.94%, 54.17% and 61.11% of companies with post/pre ratios of higher than 1.

Given the results observed for inclusions across both indices an overall increase in liquidity can be observed which is consistent with the results observed by Gregoriou (2011). This adds to the evidence for the information cost liquidity hypothesis, as it shows that index additions improve stock liquidity over time.

Exclusions

For the exclusion of companies to the Top 40 an overall decrease in liquidity can be observed. For turnover, the 125 and 60 event day periods are statistically significant where 79.55% and 88.64% of companies have post/pre ratios of less than 1. A similar trend is noted for aggregate turnover where the statistically significant 60 and 30 event day periods have 77.27% and 88.64% of companies with post/pre ratios of less than 1.

For the exclusion of companies to the Mid Cap there is no consistent or insightful observations that can be conclude. With only the 125 and 30 being statistically significant and the rest of the measures not the only conclusion that can be drawn is that there is an increase in liquidity for the turnover measure for the 125 event day period with 49.38% of companies experiencing a post/pre ratio of higher than 1 and a decrease in liquidity for the 30 day event day period where 58.02% of companies with post/pre ratios of higher than 1.

Based on the results for inclusions in both indexes, an overall drop in liquidity can be seen, which is consistent with Gregoriou's (2011) findings. This is further explained by Aboud & Karlsen (2019), who asserts that excluded companies become less liquid after being removed from the index, with plausible explanations including a decrease in the number of investor analysts following their stocks after they are removed and a large number of passive index trackers removing the companies from their portfolios and funds after they are removed from the index.

The results discussed in the above univariate analysis do not provide a conclusive result as to what is the exact liquidity effect observed after a stock is included on excluded from the Top 40 or Mid Cap Index and unable to answer all the research questions of this study. Therefore, the multivariate method of analysis that follows is expected to provide a more concise and useful summary of results as well as being a better method to capture the potential size effects that could be observed on liquidity.

5.2 Multivariate Analysis

Results of this analysis is shown table 5.3, a summary of results in table 5.4 below, proxies and control variables used outlined in Chapter 4 .The panel root test was carried out and found to be stationary either at level or first difference at varying levels of significance of 1%, 5% and 10%. The results can be seen in Appendix B (page 76). The Hausman test results can also

be seen in Appendix C (page 76) and the results indicate that the FE is appropriate and as a result the multivariate analysis below has been carried out utilising equation 4.8 as discussed in Chapter 4.

Table 5.3 Results of the multivariate tests for inclusions and exclusions for each liquidity proxy, over the 125, 60 and 30 day event periods

	125 Day Event Period					60 Day Event Period					30 Day Event Period				
	Turnover	**Aggregate Turnover**	**Bid-Ask Spread**	**Percentage Spread**	**Amihud Illiquidity Measure**	**Turnover**	**Aggregate Turnover**	**Bid-Ask Spread**	**Percentage Spread**	**Amihud Illiquidity Measure**	**Turnover**	**Aggregate Turnover**	**Bid-Ask Spread**	**Percentage Spread**	**Amihud Illiquidity Measure**
Top 40 Inclusions															
C	14.08*	7.88*	-3.75*	0.72	17.02*	14.58*	8.50*	-2.98**	1.66	20.26*	16.20*	8.31*	-1.35	3.20	23.96*
Volume	-	-	-0.05*	-0.05*	-0.64*	-	-	-0.03	-0.03	-0.62*	-	-	-0.01	-0.01	-0.62*
Price	0.89*	-0.10*	0.88*	-0.11	-1.16*	0.87*	-0.10*	0.77*	-0.32***	-1.84**	0.60*	-0.18	0.30	-0.81**	-2.56*
StDev	0.21*	0.18*	-0.21**	-0.22**	0.04	0.16	0.04	-0.25	-0.08	0.70*	0.39	0.29	0.38	0.64	1.45**
Dummy	0.78*	0.62*	-0.21	-0.22	-0.13	1.64*	4.29*	-0.32	-0.32	-0.90*	-1.79*	-1.72*	-0.32	-0.31	0.76
Dummy x Market Cap	-0.03*	-0.03*	0.00	0.00	0.01	-0.10*	-0.27*	0.01	0.01	0.06*	0.11*	0.12*	0.01	0.01	-0.05
Mid Cap Inclusions															
C	13.71*	7.99*	0.41	5.01*	16.86*	13.97*	8.37*	-0.72	3.82*	16.65*	15.89*	10.12*	-2.69**	1.88	17.31*
Volume	-	-	-0.05*	-0.05*	-0.43*	-	-	-0.05*	-0.05*	-0.49*	-	-	-0.03**	-0.03**	-0.49*
Price	0.289**	-0.69*	0.23**	-0.77*	-2.07*	0.57*	-0.42*	0.43*	-0.56*	-1.73*	0.55*	-0.48*	0.62*	-0.38**	-1.65*
StDev	1.46*	1.30*	0.20	0.20	1.43*	0.76**	0.58*	0.04	0.04	0.92*	0.34*	0.29	0.09	0.09	0.53***
Dummy	2.23*	0.09	-0.27	-0.28	0.12	0.87	-2.07*	-0.60	-0.61***	-0.31	1.25*	-3.18*	-0.22	-0.22	-0.15
Dummy x Market Cap	-0.15*	-0.00	0.01	0.01	-0.01	-0.05	0.15*	0.03	0.03	0.03	-0.09*	0.21*	0.01	0.01	0.02
Top 40 Exclusions															
C	18.39*	12.08*	-2.20*	2.41*	19.90*	22.75*	16.43*	-1.04	3.59*	18.94*	22.33*	15.98*	-5.56*	-0.97	18.96*
Volume	-	-	0.00	0.00	-0.57*	-	-	-0.03	-0.03	-0.60*	-	-	0.05	0.05	-0.64*
Price	-0.22*	-1.25*	0.09	-0.90*	-2.79*	-1.85*	-2.86*	0.06	-0.94*	-3.55*	-1.88*	-2.87*	0.49	-0.50	-3.31*
StDev	1.623*	1.70*	0.98*	0.96*	2.78*	4.23*	4.25*	0.86	0.87	4.88*	4.42*	4.42*	0.76	0.74	4.47*
Dummy	-1.11*	-1.07*	4.31*	4.30*	-0.91***	-1.58*	-1.57*	-0.01	0.00	0.87	0.42	0.43	-0.14	-0.14	1.93***
Dummy x Market Cap	0.06*	0.06*	-0.29*	-0.29*	0.06***	0.09*	0.09*	0.00	0.00	-0.05	-0.05	-0.05	0.01	0.01	-0.12***
Mid Cap Exclusions															
C	15.29*	9.37*	1.78*	6.50*	16.74*	18.27*	11.73*	1.97*	6.51*	18.05*	17.70*	10.56*	2.71*	7.27*	21.71*
Volume	-	-	-0.06*	-0.06*	-0.46*	-	-	-0.07*	-0.07*	-0.51*	-	-	-0.07*	-0.07*	-0.47*
Price	0.38*	-0.61*	0.13**	-0.87*	-1.67*	-0.56*	-1.41*	-0.06	-1.07*	-2.81*	-0.78**	-1.38*	-0.49	-1.46*	-4.76*
StDev	0.75*	0.70*	0.07	0.08	0.67*	2.05*	1.83*	0.54***	0.58***	3.10*	2.76*	2.15*	1.29**	1.23***	6.41*
Dummy	-0.52***	-0.84*	-0.32	-0.40***	-0.31	0.18	0.17	0.13	0.16	-0.19	-0.01	0.13	0.06	0.08	-0.83***
Dummy x Market Cap	0.04*	0.07*	0.02	0.02	0.02	-0.00	-0.00	-0.02	-0.02	0.01	-0.00	-0.01	-0.01	-0.01	0.06***

