

A practical hedge fund strategy to front run index funds on the JSE

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1. Abstract

As the popularity of passive investment has grown it has given rise to numerous phenomena. Among these is a pricing anomaly around the event of a share entering or exiting an index. Numerous event studies have quoted theoretical performance figures that can be achieved by trading on this event. However they do not consider the practical elements of an investor trying to achieve these.

This study sought to understand whether this event can be practically traded by an investor. This has provided insight into the realities of the event beyond the theoretical observations in the existing literature. The findings hold relevance for passive and active investors alike, as well as management of the listed companies within this segment of the market. This study calculated two different investment styles, which the literature has suggested should be profitable, but has applied practicality constraints in order to test the real world applicability of the findings. The two styles were built and iterated to optimise the performance using share data from the Johannesburg Stock Exchange (JSE) between January 2005 and September 2019.

The results showed style 1 was unable to outperform the J200 or J201 on a consistent basis. Style 2 was able to massively outperform, theoretically achieving 226% annual returns. However once the practicality constraints, primarily cost, was factored in the style produced a -30% return over the full period. This raises significant questions of the, until now, belief that this event produces a large outperformance which is likely being traded by investors.

2. Keywords

Index front-running, market efficiency, momentum, passive investment

3. Declaration

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

Michael Field

Date

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4. Introduction to Research Problem

The popularity of passive investing has grown beyond the levels and theories under which it was conceived (Fichtner, Heemskerk, & Garcia-Bernardo, 2017; Renshaw & Feldstein, 1960). Many investors see it as a cost effective way of achieving a market average return. Once the lower fee is factored in, they believe it will outperform most active managers. The debate as to whether it truly does outperform is ongoing but its popularity is undeniable. This massive surge in popularity has given rise to numerous problematic phenomena (Algra, 2016; Anadu, Kruttli, McCabe, Osambela, & Shin, 2018; Baltussen, van Bekkum, & Da, 2016; Baruch et al., 2018; Miller & Ward, 2015; Quixote & Bogle, 2017).

The move towards passive investment is on an upward trend (Sushko & Turner, 2018). The Vanguard Group, under the leadership of John Bogle, are credited with creating the first passive investment fund in 1976. In 2017 Vanguard's assets under management passed \$4 trillion ("Vanguard's remarkable history," 2019). As of September 2018, that figure had climbed to \$5.3 trillion making them the second largest asset manager in the world ("Fast facts about Vanguard," 2019). Vanguard together with Blackrock and State Street now control 88% of the S&P500 companies in an unprecedented concentration of funds (Fichtner et al., 2017). As the proportion of assets managed under a passive mandate increases, the phenomena that accompany it are expected to become more pronounced.

Due to the rapid rise of passive investment these phenomena are not all well understood. Many researchers and commentators speculate on how the increase will affect the markets but most acknowledge that markets are entering new territory.

One phenomenon described by Miller and Ward (2015) was the pricing distortion associated with a share entering or leaving an index on the Johannesburg Stock Exchange (JSE). Similar observations were made by Algra (2016) internationally. Millar and Ward found that the price of a share entering (or leaving) an index behaved in an otherwise unusual, yet consistent manner. Due to the very nature of a passive

investment mandate, the asset manager should logically act in a very predictable manner and this, in turn, should make the phenomenon predictable as well. While this distortion has been observed and described, and the market effects speculated about, no one has adequately considered a practical method to utilise this as an investment strategy and whether it can be achieved.

It seems logical that when a distortion occurs investors will attempt to take advantage through any strategies possible. If the scenario is such that it can be exploited by some investors then it would show that other investors stand to lose to the same degree. If the distortion is being created by passive investors, they are likely to suffer this loss. This loss could be either in the form of negative returns or simply underperforming returns. Considering that the event being considered is common and occurs multiple times per year the scope for loss for passive investors is broad.

The most likely way that an investor would look to profit from this anomaly would be a front running strategy. The term front running refers to making trades based on information of events that are going to occur. These events include transactions by other investors, news about a company or events that will affect the whole market e.g. legislative changes. Front running is done in such a way as to give the trader an advantage by trading ahead of the action in order to profit from the predictable consequences of that action. Much of this information is typically not publicly available and in most jurisdictions those with the knowledge are prohibited from trading based on this knowledge. The ability to trade on information which others do not have is seen to give an unfair advantage.

When performed based on publicly available information, the practice is allowed as any investor has the opportunity to react to the information. The ability to achieve this practically and consistently around an index inclusion or deletion event has not been determined. This is however the logical manner in which an investor would seek to take advantage of the pricing anomaly.

Passive investors have, in recent years, sought to relax their mandates to allow them a small amount of flexibility in order to reduce their tracking error. The tracking error

is defined as the difference in performance between the index and the fund attempting to track that index. Importantly, this performance is measured over a period and not simply at a point in time. This means the tracking error is a measure of consistency. The tracking error is one of the key factors on which the skill or quality of a passive fund manager is judged. Ironically these managers are attempting to introduce active strategies to minimise their tracking error. In particular, in falling markets passive investors stand to lose if they are limited to reacting to the market. Another side effect of judging a manager only on tracking error is that actual returns are given lower precedence or even ignored. This means that managers are not concerned with the price they pay in executing their trades. It is this blind trading that both defines and endangers passive investments. The vulnerability to front running is one area in which passive managers may seek more flexibility in their mandate to improve their performance. The nature of this front running is however not well understood and as such any reaction to it would be ill informed.

Investment managers could become less vulnerable with a better understanding of events occurring on the fringes of an index and the strategies that investors might employ to take advantage of these. At present the events are becoming better understood. However the driving forces behind them are less clear. Much of the literature has sought to detail the behaviour in event studies but the factors leading to them are typically ignored or the explanations are merely speculation.

An early explanation for the pricing effect being seen, was that a liquidity shock is occurring as passive investors seek to add the stock to their portfolio in order to remain correctly constituted. They aim to do this as quickly as possible to maintain a low tracking error. This does not stand up to scrutiny however as the pricing inefficiency occurs prior to the share entering the index.

One of the common explanations proposed, to explain the timing, is that of the front running investor manipulating the pricing prior to this event. At best studies have shown that some investors are trading in a manner which could indicate they are attempting to trade this event. They have not been able to show that this happens

specifically because of the event nor that it is applied consistently to the event. They have also been unable to show that it is a driving force.

The existing literature has not adequately explored the practical element of investing surrounding the events that have been analysed. While many studies have shown that a pricing anomaly is occurring and that the potential for an excess returns exists they have not given thought to how that might occur. In a literature review of this event, Afego (2017, p. 234) stated that the studies "... appear to ignore the possibility of obtaining abnormal profits from trading strategies that exploit the observed return patterns". He also observed that they consider only simple zero cost calculations in their studies and ignore numerous real world events such as delistings. He emphasises the potential bias in the literature relating to the potential return estimates due to the lack of real world considerations.

The problem with the large amount of speculation is that it is being used to infer the consequences of these trades. Should the trading strategy prove impractical or not possible in the manner being speculated the entire understanding of the consequences would be brought into question. Breaking this assumption may help to uncover other events or market drivers which have not been noticed or have been attributed to front running traders in error. For this reason the practicality element is key to all parts of this analysis.

5. Literature review

In this research a broad range of topics have been brought together seeking a practically implementable solution. This review of the literature is structured with the various concepts considered separately.

Passive Investing

The notion of an “unmanaged investment fund” was first put forward in 1960 (Renshaw & Feldstein, 1960). The idea was that the strategy only needed to follow the average of all the other investment managers to achieve the average return, but that by simply following, the fund could operate at a lower cost and therefore achieve above average returns. The concept later grew to be known as passive investing due to the fact that there is no need to make an active decision on what trades to make. The most popular form of passive investment has been investments into an index, most commonly linked to the top selection of shares when ranked on market capitalisation, the S&P500 being a popular choice in the American market or the Top40 in the South African market. This has led to many investors following an identical trading strategy.

While countless studies argue for and against the merits of passive investment and whether it truly does outperform, the remarkable uptake by clients is unquestioned. This led to questions about what effect this shift is having on the market and whether fundamentals are breaking down. When Renshaw and Feldstein (1960) proposed the concept, it was on the basis that the fund could follow the average of active decisions being taken by other managers. As the number of active participants reduce their most fundamental assumption is called into question. They assume that there is a large number of active investors who are doing the decision making which the passive mandate can follow. As the number of active investors reduces the concerns being raised include, whether shareholders still have any power since they cannot sell the stock (Fichtner et al., 2017), effects on market volatility, liquidity, market concentration, abnormal company valuations (Anadu et al., 2018), their

causing serial correlations to shift from positive to negative around the year 2000 (Baltussen et al., 2016), that they are creating bubbles and distorting prices in the market (Quixote & Bogle, 2017) (Baruch et al., 2018) and many more. This has led some to suggest that a saturation point has been reached, this is also known as peak passive (Authers, 2018), beyond which market fundamentals break down. This suggests that the fundamental assumption made by Renshaw and Feldstein, that the market average could be followed, comes into question. This poses concerns at the micro level for the investor and at the macro level for the market as a whole.

Passive investment in South Africa

The South African passive investment market has some unique characteristics. The share of the market invested through a passive mandate, while growing, is currently lower than a market such as the United States. In addition the adjustment to the indexes in South Africa are easily understood ahead of time. The details that determine the index reconstitution are well communicated and as such the market can better understand what may occur compared with an index such as the S&P500 (Katzke & Tiddens, 2019). In a study Katzke and Tiddens (2019) suggested that by accurately predicting the entrants ahead of time, an outperformance may be possible. They also noted that using a longer time frame to predict could lead to higher returns although the maximum time frame they analysed was only 12 days prior to the announcement. This coincided with the cut-off date for valuations used in calculating the index. They did not analyse longer time frames utilising less certain information.