'*', '**' and '***' represent statistical significance at the 1%, 5% and 10% levels respectively, using a two-tailed test of significance. Green highlight shows increased liquidity and yellow highlight shows decreased liquidity. Source: Own estimation (2021)

5.2.1 Inclusions: Liquidity Effects

This discussion aims to answer the first research question by analysing the coefficients of the dummy variable (*Dummy*) discussed in equation 4.8. The expected coefficients of this dummy variable and its relation and effect on liquidity is highlighted in table 4.3 on page 43.

For the 125 and 60 day event period for inclusions, the dummy variable is positively statistically significant for turnover and aggregate turnover for the Top 40 and for the Mid Cap the dummy variable is positive for Turnover in the 125 and 30 day period, a negative coefficient for Aggregate Turnover in the 60 and 30 day period. This indicates that there in an increase in liquidity as a result of the increased trade after the stock was included into the index. This supports the DSDC, PPH and LCH as it confirms that an increase in volume and trading activity results in increased liquidity. For the 30 day period the negative coefficient for these proxies are contradicting the results for the 125 and 60 period implying that the short term cannot fully realise the volume effects that are hypothesised to result in an increase in liquidity.

The observed increase in liquidity is consistent with the study carried out by Erwin & Miller (1998) and Gregoriou & Ioannidis (2011) whereby they state that for an inclusion to the index the increase in volume results in increased liquidity. The only other statistically significant variable seen is percentage spread in Mid Cap inclusions over the 60-day period and the Amihud Illiquidity Measure for the Top 40 Inclusions indicating increase in liquidity. However, the dominant effect is seen in the Top 40 with an increase in overall liquidity as a result of higher turnover.

5.2.2 Exclusions: Liquidity Effects

This discussion aims to answer the second research question by analysing the coefficients of the dummy variable (*Dummy*) discussed in equation 4.8. The expected coefficients of this dummy variable and its meaning to liquidity is highlighted in table 4.3 on page 43.

The negative coefficient for the turnover and aggregate turnover equations indicates that traded volume decreased in the 125 and 60 days after index inclusion. Combined with the increasing spreads for the Top 40 as shown in table 5.3 , this indicates diminished liquidity for companies which were excluded in both the Top 40 and Midcap indices.

The observation made largely during the longer period of the index exclusion is that there is an observed decrease in liquidity which is consistent with studies by Erwin & Miller (1998), Gregoriou (2011). The overall observation is that liquidity has decreased as a result of the exclusion and the effect is noted over the longer time period indicating there is a long term effect of a decrease in liquid when a stock is excluded form an index. This confirms the information cost liquidity hypothesis since it indicates that index exclusions produce a long-term decline in liquidity.

5.2.3 Size of Firm that are Included and Excluded: Liquidity Effects

This discussion aims to answer the third research question by analysing the coefficients of the dummy variable (*Dummy x Market Cap*) discussed in equation 4.8. The expected coefficients of this dummy variable and its meaning to liquidity is highlighted in table 4.3 on page 43.

When it comes to firm size, the larger the firm, the more stocks that circulate in the market. More stockholders increase the depth and breadth of the market. According the hypothesis by Merton (1987), it is believed that because larger firms have more corporate information, there will be less information asymmetry and increased stock liquidity. Smaller firms are referred to as the stocks part of the Mid Cap and larger firms referring to the stocks in the Top 40. However this is only evident in the exclusions of stocks in the Top 40 whereby the positively statistically significant coefficients are noted for turnover, aggregate turnover, bid-ask spread and percentage spread for the 125 day period and positively statistically significant for the 60-day period for turnover and aggregate turnover and negatively statistically significant for the Amihud Illiquidity measure for the 30 day period.

For the inclusions of the stocks onto the Top 40 and the Mid Cap index, this is not seen as there is a decrease in liquidity observed for the larger cap firms during the 125 and 60 day period with an increase seen in the 30 day period. This could indicate that the firm size has a short term impact on liquidity by increasing in the short term and decreasing in the long term.

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5.3 Conclusion

This chapter analyses and discusses the results obtained from the multivariate regression analysis of the liquidity proxies in order to answer the three research questions the study set out to answer. The results for the each of the questions are outlined in the table 5.4 below. The results provide three important insights to the effects of index revisions and firm size on liquidity. Firstly, for inclusions to an index (more prominent in the Top 40 where higher trading volumes are expected), there in an increase in liquidity as a result of the increased trade after the stock was included into the index and provides support from the DSDC, PPH and LCH. Secondly, for exclusions stocks experience a decrease in volume traded and increasing spreads for the Top 40 and indicates that this diminished liquidity observed for such companies that find themselves excluded in both the Top 40 and Midcap indices. Lastly, large firms such as those listed on the Top 40 have more stockholders increasing the depth and breadth of the market the larger the firm, as more stocks circulate in the market. However, this is not seen in this study and the question remains unanswered.

Table 5.4 Summarised Results from Multivariate results

Index	**Increased/Reduced Liquidity**	**Impact on Liquidity based on Firm Size**
Panel A Top 40		
Inclusions 125	Increase	Yes (Decrease)
Inclusions 60	Increase	Yes (Decrease)
Inclusions 30	Decrease	Yes (Increase)
Panel B Mid Cap		
Inclusions 125	Increase	Yes (Decrease)
Inclusions 60	Increase/Decrease	Yes (Increase)
Inclusions 30	Increase/Decrease	Yes (Increase/Decrease)
Panel A Top 40		
Exclusions 125	Decrease	Yes (Increase)
Exclusions 60	Decrease	Yes (Increase)
Exclusions 30	Decrease	Yes (Increase)
Panel B Mid Cap		
Exclusions 125	Decrease	Yes (Increase)
Exclusions 60	-	-
Exclusions 30	Increase	Yes (Decrease)

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 A Review of Objectives

The inclusion and exclusion of stocks from equity indices give valuable information about a company's performance. There have been no studies on liquidity effects in a South African market, as shown in Chapter 3 of this thesis, and past research in such a market has focused on pricing and index rebalancing effects as a result of inclusions and exclusions from the FTSE/JSE and JSE Top 40. One of the main purposes of the study is to fill in the gap of this area of research by using the understanding that international studies (covered in Chapter 3) produce that would be valuable to interpret in a South African setting. The dearth of studies examining the impact of JSE Top 40 and Mid Cap Index inclusions and exclusions on liquidity is a disadvantage for South African investors, companies, and regulators.

The objective of the study are as follows:

- To examine what effect the inclusion of stocks to the JSE Top 40 and Mid Cap indices has on liquidity
- To examine what effect the exclusion of stocks to the JSE Top 40 and Mid Cap indices has on liquidity
- To examine whether the liquidity impact experienced from an index inclusion/deletion is related to the size of the firm

This study uses an event study methodology and employs both univariate and multivariate analysis through two regressions using liquidity proxies to create the results. The findings of which have been discussed in the preceding chapter. In an attempt to answer the study's research questions, the following section highlights the significant findings.

6.2 Summary of Results Including Conclusions

6.2.1 Research Question One: What is the liquidity response to the inclusion of a stock on the JSE Top 40 and Mid Cap Indices?

The results from the multivariate analysis shows the observed increase in liquidity according to the turnover measures. This finding is consistent with the study carried out by Erwin and Miller whereby they state that for an inclusion to the index the increase in volume results in increased liquidity. A higher trade volume is associated with the Top 40 compared to the Mid Cap and it would be expected that a higher or observed increase in liquidity should be seen in

more in the Top 40. This indicates that there in an increase in liquidity as a result of the increased trade after the stock was included into the index. This supports the DSDC, PPH and LCH as it confirms that an increase in volume and trading activity results in increased liquidity.

6.2.2 Research Question Two: What is the liquidity response to the exclusion of a stock on the JSE Top 40 and Mid Cap Indices?

The results from the multivariate analysis shows that predominantly during the longer period of the index exclusion that there is an observed decrease in liquidity which is consistent with studies by Erwin & Miller (1998), Gregoriou (2011). This indicates that liquidity has decreased as a result of the exclusion and the effect is noted over the longer time period indicating there is a long term effect of a decrease in liquid when a stock is excluded form an index.

6.2.3 Research Question Three: How does the size of a firm impact on the liquidity effects of an index inclusions and exclusion?

According to Merton (1987) larger firms have more corporate information, there will be less information asymmetry and increased stock liquidity. However, this is only evident in the exclusions of stocks in the Top 40. whereby the positive coefficients are noted for turnover, aggregate turnover, bid-ask spread and percentage spread for the 125 day period and positive coefficients for the 60-day period for turnover and aggregate turnover and negatively statistically significant for the Amihud Illiquidity measure for the 30 day period. For the inclusions of the stocks onto the Top 40 and the Mid Cap index, this is not seen as there is a decrease in liquidity observed for the larger cap and Mid Cap firms for inclusions and increases firms excluded from the Top 40 and Mid Cap index.