Price Distortion

One particular form of pricing distortion is an inefficiency that occurs when a share is included (or excluded) into an index. This effect has been described in numerous studies across the world, all offering similar results. They find that the inclusion into (or deletion from) an index causes a temporary distortion in the pricing (Bildik &

Gülay, 2008; Brooks, Kappou, Stevenson, & Ward, 2013; Chen, Koutsantony, Truong, & Veeraraghavan, 2013; Elayan, Li, & Pinfeld, 2000; Gowri Shankar & Miller, 2006; Masse, Hanrahan, Kushner, & Martinello, 2000; Miller & Ward, 2015; Shu, Yeh, & Huang, 2004; Vespro, 2006; Wilkens & Wimschulte, 2005). Most studies find that the price typically returns to similar levels soon after the event. They explain that requirement for passive investors to invest in a share as soon as it enters the index, means there is an abnormal demand for the stock that has entered and an abnormal lack of demand for the share which has left the index. This demand is driven by factors unrelated to the fundamental value of the share.

The reasons for this distortion are more broadly explained by either demand or that the inclusion is introducing information into the market. The, more common, demand argument suggests that when a share enters the index the sudden demand for it causes a liquidity shock, which in turn drives the price up. The information argument suggests that it is simply the positive sentiment surrounding an inclusion that causes the price to increase. The demand and information arguments contain numerous sub elements as detailed by Afego (2017).

Demand theories:

Price pressure hypothesis – This suggests that the short term effects will revert to the norm once the rebalancing has completed.

Imperfect substitute hypothesis - This is in contrast to the price pressure hypothesis and states that the price changes are expected to persist. This is based on the assumption that there are no substitutes similar enough for investors to switch to in the short term.

The literature tends to support the notion that both theories are correct but indexes themselves tend to show evidence of one or the other. For example the S&P500 support the imperfect substitutes hypothesis while the FTSE100 and ASK200 both support the price pressure hypothesis (Afego, 2017).

Information Theories:

Information hypothesis – This suggests that the inclusion into a major index signals to the market positive news regarding the company's position, leadership and prospects. It extends to include an effect in which analysts tend to look on a firm more favourably once it enters an index.

Liquidity hypothesis – The liquidity hypothesis states that the share becomes more liquid on the basis that it is now being traded within a major index and this in turn drives up its inevitability and hence price.

Investor awareness hypothesis – Quite simply this hypothesis states that the increased visibility and awareness of the stock increases the likelihood that investors will purchase it. This in turn drives up the price.

Selection criteria hypothesis – This hypothesis states that it is not the inclusion that is driving the increase but rather the improvement in the underlying fundamentals, which in turn lead to the share being included in the index.

There remains ongoing debate as to which of the above hypotheses most accurately explain the pricing anomaly. There is some agreement that certain inconsistencies exist across different markets. For this reason it is necessary to focus on South Africa and the JSE.

Within the South African context, a study by Miller and Ward (2015) showed that when a share enters or exits an index on the JSE it displays inefficient demand behaviour. They found that the share price starts to be affected 70 days prior to the event and remains distorted a further 120 days thereafter. The behaviour after an index inclusion was described as decreasing consistently. They further found that the JSE tended to respond earlier than other international studies had found. However they did not state exactly which study they used for this comparison and whether they accounted for global cycles and trends. Ultimately, they found that the pricing inefficiency was temporary. Their finding that the share price would decline after the inclusion is in line with the price pressure hypothesis as discussed above.

In a similar study Katze and Tiddens (2019) found that while the shares did not produce negative results they did underperform the index. They attributed this to the so called size effect as described by Pillay, Muller and Ward (2018). These two studies have produced contradicting results. The Katze and Tiddens study did not address this difference despite referencing the Miller and Ward study.

The JSE has displayed some unusual behaviour when compared to its international counter parts. This is attributed to the small size of the exchange. In addition the high concentration of funds with large asset managers has reduced the stocks available for them to practically invest into (Pillay et al., 2018). Another study found that the “active share” or the difference between an active manager’s holdings and an index has reduced to only 15% on the JSE (Muller & Ward, 2018). This shows that regardless of the funds claimed mandate, most asset managers are following a passive, or near passive, strategy. These unique properties of the South African market are expected to exaggerate the price distortions when compared to other international markets. The literature, however is silent on whether it does experience a stronger effect than other markets. This comparison cannot be done on a simple notional basis as factors such as exchange rates and local inflation rates would need to be factored in to understand the relative scale. The evidence however suggests that the effect would be expected to be larger.

The consensus after a thorough literature review, conducted by Afego (2017), is that most researchers believe the effect to be reducing in intensity in recent years although emerging markets require more studies to reach a definitive conclusion.

Front Running Strategies

Due to the reactive nature of passive investing and their consistent lag to the market their actions are very predictable. Trading based on knowledge of how and when they will react to market changes enables a strategy that pre-empt and takes advantage of their actions. Similar strategies have been proposed to take advantage of other events which cause similar liquidity shocks. Dyakov and Verbeek (2013)

showed that front running on mutual funds who were subject to “extreme capital outflows” could produce an excess return of 0.5% per month. The two critical factors the strategy relied on were that investor behaviour could be well predicted and the effects of the investor actions could likewise be well predicted. They also state that their findings are likely applicable to other demand shock events. The nature of the event in this study is similar to the one created by an index inclusion or deletion. In a study Segeritz and Van Rensburg (2017) found that by front running a momentum strategy by one week they could achieve excess returns. They found that the strategy was most significant at reducing volatility. Manahov (2016) found that high frequency traders could take advantage of large orders through front running. These findings were supported by Hens, Lensberg and Schenk-Hoppé (2018). The literature shows that front running strategies have been effectively used during liquidity shock events, it does not show that an index addition (or deletion) can be front run.

Bessembinder, Carrionb, Tuttlec and Venkataraman in a study of market quality surrounding predictable trades within Oil ETFs found no evidence of traders exhibiting “predatory” behaviour (2016, p. 142). They further state that while the possibility of front running remains it is held back by practical considerations. Most notably they identify the difficulty in executing a trade in close proximity to the bulk trade as being a limiting factor. They further note that the effects would likely be greater in a market with low resilience and with a single or small number of traders targeting the event. While the distortions are caused by different factors they exhibit similar predictable characteristics and hence the practical limiting factors may be present in an index inclusion or deletion. Their finding that investors are not exploiting this event due to practical considerations is particularly relevant to this study. They were able to demonstrate both that the event produces a theoretical out performance and that is cannot be practically exploited. The passive investment literature has only shown the theoretical outperformance without considering the practicality element as discussed above.

A study of the Nikkei 225 evidence was found of short selling occurring around the event of an index deletion (Baltussen et al., 2016). They estimate that this produces

an abnormal return in the region of 7.5%. This study confirms that the event has the potential to yield returns and that there is evidence of short selling occurring at the time of the event, however it does not confirm that it is being used as an active strategy and is silent on whether such a strategy can be practically implemented on a consistent basis. The study is also limited to evaluating whether short positions were held in the stocks at the time of deletion. It did not extend to analyse how long before (after) the deletion the position was opened (closed) nor did it present data on how consistently this effect was observed relating to share deletions. As such the implied correlation between the potential outperformance and the evidence of short selling occurring is misleading.

A study of the index reconstitution event on the JSE found similar results. They showed that the event has the potential to produce excess returns, however they did not analyse whether the strategy could be effectively implemented (Katzke & Tiddens, 2019). The literature shows consistently that the event has the potential to produce an excess return but is largely silent on the potential for this event to be used. It is equally silent on whether it is occurring as a defined strategy. Where these factors are raised it is as speculation to try and explain the observations of an event study.

Momentum

Momentum has long been used to predict returns since it was first described by Jegadeesh and Titman (1993). It is now one of the most widely studied factors in financial literature (Hühn & Scholz, 2018). Goyal and Wahal described this as “winners continue to win and losers continue to lose” (2015, p. 1237). They also stated that this approach is robust and commonly used. This is an important factor when analysing specific shares which are expected to gain sufficient size in order for them to enter an index. In a relatively short period of time a large amount of literature has analysed momentum investing. It offers the potential of excess returns without

requiring in depth analysis of the share and it allows an investor to select a share without introducing bias.

Goyal and Wahal (2015) showed that momentum portfolios utilising seven to twelve month returns out performed those based on shorter time periods. This counter intuitive finding has been backed up by numerous studies and has come to be known as the '12 month effect'.

Fuertes, Miffre and Fernandez-Perez (2015) utilised momentum along with term structure and idiosyncratic volatility in a strategy for investing on commodities markets. The strategy was able to outperform the S&P-GSCI by 5 times over a 26 year period. The combination of factors used was found to be a critical element and branched into a new area of research. However, a later study looking at these factors in the Chinese market found no relation (Cheema & Nartea, 2017). Conrad and Yavuz (2017) analysed momentum to determine what factors caused it to reverse. They found that shares likely to reverse could be separated using size and book-to-market ratios. Difficulty in being able to accurately predict a momentum reversal has been the main factor preventing its wide spread adoption.