6.3 Opportunities for Further Research

The study only utilised two ETF's within an emerging market. Based on this limitation, the following study opportunities for contributing to current knowledge on liquidity impacts on the inclusions and exclusions of stocks on the Top 40 and Mid Cap indices in the South African context have been identified:

- Future research could seek to extend the study's sample to include for more ETF's withing the JSE

- Future studies could also compare liquidity effects across markets (emerging vs developed markets) to observe the impact growth and development may have on liquidity.

6.4 Conclusion

The univariate and multivariate analysis was conducted and the results were shown and carried out in Chapter 5. The multivariate analysis provided an opportunity to address a three research questions as opposed to just the two in the univariate analysis. The post/pre ratios for all five proxies utilised were examined using the univariate technique of analysis. Whilst the multivariate analysis utilised a fixed effects panel data analysis, which used the dummy variable and dummy x market cap variable to answer all three research questions. The five chosen liquidity measures that were used in this study were namely turnover, aggregate turnover, bid-ask spread, percentage spread and Amihud illiquidity. The study utilised three event windows of 125, 60 and 30for inclusions and exclusions of stocks in the JSE and varied over January 2010 to December 2020. The sample consisted of 299 companies that that were observed to be included or excluded from the indices, however, only 241 clients could be analysed given 57 of the clients had no data available on Bloomberg, IRESS or Yahoo Finance. For the Top 40 44 clients 44 clients were analysed for the inclusions and exclusions and for the Mid Cap 72 clients were analysed for inclusions and 81 for exclusions.

The primary objective of this study is to observe and analyse the effect of inclusions and exclusions from the Top 40 and Mid Cap Index on liquidity as well to determine how does the size of a firm impact on the liquidity effects of an index addition or deletion. The analysed results conclude that for inclusions. the volume traded is an important determinant of liquidity. This leads to the conclusion that during the mid-period of 60 days that the Top 40 experiences an increase in liquidity as a result of increased trade volume compared to the Mid Cap. Further, liquidity has decreased as a result of exclusions to the index and the effect is noted over the longer time period.

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APPENDICES

Appendix A

Table A-1: Summary of companies used in the liquidity analysis

#	Company Ticker	Company Ticker	Event Date	Included/Excluded from Sample
JSE Top 40 Inclusions				
1	Woolworths Holdings Ltd	WHL	19 September 2011	Included
2	British American Tobacco Plc	BTI	19 December 2011	Included
3	Assore Ltd	ASR	20 June 2011	Included
4	Mr Price Group Ltd	MRP	25 September 2012	Included
5	*Mediclinic International Ltd*	*MDC*	*24 December 2012*	*Excluded**
6	*Imperial Holdings Ltd*	*IPL*	*18 June 2012*	*Excluded**
7	Life Healthcare Group Holdings Ltd	LHC	23 December 2013	Included
8	Discovery Ltd	DSY	18 March 2013	Included
9	Capital & Counties Prop Plc	CCO	23 December 2013	Included
10	*Reinet Investments S.C.A*	*RNI*	*24 March 2014*	*Excluded**
11	Rand Merchant Ins Holdings Ltd	RMI	22 December 2014	Included
12	Netcare Limited	NTC	22 December 2014	Included
13	Mr Price Group Ltd	MRP	22 September 2014	Included
14	Redefine Properties Ltd	RDF	21 September 2015	Included
15	PSG Group Ltd	PSG	21 December 2015	Included
16	MMI Holdings Limited	MTM	22 June 2015	Included
17	Fortress Inc Fund Ltd B	FFB	21 December 2015	Included
18	Fortress Inc Fund Ltd A	FFA	21 December 2015	Included
19	Capitec Bank Holdings Ltd	CPI	22 June 2015	Included
20	Brait SE	BAT	22 June 2015	Included
21	Sibanye Gold Limited	SSW	19 September 2016	Included
22	Sappi Ltd	SAP	19 December 2016	Included
23	Life Healthcare Group Holdings Ltd	LHC	19 September 2016	Included
24	Gold Fields Ltd	GFI	19 September 2016	Included
25	Bidvest Ltd	BVT	19 September 2016	Included
26	AngloGold Ashanti Ltd	ANG	22 March 2016	Included

27	Truworths International Ltd	TRU	20 March 2017	Included
28	Resilient REIT Limited	RES	18 December 2017	Included
29	*Nepi Rockcastle Plc*	*NRP*	*18 September 2017*	*Excluded**
30	Capitec Bank Holdings Ltd	CPI	19 June 2017	Included
31	Truworths Int Ltd	TRU	19 March 2018	Included
32	The Spar Group Ltd	SPP	19 March 2018	Included
33	The Foschini Group Ltd	TFGP	19 March 2018	Included
34	Reinet Investments S.C.A	RNI	25 September 2018	Included
35	PSG Group Ltd	PSG	24 December 2018	Included
36	Netcare Limited	NTC	18 June 2018	Included
37	Imperial Holdings Ltd	IPL	19 March 2018	Included
38	Clicks Group Ltd	CLS	18 June 2018	Included
39	Sibanye Gold Limited	SSW	23 September 2019	Included
40	Impala Platinum Holdings Ltd	IMP	23 September 2019	Included
41	Gold Fields Ltd	GFI	18 March 2019	Included
42	Exxaro Resources Ltd	EXX	24 June 2019	Included
43	Aspen Pharmacare Holdings Ltd	APN	23 December 2019	Included
44	Anglo American Plat Ltd	AMS	18 March 2019	Included
45	Reinet Investments S.C.A	RNI	23 March 2020	Included
46	Northam Platinum Ltd	NHM	23 March 2020	Included
47	Harmony Gm Co Ltd	HAR	21 September 2020	Included
48	Exxaro Resources Ltd	EXX	22 June 2020	Included
JSE Top 40 Exclusions				
1	Pick N Pay Stores Ltd	PIK	20 June 2011	Included
2	*Reinet Investments SCA*	*RNI*	19 September 2011	*Excluded**
3	ArcelorMittal SA Limited	ACL	19 December 2011	Included
4	*Lonmin Plc*	*LON*	18 June 2012	*Excluded**
5	*African Bank Investment Ltd*	*ABL*	25 September 2012	*Excluded**
6	Harmony Gm Co Ltd	HAR	24 December 2012	Included
7	Mr Price Group Ltd	MRP	18 March 2013	Included
8	Massmart Holdings Ltd	MSM	23 December 2013	Included
9	Gold Fields Ltd	GFI	23 December 2013	Included

10	Truworths Int Ltd	TRU	24 March 2014	Included
11	African Rainbow Min Ltd	ARI	22 September 2014	Included
12	Exxaro Resources Ltd	EXX	22 December 2014	Included
13	Assore Ltd	ASR	22 December 2014	Included
14	Impala Platinum Holdings Ltd	IMP	22 June 2015	Included
15	Life Healthcare Grp Holdings Ltd	LHC	22 June 2015	Included
16	Imperial Holdings Ltd	IPL	22 June 2015	Included
17	Kumba Iron Ore Ltd	KIO	21 September 2015	Included
18	MMI Holdings Limited	MTM	21 December 2015	Included
19	AngloGold Ashanti Ltd	ANG	21 December 2015	Included
20	PSG Group Ltd	PSG	22 March 2016	Included
21	Capitec Bank Holdings Ltd	CPI	19 September 2016	Included
22	Rand Merchant Investments Holdings Ltd	RMI	19 September 2016	Included
23	Anglo American Plat Ltd	AMS	19 September 2016	Included
24	Capital & Counties Prop Plc	CCO	19 September 2016	Included
25	Sibanye Gold Limited	SSW	19 December 2016	Included
26	Brait SE	BAT	20 March 2017	Included
27	Impala Platinum Holdings Ltd	IMP	19 June 2017	Included
28	Truworths Int Ltd	TRU	18 September 2017	Included
29	Netcare Limited	NTC	18 December 2017	Included
30	Fortress REIT Ltd A	FFA	19 March 2018	Included
31	Fortress REIT Ltd B	FFB	19 March 2018	Included
32	*Intu Properties Plc*	*ITU*	19 March 2018	*Excluded**
33	Resilient REIT Limited	RES	19 March 2018	Included
34	Steinhoff International Holdings N.V.	SNH	19 March 2018	Included
35	Reinet Investments S.C.A	RNI	18 June 2018	Included
36	Imperial Holdings Ltd	IPL	18 June 2018	Included
37	Gold Fields Ltd	GFI	25 September 2018	Included
38	Mediclinic Int Plc	MEI	24 December 2018	Included
39	Life Healthcare Grp Holdings Ltd	LHC	18 March 2019	Included
40	Reinet Investments S.C.A	RNI	18 March 2019	Included

41	Netcare Limited	NTC	24 June 2019	Included
42	Aspen Pharmacare Holdings Ltd	APN	23 September 2019	Included
43	Sappi Ltd	SAP	23 September 2019	Included
44	Exxaro Resources Ltd	EXX	23 December 2019	Included
45	The Foschini Group Limited	TFGP	23 March 2020	Included
46	Tiger Brands Ltd	TBS	23 March 2020	Included
47	Redefine Properties Ltd	RDF	22 June 2020	Included
48	RMB Holdings Ltd	RMH	21 September 2020	Included
JSE Mid Cap Inclusions				
1	Assore Ltd	ASR	20 December 2010	Included
2	Capitec Bank Holdings Ltd	CPI	20 December 2010	Included
3	PSG Group Ltd	PSG	20 December 2010	Included
4	ArcelorMittal SA Limited	ACL	19 December 2011	Included
5	*Reinet Investments SCA*	*RNI*	*19 September 2011*	*Excluded**
6	Capital & Counties Prop Plc	CCO	19 December 2011	Included
7	Brait S.A.	BAT	20 June 2011	Included
8	Pick N Pay Stores Ltd	PIK	20 June 2011	Included
9	*Royal Bafokeng Platinum Ltd*	*RBP*	*22 March 2011*	*Excluded**
10	*Lonmin Plc*	*LON*	*18 June 2012*	*Excluded**
11	*Omnia Holdings Ltd*	*OMN*	*24 December 2012*	*Excluded**
12	Harmony Gm Co Ltd	HAR	24 December 2012	Included
13	Oceana Group Ltd	OCE	24 December 2012	Included
14	*African Bank Investment Ltd*	*ABL*	*25 September 2012*	*Excluded**
15	Vukile Property Fund Ltd	VKE	25 September 2012	Included
16	Mr Price Group Ltd	MRP	18 March 2013	Included
17	*Tsogo Sun Holdings Ltd*	*TSH*	*23 December 2013*	*Excluded**
18	Gold Fields Ltd	GFI	23 December 2013	Included
19	Massmart Holdings Ltd	MSM	23 December 2013	Included
20	PSG Group Ltd	PSG 1	23 December 2013	Included
21	New Europe Prop Investment PLC	NEP	24 June 2013	Included
22	African Rainbow Minerals Ltd	ARI	22 September 2014	Included
23	Assore Ltd	ASR 1	22 December 2014	Included