Momentum strategies have promised high returns but their performance during a market crash has led many investors to be wary. A study into market cycles found that a momentum strategy could lose 9% per month during a market rebound (Bohl, Czaja, & Kaufmann, 2016). While the momentum of a market is typically determined by analysing past returns, other metrics have also been successfully shown to predict the market momentum. These have typically been explored as a means to overcome the poor performance during a rebounding market. Some strategies now prefer to use earnings rather than return as the base measure to determine momentum. These have been shown to be more resilient in a market rebounding from a crash (Bohl et al., 2016). In a rebound market a return based momentum strategy can generate large losses if no other factors are considered. This has led others to consider a risk managed momentum strategy. Barroso and Santa-Clara (2014) found that through managing this risk the crashes could be almost entirely eliminated. This could lead

to returns reaching levels almost double those of a traditional momentum strategy. Still other studies argue that short term alpha is a better predictive measure than past return (Hühn & Scholz, 2018). This has been applied at the individual stock level as well as the country and index level. Zaremba, Umutlu and Karathanasopoulos (2019) found that short terms alphas are able to positively predict returns while long term alphas can predict negative returns. They found this method was also an effective tool which could be used in designing an international portfolio. By applying the methodology to a country or an index the momentum of the country or index itself could be determined, this allowed for a weighted international portfolio to be designed. It further demonstrated an ability to robustly hold up to different weighting methods as well as trading cost effects. Other less intuitive methods have also been analysed as a means to overcome the weaknesses in momentum strategies. In a study of the Chinese Oil commodity market it was found that the performance on the oil market could predict the momentum of the share market (Chen, Cheng, & Demirer, 2017). The study was however silent on the performance of this method during a rebound.

Within the South African context much of the literature has focused on a single variable when analysing momentum. Fortunately the latest literature has found that the momentum behaviours are consistent with international patterns and as such that literature can be applied to the South African market and specifically the JSE (Page & Auret, 2018). This finding is significant in that it differs to the many other unique characteristics of the JSE that have been found to not behave in a consistent manner with other markets.

Volatility is another concept closely linked with momentum. While momentum has shown that longer timeframes better predict performance, volatility differs in that recent data is a better predictor (Grobys, Ruotsalainen, & Äijö, 2018). Liquidity is similarly a related factor. Contrary to intuition the returns produced by a momentum strategy are higher in liquid markets (Avramov, Cheng, & Hameed, 2016).

The effect of trading costs

The friction introduced by trading costs is an important factor for any practical strategy. Many studies exclude the effect of trading costs and as such their results are descriptive but not necessarily directly applicable for a manager. They can also result in misleading findings when a comparison of returns is made to an index or other return. Many of the benchmark comparisons can easily be invested in, at low cost. As such much of the excess return described is not practically attainable. The inclusion of costs is not common due to the subjective nature of cost as a variable. The cost experienced by each investor can vary wildly and as such most researchers are silent on costs or include the assumption that they are not significant. This appears to be an under researched factor in the current literature.

Agyei-Ampomah (2007) found that a momentum strategy with a holding period below six months was not likely to be profitable for most investors due to the cost of trades. Korajczyk and Sadka (2004) examined the relationship between size and costs in momentum investing strategies. Counter intuitively they found that the price impact increases with the size of a portfolio. They found that in ideal circumstances with a strategy targeting a cost effective strategy the largest fund size was just \$5 billion. They showed that at this level the fund would break even on any excess return. This finding shows the large impact that trading costs can have on strategies which require frequent trades.

In the South African context a study by Katzke and Tiddens (2019) arrived at the potentially false conclusion that the index entry event could be profitably traded. The study failed to account for costs in their findings despite noting the significant quantity of trades. Afego (2017) in a literature survey of event studies analysing the inclusion event was highly critical of the estimated outperformance figures that have been quoted in numerous studies. He stated that numerous real world considerations had not been considered and as such feels the current literature body is biased in its estimates.

The literature has been able to provide a good understanding of the event that is being targeted in this study. Some of the factors required to try and implement a strategy effectively have likewise been explored in the literature. The body of knowledge has provided these insights both at an international and local level and where differences exist they have been explained. The exact driving forces behind the pricing anomaly remains a contested area in the research although the descriptions of the behaviour are quite consistent. Some variation does however remain in the South African context with two contradictory studies having been identified. This is also an area which was identified as being under researched. The practical considerations are another under researched element in the literature. This was found to be lacking both locally as well as internationally.

6. Propositions

The literature has provided a solid base on which this research is built. The events have been well understood and as such the results should yield few surprises. The practicality element appears lacking in substance within the current body of knowledge. The literature is consistent in the belief that this event can be traded profitably however no substantial method has been proposed. This study seeks to confirm the findings of existing literature and extend the body of knowledge to understand a mechanism for how this event could be practically traded.

6.1. Purpose statement

This research seeks to determine whether a practical investment strategy that takes advantage of a market pricing inefficiency during the event of a share entering (or exiting) an index can produce excess return on the JSE. It will detail the predicting factors, optimised weightings and modelled returns based on historical data. These factors will be explored while constraining the model in such a way that it would be possible for an investor to have followed the investment strategy.

An understanding of the predicting factors and strategies, used to exploit the market inefficiencies related to a share entering or leaving an index would allow numerous responses. A hedge fund manager could follow the strategy to extract excess returns for their clients. An understanding of how this strategy works as well as the nature of its performance allows the suitability and expectations to be understood. A passive asset manager could seek to alter their mandate to avoid being subject to the inefficiency. When passive investors are excluded from this event they suffer a loss of potential return. As passive investment becomes more common managers are looking for ways to distinguish themselves. With a strong understanding of events that happen on the periphery a manager could look for minor tweaks to their portfolio to greatly improve their performance in return, tracking error or downturn performance. An understanding of the nature of a practical investment solution will

also provide insight into the factors that surround it, for example the volatility or the maximum draw down. This understanding will also provide insight into which type of investor could possibly pursue such a strategy, if any. The potential investors that could follow the strategy will provide insight into how large the potential trade could be and hence gain insight into any secondary effects that might be caused. Finally the South African context is key. The small scale of the JSE relative to asset managers means that some funds size, cause them to behave like a passive manager even if they have the mandate freedom to invest differently (Muller & Ward, 2018). This context means that the JSE market behaves, abnormally, in line with the index, exaggerating the phenomena and reducing the ability for large managers to change their behaviour. This characteristic means that many international studies of this phenomenon cannot be directly applied. While there are event studies which have been carried out in the South African context, they are few in number and at times contrary in their findings. By adding to this knowledge a greater level of certainty should emerge.

6.2. Propositions

The propositions put forward below are based on the predictions expressed in the literature.

1. The share expected to enter or exit the index can be accurately predicted with sufficient lead time to enable an investment strategy.
2. A practical investment strategy that targets a market pricing inefficiency during the event of a share entering (or exiting) an index on the JSE can produce excess return.
3. An investment strategy that targets a market pricing inefficiency during the event of a share entering (or exiting) an index on the JSE can be formulated such that it can be practically implemented.

In confirming the above propositions many of the assertions in the literature would be confirmed. The literature requires confirmation in two key areas. Firstly the

literature has suggested that emerging markets and the south African context has not been sufficiently confirmed to follow the behaviour of international markets. This is based on some of the unique characteristics of these markets and a current lack of studies in this area. Secondly the practicality element is lacking in all literature. This element has been repeatedly assumed to be achievable without confirmation. A recent literature survey identified this as a key weakness in the current body of knowledge (Afego, 2017). By confirming these propositions the knowledge will be significantly strengthened.

7. Research Methodology

The methodology for this study draws from a wealth of existing studies. The literature contains many event studies which aim to understand the index inclusion event or other events which exhibit similar characteristics. The methods used extend to data adjustment techniques and measures of success. The literature was however largely silent on whether a strategy could be considered practical. This element required the methodology to extend or adapt techniques in order to fully understand and test the propositions.

A **positivist** (Saunders & Lewis, 2012) approach was applied to this research. Through the use of modelled simulation the propositions were tested. This places this study firmly in the positivist realm as defined by Saunders and Lewis (2012). Since the study is focused on whether the strategy can be practical in the real world any deviation from this philosophy would likely have introduced variables that would be very difficult to control.

An **inductive** approach (Saunders & Lewis, 2012) was used based on existing data from the JSE. By using this existing historical base data the research was then built up to the more generalised strategy to be utilised on a forward looking basis. The study was limited to the South African and more specifically JSE context, this further informs this choice of approach.

A **mono quantitative** (Saunders & Lewis, 2012) approach was applied through the analysis of various models based on the existing data. The study utilised models based on historical data in order to remove subjective bias. The outcome required a model that can predict behaviours and as such the human bias introduced through the knowledge of how history unfolded would be near impossible to isolate if any qualitative methods were utilised.

This is an **explanatory** study. The study analysed the variables associated with the event and the subsequent relationship to how that might affect potential returns. The phenomenon has already been well described in multiple exploratory studies in the literature. This study looks to build on that by linking the variables to potential returns and their ability to be practically implemented.

The study was undertaken based on **archival research** (Saunders & Lewis, 2012) of existing publicly available data sources. These sources are deemed to be the best representation of the majority of the market. In addition the data is readily available and fully represents the population that the propositions relate to. An approach based on randomly generated data was considered and rejected. Stock market pricing contains all the beliefs of all investors and as such is not random. The phenomena on which the research is based was all performed on historical archival data and as such this is deemed the best data source.

The study uses **longitudinal** data; this was possible due to the exclusive use of archival data. The study requires longitudinal data as the returns are time based and only through a longitudinal set can the effectiveness of a strategy be evaluated.

The study made use of purely archival data, as such no interviews, questionnaires or other data collection took place.