24	Exxaro Resources Ltd	EXX	22 December 2014	Included
25	*Alexander Forbes Grp Holdings*	*AFH*	*22 September 2014*	*Excluded**
26	Fortress Inc Fund Ltd A	FFA	22 September 2014	Included
27	Fortress Inc Fund Ltd B	FFB	22 December 2014	Included
28	*Acucap Properties Ltd*	*ACP*	*22 December 2014*	*Excluded**
29	Super Group Ltd	SPG	22 December 2014	Included
30	*Redefine International P.L.C*	*RPL*	*23 June 2014*	*Excluded**
31	*Attacq Limited*	*ATT*	*24 March 2014*	*Excluded**
32	Sibanye Gold Limited	SSW	24 March 2014	Included
33	Truworths Int Ltd	TRU	24 March 2014	Included
34	AngloGold Ashanti Ltd	ANG	21 December 2015	Included
35	*PSG Konsult Limited*	*KST*	*21 September 2015*	*Excluded**
36	Italtile Ltd	ITE	21 December 2015	Included
37	JSE Ltd	JSE	21 September 2015	Included
38	Kumba Iron Ore Ltd	KIO	21 September 2015	Included
39	MMI Holdings Limited	MTM	21 December 2015	Included
40	Net 1 UEPS Tech Inc	NT1	21 September 2015	Included
41	Impala Platinum Holdings Ltd	IMP	22 June 2015	Included
42	Imperial Holdings Ltd	IPL	22 June 2015	Included
43	Life Healthcare Grp Holdings Ltd	LHC	22 June 2015	Included
44	Vukile Property Fund Ltd	VKE 1	22 June 2015	Included
45	Zeder Investments Ltd	ZED	22 June 2015	Included
46	*Distell Group Ltd*	*DGH*	*23 March 2015*	*Excluded**
47	*Rockcastle Global Real Estate Co Ltd*	*ROC*	*23 March 2015*	*Excluded**
48	ArcelorMittal SA Limited	ACL 1	19 September 2016	Included
49	Capital & Regional Plc	CRP	19 September 2016	Included
50	Net 1 UEPS Tech Inc	NT1 1	19 September 2016	Included
51	*Lonmin Plc*	*LON*	*20 June 2016*	*Excluded**
52	Harmony Gm Co Ltd	HAR 1	22 March 2016	Included
53	*Illovo Sugar Ltd*	*ILV*	*22 March 2016*	*Excluded**
54	PSG Group Ltd	PSG 2	22 March 2016	Included
55	Brait SE	BAT 2	18 September 2017	Included

56	Echo Polska Prop N.V.	EPP	18 September 2017	Included
57	*Greenbay Properties Ltd*	*GRP*	*18 September 2017*	*Excluded**
58	Netcare Limited	NTC	18 September 2017	Included
59	ArcelorMittal SA Limited	ACL 2	20 March 2017	Included
60	Gold Fields Ltd	GFI 1	20 March 2017	Included
61	*Dis-Chem Pharmacies Ltd*	*DCP*	*20 March 2017*	*Excluded**
62	Sibanye Gold Limited	SSW 1	20 March 2017	Included
63	*Steinhoff African Rt Ltd*	*SRR*	*18 June 2018*	*Excluded**
64	Capital & Counties Prop Plc	CCO 1	19 March 2018	Included
65	Fortress REIT Ltd A	FFA 1	19 March 2018	Included
66	Fortress REIT Ltd B	FFB 1	19 March 2018	Included
67	Resilient REIT Limited	RES	19 March 2018	Included
68	Steinhoff International Holdings N.V.	SNH	19 March 2018	Included
69	AngloGold Ashanti Ltd	ANG 1	25 September 2018	Included
70	*Quilter Plc*	*QLT*	*25 September 2018*	*Excluded**
71	*Intu Properties Plc*	*ITU*	*25 September 2018*	*Excluded**
72	*Vivo Energy Plc*	*VVO*	*25 September 2018*	*Excluded**
73	Mas Real Estate Inc.	MSP	18 March 2019	Included
74	Sappi Ltd	SAP	18 March 2019	Included
75	Aspen Pharmacare Holdings Ltd	APN	23 September 2019	Included
76	Hammerson Plc	HMN	23 September 2019	Included
77	Mediclinic Int Plc	MEI	23 September 2019	Included
78	Mr Price Group Ltd	MRP 1	23 September 2019	Included
79	Redefine Properties Ltd	RDF	23 September 2019	Included
80	Rand Merchant Ins Holdings Ltd	RMI	23 September 2019	Included
81	Tiger Brands Ltd	TBS	23 September 2019	Included
82	Bidvest Ltd	BVT	21 September 2020	Included
83	DRD Gold Ltd	DRD	21 September 2020	Included
84	Nedbank Group Ltd	NED	21 September 2020	Included
85	Nepi Rockcastle Plc	NRP	21 September 2020	Included
86	Old Mutual Limited	OMU	21 September 2020	Included
87	Remgro Ltd	REM	21 September 2020	Included

88	*Ninety One Plc*	*N91*	*21 September 2020*	*Excluded**
89	*Ninety One Limited*	*NY1*	*21 September 2020*	*Excluded**
90	*Investec Plc*	*INP*	*21 September 2020*	*Excluded**
91	*Investec Ltd*	*INL*	*21 September 2020*	*Excluded**
92	Exxaro Resources Ltd	EXX 1	23 March 2020	Included
93	Growthpoint Prop Ltd	GRT	23 March 2020	Included
94	Multichoice Group Ltd	MCG	23 March 2020	Included
95	PSG Group Ltd	PSG 3	23 March 2020	Included
96	*Pepkor Holdings Ltd*	*PEP*	*23 March 2020*	*Excluded**
97	Sirius Real Estate Ltd	SRE	23 March 2020	Included
98	Woolworths Holdings Ltd	WHL	23 March 2020	Included
JSE Mid Cap Exclusions				
1	*Caxton CTP Publish Print*	*CAT*	*20 December 2010*	*Excluded**
2	*Group Five Ltd*	*GRF*	*20 December 2010*	*Excluded**
3	Trencor Ltd	TRE	20 December 2010	Included
4	Astral Foods Ltd	ARL	19 December 2011	Included
5	Blue Label Telecoms Ltd	BLU	19 December 2011	Included
6	Woolworths Holdings Ltd	WHL	19 September 2011	Included
7	Assore Ltd	ASR	20 June 2011	Included
8	*Evraz Highveld Steel & Van*	*EHS*	*20 June 2011*	*Excluded**
9	*Gold Reef Resorts Ltd*	*GDF*	*22 March 2011*	*Excluded**
10	*Imperial Holdings Ltd*	*IPL*	*18 June 2012*	*Excluded**
11	*Allied Technologies Ltd*	*ALT*	*24 December 2012*	*Excluded**
12	*Mediclinic International Ltd*	*MDC*	*24 December 2012*	*Excluded**
13	PSG Group Ltd	PSG	24 December 2012	Included
14	Mr Price Group Ltd	MRP	25 September 2012	Included
15	Palabora Mining Co Ltd	PAM	25 September 2012	Included
16	Discovery Ltd	DSY	18 March 2013	Included
17	Capital & Counties Prop Plc	CCO	23 December 2013	Included
18	*JD Group Ltd*	*JDG*	*23 December 2013*	*Excluded**
19	Lewis Group Ltd	LEW	23 December 2013	Included
20	Life Healthcare Grp Holdings Ltd	LHC	23 December 2013	Included

21	*Sibanye Gold Limited*	*SSW*	*24 June 2013*	*Excluded**
22	Aveng Group Limited	AEG	22 December 2014	Included
23	*Allied Electronics Corp A*	*AEL*	*22 December 2014*	*Excluded**
24	*Allied Elec Corp N*	*AEN*	*22 December 2014*	*Excluded**
25	Netcare Limited	NTC	22 December 2014	Included
26	Rand Merchant Ins Holdings Ltd	RMI	22 December 2014	Included
27	Mr Price Group Ltd	MRP 1	22 September 2014	Included
28	Sa Corp Real Estate Fund	SAC	22 September 2014	Included
29	Vukile Property Fund Ltd	VKE	22 September 2014	Included
30	Acucap Properties Ltd	ACP	23 June 2014	Included
31	*African Oxygen Limited*	*AFX*	*24 March 2014*	*Excluded**
32	Emira Property Fund	EMI	24 March 2014	Included
33	*Reinet Investments Soc Anon*	*REI*	*24 March 2014*	*Excluded**
34	Fortress Inc Fund Ltd A	FFA	21 December 2015	Included
35	Fortress Inc Fund Ltd B	FFB	21 December 2015	Included
36	PSG Group Ltd	PSG 1	21 December 2015	Included
37	Trencor Ltd	TRE 1	21 December 2015	Included
38	Illovo Sugar Ltd	ILV	21 September 2015	Included
39	*Lonmin Plc*	*LON*	*21 September 2015*	*Excluded**
40	Royal Bafokeng Platinum Ltd	RBP	21 September 2015	Included
41	Redefine Properties Ltd	RDF	21 September 2015	Included
42	ArcelorMittal SA Limited	ACL	22 June 2015	Included
43	Brait SE	BAT	22 June 2015	Included
44	Capitec Bank Holdings Ltd	CPI	22 June 2015	Included
45	Harmony Gm Co Ltd	HAR	22 June 2015	Included
46	MMI Holdings Limited	MTM	22 June 2015	Included
47	Murray & Roberts Holdings	MUR	23 March 2015	Included
48	Wilson Bayly Hlm-Ovc Ltd	WBO	23 March 2015	Included
49	Gold Fields Ltd	GFI	19 September 2016	Included
50	Net 1 UEPS Tech Inc	NT1	19 September 2016	Included
51	Sibanye Gold Limited	SSW 1	19 September 2016	Included
52	Sun International Ltd	SUI	2 June 2016	Included