7.1. Population

The population is all shares on the JSE, listed on the ALSI index during a period from January 2006 to September 2019. The JSE context was chosen as the propositions relate to investing in the JSE traded shares. The scope was limited to the ALSI, which contains only the 160 largest companies by capitalisation. The remaining shares were excluded on the basis that they are small and illiquid and hence cannot be practically traded in institutional funds. This approach is consistent with that followed by Muller and Ward (2013). The literature has suggested the JSE has numerous factors which make it different from many international counterparts. In particular these relate to the size effect of a small market and large investor concentration

(Muller & Ward, 2018) as well as difference in the way the index reconstitutions occur (Katzke & Tiddens, 2019). For this reason introducing data from other exchanges is expected to reduce the relevance of the model rather than enhance it. The time period from 2005 onwards utilises market conditions that are largely similar to those found today and expected for the foreseeable future. The population set was limited to recent years as the phenomenon that is being studied is a function of the recent shift towards passive investment. Older data will not contain this phenomenon.

7.2. Unit of analysis

The unit of analysis is the returns of a share traded on the JSE as it enters or leaves an index.

7.3. Sampling method and size

Due to the public nature of publicly traded companies on an exchange the full population data set is available. For this reason there was no need to sample as the population will facilitate more accurate analysis.

7.4. Measurement instrument

Due to the nature of the study and the use of archival data, a measurement instrument was not required.

7.5. Data gathering process

The data was collected from the JSE bulletin publication. This is a monthly publication issued by the JSE which includes all the relevant data used for this research. This publication is available, for a fee, directly from the JSE. In addition

daily prices were acquired through Yahoo Finance in order to track daily movements as the portfolio was rebalanced.

Importantly this data set includes the constitution of the various indexes over time. It is important to understand that the index is reconstituted roughly quarterly in meetings of the FTSE/JSE Advisory Committee (AC). This committee determine the constituent shares of the various indexes. This is important as the constituents are not simply determined based on the daily market capitalisation. The dates of these meetings were extracted from the JSEs Stock Exchange News Service (SENS) announcements and reports produced at the time. Both contained complete data sets.

Certain events required data to be adjusted for accurate modelling. These events were handled in the manner specified by Muller and Ward (2013). This study gave significant consideration to rectifying the data in a manner that was deemed more accurate when compared to the prevailing literature. The specific actions are as follows:

- Price changes from shares being consolidated or split are backwards adjusted.
- Data errors are excluded by treating the daily change as zero where the daily change is greater than 40% in absolute terms.
- Dividend returns are included.

7.6. Analysis approach

The study analysed two distinct styles in trying to trade on this event. These are denoted by style 1 and style 2. These styles differed in that they looked at different time contexts, namely pre and post the reconstitution announcement. Style 1 considered the possibility of trading post the reconstitution announcement utilising the information announced. Style 2 used publicly available information and metrics to attempt to predict the reconstitution movement. To analyse style 1 the “Style

Engine” software package developed by Chris Muller was used. This system was developed as part of a style analysis study by Muller and Ward (2013). The system was programmed with multiple portfolio configurations. The portfolio performances were then calculated by the system. In analysing style 2, custom code was written (Appendix 1) to evaluate the potential factors of this more complicated style. The configurations consisted of the following criteria:

Style 1

- Look back period for when a share has shifted into (or out of) the index.
- How long to hold (short) the share after it has entered (exited) the index.

Style 2

- The number of shares in the consideration set (N)
- What period the momentum should be evaluated over (P)
- What percentage of shares to exclude based on their momentum (M)
- Shares entering or leaving the J200 index also known as the JSE Top40 was selected as literature suggests it experiences the largest liquidity shock events.

Iterations were limited to the bounds of practically implementable strategies. The practicality requirement criteria are as follows:

- A holding period may not be less than a single day.
- Only data available at the time of the decision may be considered e.g. financials are typically not available until three months post the period and hence may not be used.
- Funds can only be allocated once at all times.
- Returns had to achieve sufficient stability for an investor to remain invested.

Style 1

This style simply relied on adding the share which had just moved into (or out of) the index into the portfolio. This was done with index inclusions being held long and exclusions being shorted. The two factors varied in analysing the portfolio was how long to hold the positions and how far to look back for shares to include. Shares were then held at equal weighting if they met the inclusion criteria.

Style 2

The style 2 selection was processed by selecting a top N shares based on free float market capitalisation that were not in the J200 where N is an integer variable that was one of the optimisation factors above. This ensured only shares which did not have a large enough free float market capitalisation were filtered out.

These N shares were then analysed for momentum characteristics in order to distinguish between shares that were moving towards or away from the index. This was applied as the top M% of the candidate shares when ordered by momentum over the prior P months. Where M is the % of candidate shares and P is the number of months performance to be included for the momentum calculation.

In order to determine the weighting into each of the candidate shares identified, a modified version of the Black Scholes formula (Equation 2 in conjunction with Equation 3, Equation 4 and Equation 5) was used.

The Black Scholes equation (Black & Scholes, 1973) was originally created to price put and call options in such a way that a perfect hedge could be created. The resulting insight from this success was that there is a correct price for an option. The Black Scholes Equation can be solved from the differential form of Equation 1 to the form in Equation 2. This form can be utilised to calculate the price of put and call options. In deconstructing this form and by utilising only the $N(D_1)$ function (Equation 3) the probability of the share reaching the strike price is returned. This can then be

combined through Equation 6 in order to determine a weighting for allocation to specific shares. The result is share weighting that aligns to the probability of a shares expectation of entering the index. This is the method that was utilised in style 2 in order to determine the optimal weighting of the shares to hold in the portfolio. The intention was to allow for a share to be upweighted when it became clear that it was the most likely candidate. This would allow the portfolio to diminish any dilution effects.

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} - rV = 0 \quad \text{Equation 1}$$

$$C(S_t, t) = N(D_1)S_t - N(D_2)PV(K) \quad \text{Equation 2}$$

$$D_1 = N \left(\frac{1}{\sigma\sqrt{T-t}} \left[\ln \left(\frac{S_t}{K} \right) + \left(r + \frac{\sigma^2}{2} \right) (T-t) \right] \right) \quad \text{Equation 3}$$

$$D_2 = D_1 - \sigma\sqrt{T-t} \quad \text{Equation 4}$$

$$PV(K) = K e^{-r(T-t)} \quad \text{Equation 5}$$

$$\text{Weighting}_1 = \frac{D_1}{\sum D} \quad \text{Equation 6}$$

Where:

V is the price

D is the discount factor

N() is the cumulative distribution function of the standard normal distribution

T is the time of maturity

t is the current time

S_t is the spot price of the share

K is the strike price of the share expected to leave the index

r is the risk free rate (the 6 month Jibar rate was selected)

σ is the volatility of returns of the underlying asset

Performance measurement

The optimal strategy was compared to the returns of common indexes to determine whether it does in fact, produce an excess return. The results were compared on the ultimate return on a cumulative basis as well as relative out performance to the J200 (Top 40) and J201 (Mid Cap) indexes. These indexes were selected for comparison as they are investable and include the same shares that are moving into and out of the J200. It is important to note that a total return number was used and hence incorporates all returns not simply share price growth. The most notable difference being dividend income.

The volatility of the strategy was also analysed and compared to the benchmark indexes. The volatility was calculated using Equation 7 and Equation 8 below. The volatility was compared to that of the benchmark indexes.

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (r_i - m)^2}{n - 1}}$$

Equation 7

$$\sigma_A = \sqrt{252} \cdot \sigma$$

Equation 8

Where:

σ_A is annualised volatility

σ is volatility

r_i is returns

m mean of all returns

n number of days

The number of trades required to execute the strategy reached significantly high levels and hence in order to evaluate the practicality, It became necessary to factor in the associated cost of these trades. This cost was calculated using Equation 9 below.

$$T_c = \sum \frac{T.P}{W}$$

Equation 9

Where:

T_c is the trading cost

T is the number of trades

P is the price of a trade as a % of the trade value

W is the average count of shares being held

The result of Equation 9 produced a percentage of the value of the portfolio that should be removed as a fee. This amount was then factored into the daily performance in order to determine the performance after fees and how that built up to the total performance. This needed to be calculated as part of each days performance in order to include the effect over time and account for the scale of the portfolio as it changed.

The methodology is built on sound principles based on existing literature. The unique properties of the market being analysed (JSE) have been considered in all aspects so as to not introduce factors which would likely skew the results. The data adjustments in particular have been robustly proven in the existing literature. This was an element which many early studies were criticised for and as such care has been taken to address this factor based on the most current leading literature. The measurement of outperformance is a critical factor and has been based on both existing literature as well as the best practice from within the investment industry. There are areas in which the study goes beyond existing literature, in particular with

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regard to practicality considerations. In these areas best practice has been adopted and real world implementations have been followed as closely as possible so as to not introduce extra variables.

8. Results

The results of the study are presented below. The two styles analysed are addressed separately for each section. The stark difference between the methodology, context and results necessitate considering the two styles individually. The results are presented as follows: result data collection, benchmark performance, portfolio holding illustrative statistics, reliability and validity, data transformations before finally analysing each proposition.

Data

The source data used consisted of market data from January 2006 until September 2019. This was used to produce a vast number of comparative datasets based on the variables that were altered in testing various strategies. Due to the high volume of data produced only subsets that are relevant to the findings are presented. The full dataset is included in the electronic submission that accompanied this document. Data sets for the comparison indexes were also assembled into the same structure as the generated datasets to facilitate comparison.

The raw data produced for each style is discussed below:

Style 1

The results from the final analysis of style 1 consisted of over 150 000 data points. This data consisted of the daily returns of the portfolio for each variation between the look back and hold variables. The daily data points were arranged into timeseries for each combination to facilitate analysis.

Style 2

The style 2 analysis produced a dataset consisting of 1.23 million data points. This consisted of all the permutations across the full date range. This is vastly larger than style 1 due to the increased number of variables that were tested. A custom database was created in order to store and analyse this vast dataset. Timeseries could then

be extracted from this database in order to analyse and compare the various combinations. The data was then available to produce numerous cross sectional slices depending on which factors were being considered.

The two styles required varying numbers of shares at any one time and in total. This was determined by the method they used to determine which shares to include in the portfolio. Style 1 was achieved with objective index constituent data while style 2 utilised predictive factors. The optimal solutions using each style are presented in

Table 1. This shows the total count of shares that were ever held by the strategy as well as how the holdings were utilised over time.

Table 1 - Share holdings

	Style 1	Style 2
Total Shares Held	80	58
Average number shares held simultaneously	3.95	2.00
Average number of shares held in a month	3.95	3.06

The movement into the index over time is displayed in

Figure 1 below. This shows significant variation in the number of shares moving during a rebalance as well as numerous occasions when the rebalance resulted in no change to the index constituents..

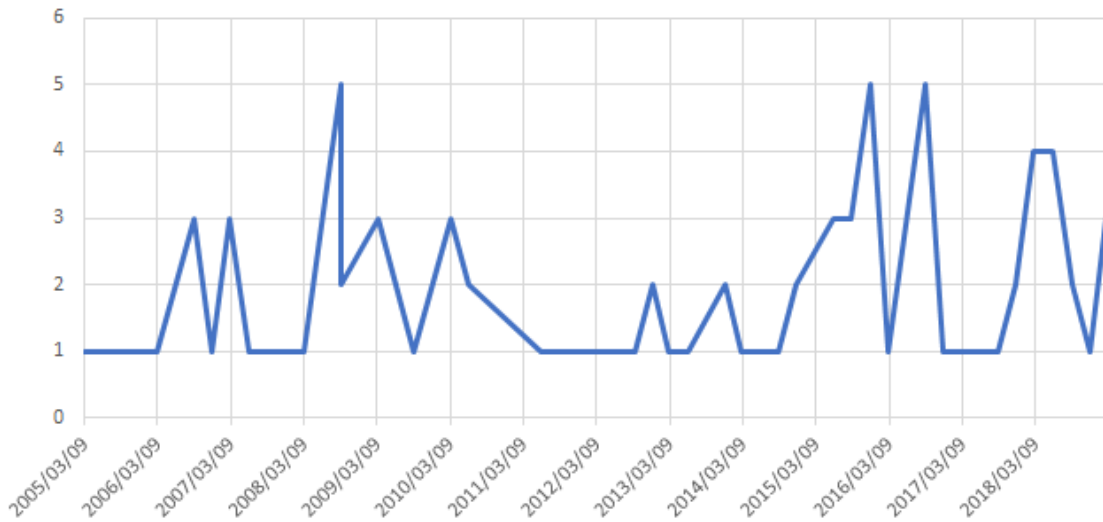


Figure 1 - Count of shares entering the J200 over time

The performance of the benchmark indexes, namely J200 (Top 40) and J201 (Mid Cap) have been graphed below to illustrate the growth target required for the portfolio concepts being tested to be considered successful in outperforming.

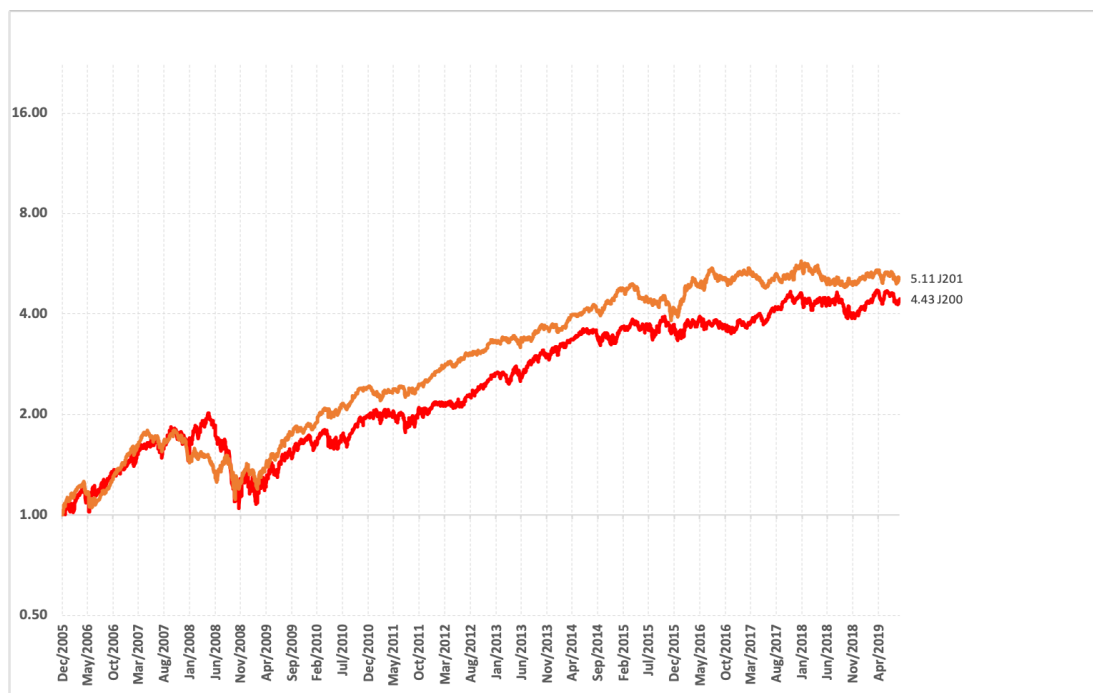


Figure 2 - Index Performance

Results on reliability and validity of data

In order to confirm the reliability of the data numerous checks were run. The JSE bulletin data was cross checked against the daily price data extracted from Yahoo Finance with no anomalies being detected within the data set being used. Similarly the shares that were contained in the indexes and consideration sets (*Appendix 2, Appendix 3*) set produced were spot checked and found to be accurate. Finally the dates for announcement and effective date of index changes were analysed. These were cross checked with the changes in the JSE bulletin data as well as the SENS announcements, which announced them at the time, vs the reports published after the fact. The dates were found to be consistent.

Samples of the results produced using the software for both Style 1 and Style 2 were recalculated by hand to test against programmatic errors; all these tests were unable to find inconsistencies. Where results produced were inconsistent with existing literature these events have been carefully considered and the methodological difference unpacked. These differences are discussed in section 9 below.

The calculations are based on a large range of data over a 14 year time period and as such are expected to return a high level of validity. The careful attention to achieving an accurate base data set has also contributed to a high quality of output data. The nature of any study analysing past performance is limited in its ability to predict although this does meet the level expected of a portfolio construction. This factor is considered in more depth in section 10.3 below.

Data transformations

Some level of base data transformation was necessary before analysis could be conducted. Whenever possible data anomalies were sourced from multiple sources to improve accuracy. In order to handle potential errors in the data, where a corrected figure could not be sourced, the following adjustments were made:

- Price changes from shares being consolidated or split were backwards adjusted.
- Data errors were excluded by treating the daily change as zero where the daily change is greater than 40% in absolute terms.
- Share code changes were adjusted to accurately reflect the share available to investors at the time.
- Where market capitalisation or free float data was missing, a rare occurrence, these shares were excluded from the consideration set.
- For ease of analysis the announcement dates were adjusted to reflect close of trade dates. If an announcement occurred before trade it was considered to have been announced after trade on the day prior. In all cases care was taken to ensure no information was introduced to the model with an ability to trade earlier than could have been possible in the market.

The above resulted in few actual changes to the base data that was utilised. The nature of the study meant that it contained a small subset of fairly large shares which were under consideration and these tended to have complete data sets.

8.1. Results - Proposition 1

In testing proposition 1, whether the share expected to enter or exit the index can be accurately predicted with sufficient lead time to enable an investment strategy, the analysis was conducted only on style 2. Style 1 was not considered because this style looked at reacting to known information. The optimal return solution for style 2 achieved a prediction accuracy of 48.1%. This being a measure of how many of the shares selected were included into the index. The accuracy was not significantly affected by events over time as can be seen in *Figure 3* below.



Figure 3 - Prediction accuracy over time

The number of shares included in the portfolio, that ultimately went on to be included in the index, was found to increase under variations with higher numbers of shares included. The optimal strategy utilised 7 shares in the consideration set, increasing this to 8 improved the accuracy from 48.1% to 59.8%. Likewise it was found to be least accurate under more restrictive conditions. Beyond the number of shares in the consideration set the momentum factor caused the greatest increase in accuracy. These variations did not produce the same level of return as the optimal strategy.

8.2. Results – Proposition 2

The results from testing proposition 2, a practical investment strategy that targets a market pricing inefficiency during the event of a share entering (or exiting) an index on the JSE can produce excess return, were again analysed separately for both styles.

Style 1

The results of the analysis of style 1, in which the announcement was reacted to, are included in *Appendix 2*. The variables that were found to produce optimal results were a look back period of 5 months and a hold period of 5 months. The other strategies produced returns which in many cases were negative.

The optimal solution for style 1 produced returns of 7.4% annualised returns for the share entering and 2.3% on the share exiting. The strategy of utilising the short sale to fund the long strategy was found to produce 9.9% annualised returns. This was below the returns produced by the J200 (Top 40) which returned 11.8% over the same period. These results are shown in Figure 4 below. This strategy could theoretically be run without the investor needing to use their own capital. The ability for an investor to invest in this manner is largely dependent on their ability to handle the cashflow requirements should a margin call be required and the high level of risk that this strategy introduces. The theoretical return is therefore only limited by the investors risk appetite and short term cashflow.

The specific shares traded over time are included as *Appendix 2* for the optimal solution of style 1.