53	Adcock Ingram Holdings Ltd	AIP	22 March 2016	Included
54	AngloGold Ashanti Ltd	ANG	22 March 2016	Included
55	Grindrod Ltd	GND	22 March 2016	Included
56	ArcelorMittal SA Limited	ACL 1	18 September 2017	Included
57	Bidvest Ltd	BVT	20 March 2017	Included
58	Kumba Iron Ore Ltd	KIO	20 March 2017	Included
59	*Lonmin Plc*	*LON 1*	*20 March 2017*	*Excluded**
60	*New Europe Prop Investments PLC*	*NEP*	*20 March 2017*	*Excluded**
61	PSG Group Ltd	PSG 2	20 March 2017	Included
62	Resilient REIT Limited	RES	20 March 2017	Included
63	Sappi Ltd	SAP	20 March 2017	Included
64	Datatec Ltd	DTC	19 March 2018	Included
65	*Stadio Holdings Ltd*	*SDO*	*19 March 2018*	*Excluded**
66	Vivo Energy Plc	VVO	24 December 2018	Included
67	Alexander Forbes Grp Holdings	AFH	25 September 2018	Included
68	Blue Label Telecoms Ltd	BLU 1	25 September 2018	Included
69	EOH Holdings Ltd	EOH	25 September 2018	Included
70	*Omnia Holdings Ltd*	*OMN*	*25 September 2018*	*Excluded**
71	*Pepkor Holdings Ltd*	*PEP*	*25 September 2018*	*Excluded**
72	Zeder Investments Ltd	ZED	25 September 2018	Included
73	AngloGold Ashanti Ltd	ANG 1	18 March 2019	Included
74	Exxaro Resources Ltd	EXX	18 March 2019	Included
75	Lighthouse Capital Ltd	LTE	18 March 2019	Included
76	Tongaat Hulett Ltd	TON	18 March 2019	Included
77	Gold Fields Ltd	GFI 1	23 September 2019	Included
78	Nampak Ltd	NPK	23 September 2019	Included
79	*RDI REIT P.L.C*	*RPL*	*23 September 2019*	*Excluded**
80	Steinhoff Int Holdings N.V.	SNH	23 September 2019	Included
81	*Tsogo Sun Hotels Ltd*	*TGO*	*23 September 2019*	*Excluded**
82	Brait SE	BAT 1	21 September 2020	Included
83	Echo Polska Prop N.V.	EPP	21 September 2020	Included
84	Hammerson Plc	HMN	21 September 2020	Included

85	Hyprop Investments Ltd	HYP	21 September 2020	Included
86	Imperial Logistics Ltd	IPL	21 September 2020	Included
87	KAP Industrial Holdings Ltd	KAP	21 September 2020	Included
88	*PSG Konsult Limited*	*KST*	*21 September 2020*	*Excluded**
89	Massmart Holdings Ltd	MSM	21 September 2020	Included
90	Mas Real Estate Inc.	MSP	21 September 2020	Included
91	Motus Holdings Ltd	MTH	21 September 2020	Included
92	RCL Foods Limited	RCL	21 September 2020	Included
93	Reunert Ltd	RLO	21 September 2020	Included
94	Tsogo Sun Gaming Ltd	TSG	21 September 2020	Included
95	Vukile Property Fund Ltd	VKE 1	21 September 2020	Included
96	Attacq Limited	ATT	23 March 2020	Included
97	Churro Holdings Limited	COH	23 March 2020	Included
98	Famous Brands Ltd	FBR	23 March 2020	Included
99	Hosken Cons Investments Ltd	HCI	23 March 2020	Included
100	Impala Platinum Holdings Ltd	IMP	23 March 2020	Included
101	*Intu Properties Plc*	*ITU*	*23 March 2020*	*Excluded**
102	Oceana Group Ltd	OCE	23 March 2020	Included
103	Sa Corp Real Estate Ltd	SAC 1	23 March 2020	Included
104	Super Group Ltd	SPG	23 March 2020	Included
105	*Sibanye Stillwater Ltd*	*SSW*	*23 March 2020*	*Excluded**

Source: Own compilation (2021)

**Companies Excluded from the data set was due to insufficient data available on databases to form a full set of data for the event window*

APPENDIX B

Table B-1 P-Values of Unit Root Test for each Company

	Turnover	Aggregate Turnover	Bid-Ask Spread	Percentage Spread	Amihud Illiquidity Measure	Volume	Price	StDev	Market Cap
Top 40 Inclusions									
125 Day	0	0	0	0	0	0	0	0	0
Mid Cap Inclusions									
125 Day	0	0	0	0	0	0	0	0	0
Top 40 Exclusions									
125 Day	0	0	0	0	0	0	0	0	0
Mid Cap Exclusions									
125 Day	0	0	0	0	0	0	0	0	0

Source: Own estimation (2021)

APPENDIX C

Table C-1 Chi-Square values for Hausman Test for each Panel

	Turnover	Aggregate Turnover	Bid-Ask Spread	Percentage Spread	Amihud Illiquidity Measure
Top 40 Inclusions					
125 Day	44644323.68*	149.55*	19.30*	20.09*	46.89*
Mid Cap Inclusions					
125 Day	518.64*	1002.56*	201.86*	199.40*	403.69*
Top 40 Exclusions					
125 Day	100359520002031.61*	0.00	38.06*	37.07*	277.83*
Mid Cap Exclusions					
125 Day	0	0	0	0	0

'*', '**' and '***' represent statistical significance at the 1%, 5% and 10% levels respectively, using a two-tailed test of significance.

ETHICAL CLEARANCE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

17 August 2021

Miss Milanca Naicker (213511090)
School Of Acc Economics&Fin
Westville

Dear Miss Milanca Naicker,

Protocol reference number: 00013872
Project title: The effect of inclusions and deletions of stocks from the Johannesburg Stock Exchange Top 40 and Financial Times Stock Exchange/Johannesburg Stock Exchange Mid Cap indices on liquidity

Exemption from Ethics Review

In response to your application received on 13 August 2021, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

[redacted] 17 August 2021

Prof Josue Mbonigaba
Academic Leader Research
School Of Acc Economics&Fin

TURNITIN REPORT

Final Submission

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