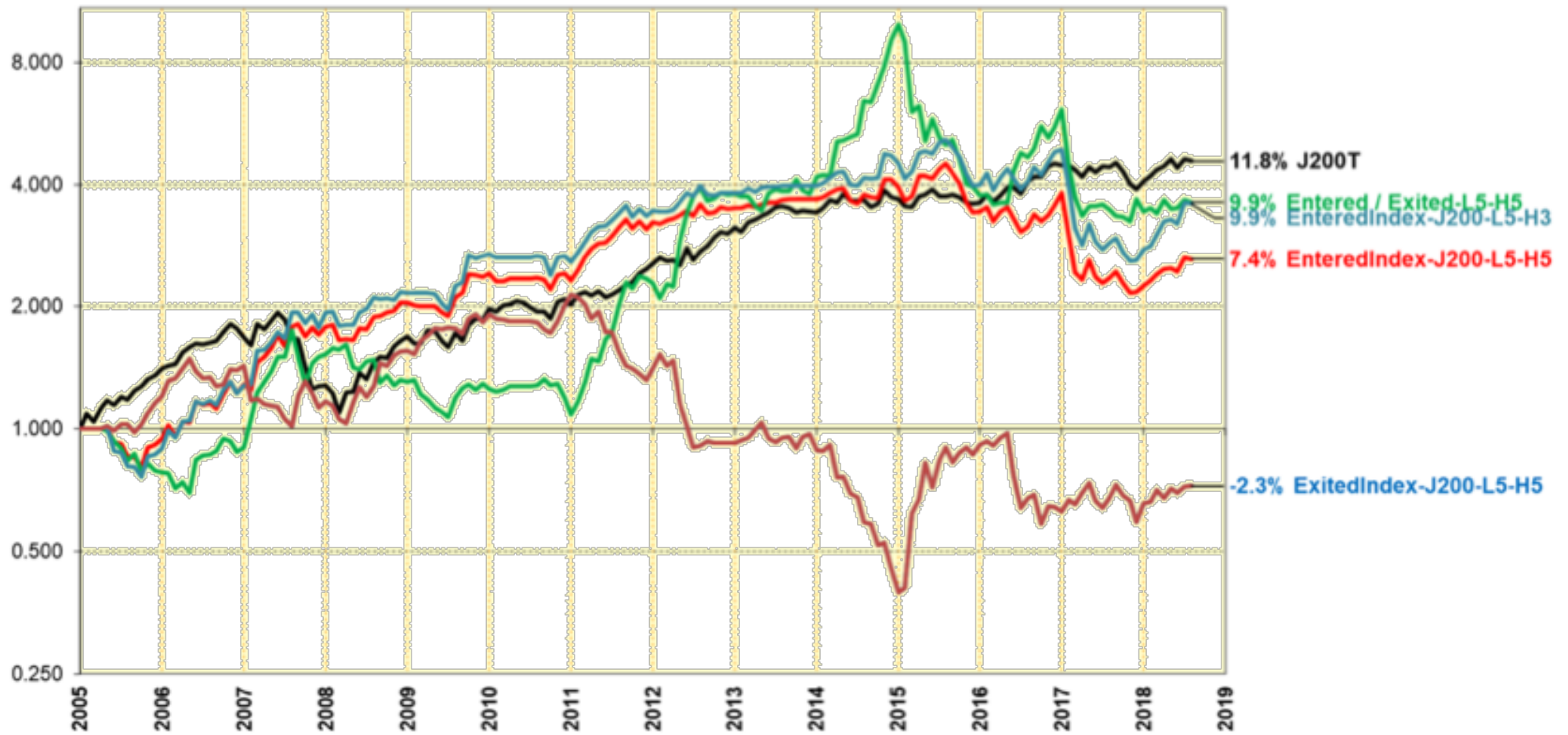


Figure 4 - Relative performance of style 1 optimal solution

Style 2

The cumulative return results produced by style 2 over the full time period are presented in *Appendix 4*. This table includes all variations of the variables tested in order to determine an optimal combination. The highest performing count of shares in the consideration set was found to be seven, the results of which are shown in *Table 2*.

Table 2 - Style 2 cumulative value of one unit considering 7 shares

		Momentum Months					
		3	6	9	12	15	18
Percent To Keep By Momentum	10%	0.22	0.87	5.82	6.61	6.24	4.20
	20%	1.58	3.37	4.24	21.11	5.87	5.87
	30%	3.26	4.72	3.54	6.63	3.42	3.31
	40%	3.26	4.72	3.54	6.63	3.42	3.31
	50%	4.18	3.68	4.58	4.64	4.22	3.43

Within this set the optimal point was found to be with a momentum time frame of 12 months and by retaining 20% of the shares with the best momentum. This produced a cumulative return of 2 111% over the full time period or a 226% annualised effective return. This compares to returns of 47% and 55% for the J200 and J201 over the same period on an annualised effective return. This also reflects a relative out performance of the two indexes by 4.76 times and 4.13 times respectively. This is shown in *Figure 5* where the performance of a single unit is tracked through the growth in each respective strategy.

A subset of the returns of the strategy using 12 month momentum time frames are presented in *Table 3*. This subset of variations showed the highest average return across all subsets.

Table 3 - Style 2 Annualised returns using 12 month momentum

		Shares considered					
		5	6	7	8	9	10
Percent To Keep By Momentum	0.1	33%	96%	71%	45%	24%	22%
	0.2	33%	124%	226%	194%	119%	137%
	0.3	124%	124%	71%	66%	64%	90%
	0.4	124%	87%	71%	61%	72%	89%
	0.5	80%	87%	50%	61%	64%	59%

The strategy showed a positive return in 93.3% of combinations tested. When compared to the highest benchmark performance (J201) the strategy out performed in 34.1% of the scenarios tested.

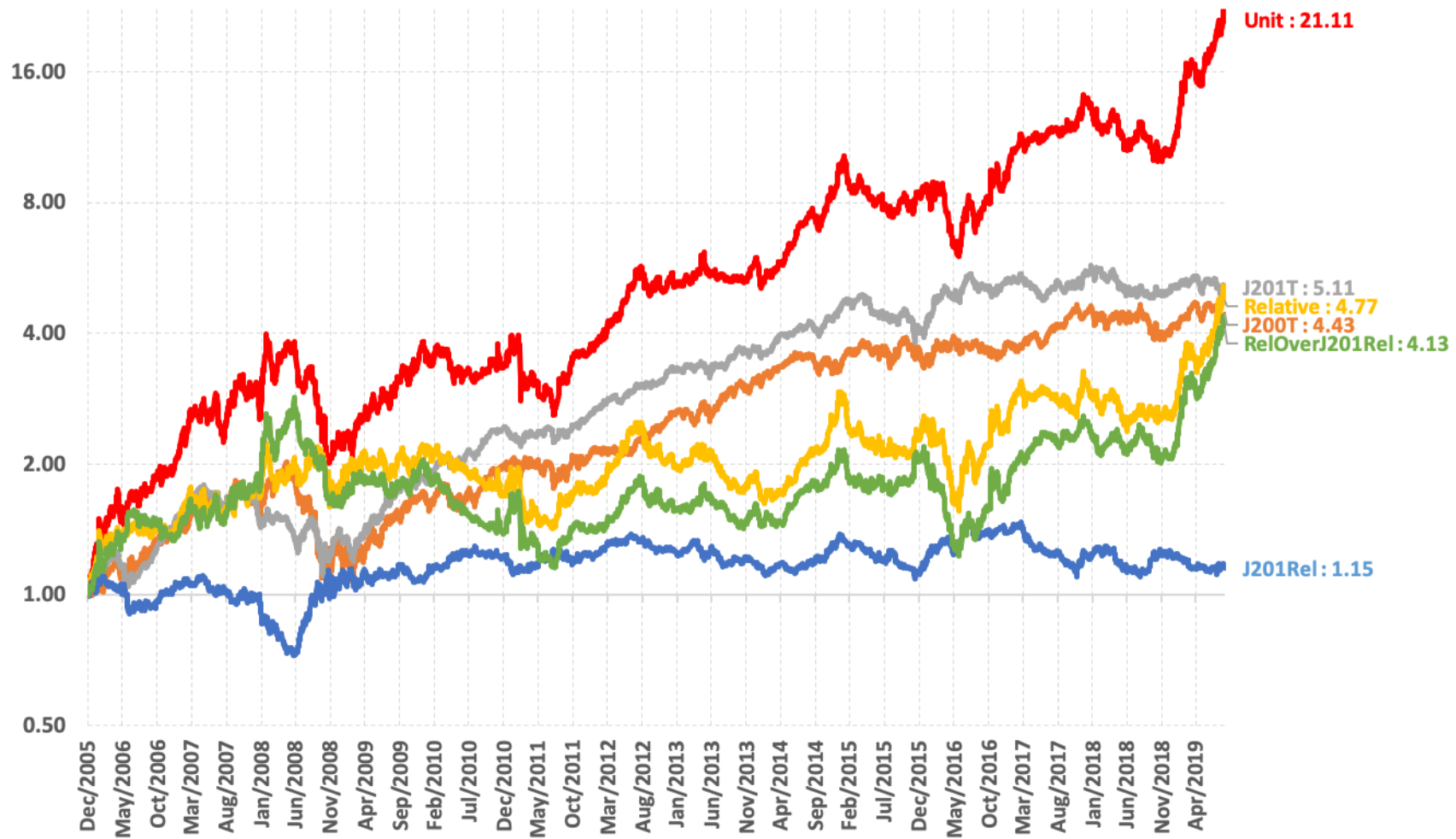


Figure 5 - Relative performance of style 2 optimal solution

The specific shares held over time with style 2 are included as *Appendix 3* for the optimal strategy. This level of detail allows certain events to be better interpreted as they relate to specific events in the market. In particular events such as the scandals surrounding Resilient and Steinhoff require evaluation in specific to understand the performance of the strategy.

Volatility

The volatility of a portfolio is very important when determining how practical it would be for an investor. The volatility was compared with that of the benchmark indexes.

Table 4 - Volatility

	Volatility	Annualised Volatility
Optimal Strategy	1.78%	28.20%
J200	1.31%	20.85%
J201	0.86%	13.67%

The optimal strategy was found to not only have the highest return but also one of the lowest volatilities of the strategies tested that managed to outperform the benchmark indexes.

The volatility can also be evaluated through the maximum drawdown. The optimal result experienced a maximum drawdown of 49.7% which occurred between March and November 2008.

Relative performance

In order to understand the relative performance of the proposed styles the full extent of their relative performance has been analysed.

Style 1

Style 1 was not able to outperform the index on a consistent basis. *Figure 4* shows that the style carried much higher volatility. At times the performance reached levels of more than double that of the indexes however this was not consistent and over time tended towards the index performance level.

Style 2

The performance of style 2 as illustrated in *Figure 5* demonstrates a consistent outperformance over the whole time period. The relative performance to the J201, the higher performing index over the period, shows a negative performance only for a short period at the beginning of the time series. Thereafter it is able to consistently outperform.

The momentum factor was found to be a critical element in the results of style 2. The momentum analysis allowed for shares approaching and moving away from the index to be well defined. Even at a level of 50% consideration of the momentum factor the results were seen to dramatically reduce.

The momentum element of style 2 showed results highly consistent with the findings in the literature. The 12 month momentum out performed all other variations tested. This phenomenon has been observed in markets across the world. Goyal and Wahal (2015) in a similar study showed that the momentum performance would work best when looking at 7-12 months of history. The result has been observed so frequently it has been dubbed the '12 month effect'.

8.4. Results – Proposition 3

In testing proposition 3, whether an investment strategy that targets a market pricing inefficiency during the event of a share entering (or exiting) an index on the JSE can be formulated such that it can be practically implemented the two styles were analysed independently.

Style 1

This style was able to be run without breaking the practicality criteria stated in section 7.6 above. At no point did any condition need to be actively relaxed. In post analysis it was also confirmed that no criteria had inadvertently been broken.

The simplicity of the strategy is believed to be the reason that the practicality element could be easily satisfied. The strategy required a low volume of trades which were made based on known data and as such it would be easy for any investor to implement this strategy.

Style 2

This style involved many additional factors and much higher trade volumes. The results were analysed in order to confirm that no errors had led to the model utilising data that would not have been available at the time. This result showed that the model had achieved the results with only information that would have been available to an investor at the time. A secondary analysis was then conducted to test whether any initial assumptions had been broken.

The trade volumes reached 1941 in total or 11.8 trades per month, this was the only factor that required additional analysis to determine whether it broke the practicality requirement. All other assumptions were found to be valid. The high volume of trades would attract fees which would detract from the return. The potential costs of these trades was calculated as per Equation 9.

The price or commission percentage used was 35 basis points plus VAT. This was selected as being the lowest price available for a retail client. This resulted in an

average monthly cost for the trades of 2.35%. This value was then compared to the return and cashflow requirements before determining whether it would meet the practicality criteria. The trading costs were however found to be very significant. The price effect was also run utilising 50% of the assumed fee to reveal the sensitivity of returns to the cost. The variation of raw return as well as return after cost is shown in *Figure 6* below. The J201 benchmark has been included for comparison as well as the performance of a unit subjected to 50% of the full cost model. The unit performance after cost was found to match the index at a level of 41.75% of the full fee. In order to reach the midpoint between the J201 and the pre cost performance a cost of just 14.02% of full fees would be required.

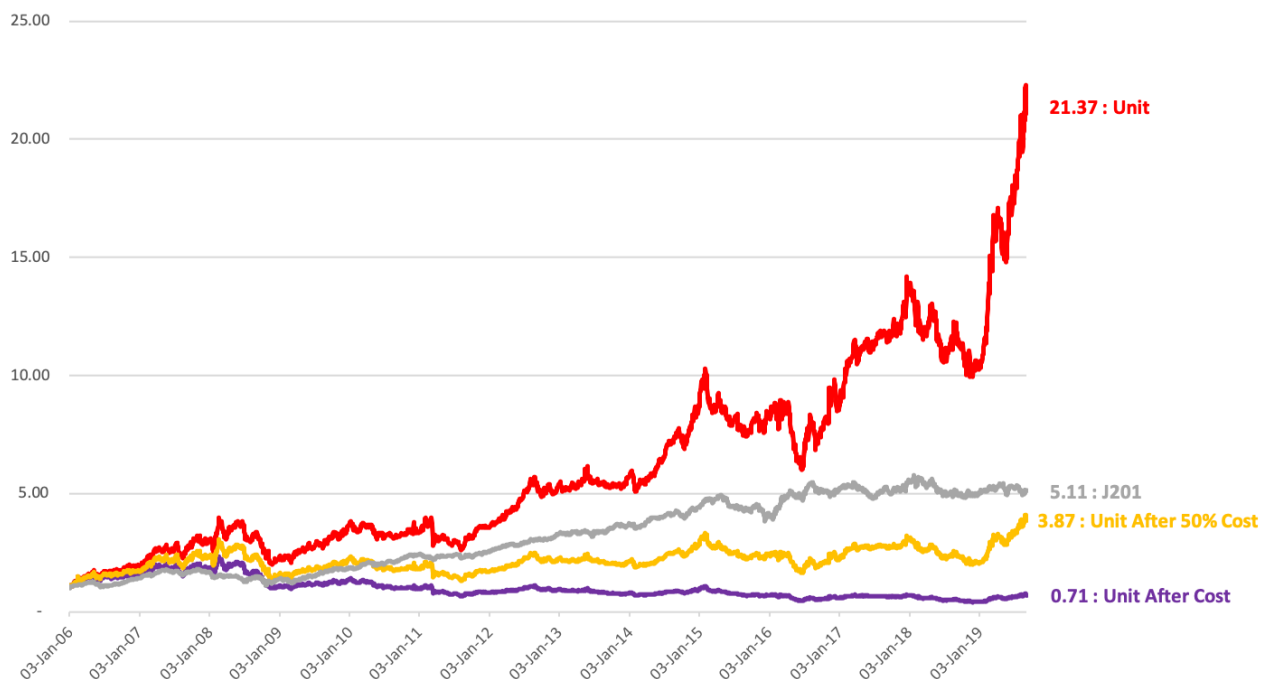


Figure 6 - Unit vs Unit after cost

The post cost performance was found to underperform the benchmark. With the full fee consideration the strategy produced a loss of 29% over the full period. At the 50% fee level the strategy was still not able to outperform the benchmark.

The study produced a vast amount of data which required significant analysis to produce meaningful results. While most of the results talk to the optimised strategy of style 1 and 2 respectively similar analysis was done on the broader data sets. The data presented above has been condensed to the most relevant items to better demonstrate the results. The nature of the study determined that certain result sets were more meaningful than others.

9. Discussion of Results

The analysis produced a broad range of data providing insight into a range of different elements of the two styles considered. The results produced numerous unexpected results, including numerous which contrast the existing literature. These are all unpacked and potential reasons for the variations are offered. This section has been structured as follows: general observations, propositions 1-3, overall discussion.

9.1. Observations

The results produced by style 1 were broadly consistent with Millar and Ward (2015) in that the movement begins well before the effective date, this is the reason that reacting to the movement, style 1, did not generate any outperformance. The effect had already been priced into the market.

The time frame of the analysis included the 2008 global financial crisis. It also included several scandals including Steinhoff and Resilient. These are uncommon events however they represent critical tests in order to understand how the strategy might perform in a variety of market conditions. The strategy was found to be remarkably stable considering the severity of these events. While it did experience a maximum drawdown of 49.7% during the financial crisis it was able to rebound effectively. Possibly more remarkable was the ability of the strategy to handle the Steinhoff and Resilient scandals. The strategy at one point or another held each of these shares. The nature of the strategy meant that approximately 50% was invested in these shares at the time of their respective scandals and yet losses were well contained. This is attributed to the frequent rebalance period and the strong influence of momentum and volatility, these factors allowed the strategy to divest from these shares quickly and hence limit the losses.

The two benchmark indexes both performed well over the period. They generated strong positive returns with acceptable levels of volatility. The J201 index, which is less popular for investors, consistently outperformed the J200 and performed 15%

better during the period. This is surprising as it suggests that the large passive investment funds are not targeting the best performing index. The volatility results (*Table 4*) show that the J201 has also experienced less volatility, compared to the J200, over the period. The J200 experienced an annual volatility of 20.85% vs just 13.67% for the J201. This is counter intuitive as smaller shares are typically associated with higher volatility. These results may be explained by the unique properties of the JSE. In their study Muller and Ward (2018) showed that there is a high concentration of investment into large shares due to the scale of investment managers. This in turn reduced the share of their portfolios being actively traded to only 15%. This could explain why the less popular index is out performing while still having lower volatility. This selection of shares are not being traded as competitively and as such there are higher yields for investors who are able to trade in these shares.

The source data was notably clean and required minimal changes before the analysis could be run. This is in contrast to some other studies but is largely explained due to the recency of the data. The dataset selected was necessarily recent in order to include the phenomenon associated with the rise in passive investing. Therefore data from 2006 and forward was used which is evidently better preserved and more available than older data. A large amount of the data was also sourced from the JSE bulletin which is a published source which is only released in arrears. As such this data is less prone to any problems that may occur affecting a more real time data feed. The bulletin is also backwards corrected where necessary. These factors combined to produce a very high quality dataset on which to run the analysis.

9.2. Proposition 1

The number of shares held by the optimal strategies of both styles was broadly similar. The results in

Table 1 show that Style 1 (which traded after the announcement) held an average of 3.95 shares at any one time. Style 2 showed an average of 3.06 shares held over

the course of a month but only 2 simultaneously. The result that Style 2 was optimised with just 3.06 shares held in a month, lower than style 1 which used objective data and therefore represents perfect information, shows that numerous shares which would go on to enter the index were never held at all. The strategy also optimised at just 2 shares being held simultaneously which suggests that the optimisation formula was favouring factors other than whether the share would or would not enter the index. Another key consideration is that the model had a requirement to always hold shares. There are periods of time when none of the constituents change, during this phase the portfolio is still required to maintain holdings as a real investor would. This requirement leads to the portfolio making predictions up to a year in advance of any change. This factor will lead to a poor prediction accuracy however it does not explain the result fully. The choice to optimise the strategy based on return and not accuracy has caused more profitable scenarios to be selected. This in turn shows that the inclusion event is not causing the highest level of return, this unexpected result is discussed later in this document.

It is also important to note that over the period a total of 80 inclusion events occurred and yet Style 2 only traded in 58 separate shares. These results all show that Style 2 was not trading in the complete set of shares. These findings are supported by the low accuracy results of just 48.1%. This shows that the strategy was not a good predictor of which share would enter the index.

Other iterations which included greater numbers of shares in the consideration set included higher numbers of the shares that would enter the index. The accuracy improved in these cases when the only consideration was whether the share that entered, was in the portfolio. However their average accuracy did not improve. This can be explained by the fact that as more shares were held by the portfolio, additional shares that would not enter the index were also brought into consideration. In effect this was serving to dilute the stock picks.

The momentum factor was found to be critical in the style 2 analysis. The results of iterations which excluded fewer shares based on momentum were found to

underperform. A sample of this can be seen in *Table 3*. In this table, as the percentage of shares retained increases so the percentage of shares being excluded is reducing. The optimal results were consistently found at the 20% level. This is consistent with what is expected from literature. The effect that the momentum factor is having is to separate the shares based on whether they are moving toward or away from the index. Where an iteration selects too many shares it includes shares which have only just been excluded from the index and as such they dilute the returns.

The accuracy of the predictions was also found to be affected by factors or events that the model did not account for. These included share splits, new listings or even companies being acquired which affected the free float percentage. The later was the case when AB InBev acquired SAB, this led to one of the largest shares in the index being excluded. These events are very difficult to predict and hence it is unlikely the model could be enhanced to include these factors in a practical manner. The results however did include these events which was a critical factor in ensuring that the performance of the strategy was tested against events it could not predict.

In their study Millar and Ward (2015) found that shares prices began to be affected 70 days prior to their inclusion. This shows that the effect is beginning earlier than the announcement, which shows that the price is being driven by speculation or some other forces. The results of this study suggest that the shares which are candidates for entry into the index all experience abnormal price increases. These two findings combine to suggest that either the increase is being driven by coincidental drivers or market speculators are having to hold a spread of shares to try take advantage of this event due to their poor ability to predict. This is a plausible scenario given the poor ability, of the strategies analysed in this study, to predict the inclusions.

In the event that the driving force is coincidental the active share notion may explain what is occurring. This would suggest that as the share reaches sufficient size, large institutional investors start to invest into the share. This would then suggest that it is the size of the share that is driving the increase rather than the inclusion into the

index itself. These two events may simply be linked by similarly sized shares. This would be a form of the Selection Criteria hypothesis as suggested in the literature.

The possibility that it is the size of shares that is driving their price movement could also explain why the J201 outperforms the J200. As the shares reach the upper end of the J201 the institutional investors begin to invest and this effect is driving the performance. The two explanations are not mutually exclusive and hence could both be compounding as they affect the market.

9.3. Proposition 2

The returns achieved by Style 1 were not significantly better than the return achieved by the indexes. This was an unexpected result because the price distortion was not being reflected in the returns and hence excess returns were not present. The style was only able to approximately match the index but not to outperform.

The result was also not consistent with the results predicted by the literature. The Millar and Ward (2015) study found that the share price decreased for 120 days after inclusion. This result would suggest that the style 1 portfolio should have produced negative returns and yet this was not observed. The reasons why this did not follow the predicted behaviour is not well understood. The optimal solution utilised a hold period of 5 months which would go beyond the 120 days. In order for the portfolio to produce a market average positive return after a 120 day decline, the final portion of the investment would need to experience a substantial increase. This was not observed in the data. The iterations tested would have optimised around this abnormal late uptick but this was not seen. However the behaviour was found to be more similar with the results found by Katze and Tiddens (2019). In this study the performance was found to be lower than the index but not negative. A possible explanation was suggested to be the more similar data set used by the Katze and Tiddens study however when analysing the performance over time this was found to be incorrect.

The Style 1 portfolio included a short side strategy. This aimed to take a short position of the share leaving the index and to use the cash to fund the long position. The strategy was able to enhance the returns moderately and could be achieved with minimal or zero cash. This result appears to produce a good return for the investor. The strategy is believed to produce sufficient return such that it could be considered to outperform the market when adjusting for a zero cash position for the investor.

The strategy was able to produce cumulative returns which were in the region of the index and as such other metrics were also analysed. The volatility is an important factor for investors, unfortunately the style 1 portfolio produced worse volatility results when compared to the index. This can be seen, most notably, in *Figure 4* during the 2015/6 period. During this time the portfolio experienced an almost 100% increase and subsequent decrease.

In understanding the results the specific holdings (*Appendix 2*) were analysed. This helped to explain some of the large movements. Two examples are Steinhoff and Resilient which were in the portfolio at the time of their respective scandals. While this may be attributed to misfortune, it could equally be argued that the nature of a portfolio with very few shares, is that the investor is exposed to these types of events. The latter is more realistic, given sufficient time it is highly probable that some event which causes a substantial drop would affect a share in the portfolio. This is evidenced by the two occurrences in the 14 year time frame of this study.

The effect of these events on an investor utilising the cash free strategy, described above, are very significant. The effect on the investor would depend largely on how they had structured this strategy, but a severe loss is guaranteed. Whether this is an acceptable or catastrophic loss would depend on the investor.

While the strategy was able to create a mechanism in which an investor could generate an out performance of the index it was not able to do so consistently. For this reason it is judged to have not confirmed Proposition 2. This result supports the findings of similar studies. Katzke and Tiddens (2019) found that the expected price increase had already been taken into account by the time of the index reconstitution

announcement. They suggested that the high demand was being equally met by investors following a front running strategy. This supports the imperfect substitute theory in the literature, which suggests that the price spike is not temporary but longer lived as investors are not easily able to substitute the share after the short term.

What is clear is that there is a price distortion occurring. This supports the majority of the existing literature. The exact behaviour and driving factors seem to be less consistent in the literature. This appears to be explained by differing methodologies which is leading to differing interpretations. In most cases these interpretations are offered as speculation as to what may be occurring. The exact driving forces appear to be a gap in the existing literature.

Style 2

The returns generated by the style 2 portfolio were consistently higher than that of style 1. This suggests that the return is being generated by the movement prior to the share entering the index. This is an interesting finding as it brings into question what the driving factor behind the returns is. The expectation was that the liquidity shock event occurring when a share enters an index would cause the price to increase. This is inconsistent with the results.

The portfolio results optimised at the intersection of 7 shares considered, 12 months of momentum considered and 20% of the shares retained when ranked by momentum. This practically resulted in just two shares being held in the portfolio at any one time. The returns that it generated in this construction were 226% annualised. This compares favourably to the benchmark returns of 47% and 55% for the J200 and J201 respectively. This outperformance represents 4.76 and 4.13 times respectively. These returns are all before costs have been taken into account. As discussed in Section 9.4 below, the cost of practically implementing this style are not insignificant.

The momentum variable was found to be the single most important factor included in the portfolio. This factor allowed the portfolio to distinguish between shares which had recently left the index and shares nearing inclusion. The momentum was

included with two separate variables in order to finely tune how this was included. These were, how far into the past the share should be analysed to determine its momentum, as well as how many shares to retain based on the momentum.

The share's momentum was varied between three months and 18 months. This allowed the effects of both short term, recent performance and long term trends to be analysed. The market demonstrated a strong optimisation at the 12 month point. This is shown in *Table 2* and *Table 3* above. In *Table 2* the performance is shown to be markedly higher using the 12 month momentum variable. The dataset displayed in *Table 3* shows the highest performing cross section of variables tested, all of which utilised the 12 month momentum look back time frame. This finding is strongly supported by the literature where it is coined the '12 month effect' (Goyal & Wahal, 2015).

The percentage of shares to keep based on their momentum, was included to limit the portfolio to shares with a reasonable chance of entering the portfolio. The model showed optimal returns with around two shares in total. This was found to be a more accurate measure than percentages. When the model was constructed the estimated number of shares that stood a chance of entering the index was overestimated. The results showed that the consideration set was ultimately very small and typically reduced down to two or three shares. The results show variations in which the percentage change had no effect on the number of shares considered and hence the performance was identical. This can be seen in *Table 3* above where, for example, the 5 shares considered by size and 0.2 and 0.3 variations both produced a return of 124% annualised return. The low number of shares considered in the result shows that while optimising the return the model did not select the shares with the highest chance of entering the index as discussed in section 9.2 above. This also showed that the model was not seeking the specific share expected to enter the index, nor was it even optimised by having that share included in the consideration set.

In order to set the weighting of the portfolio into each share a formula derived from the Black Scholes formula was utilised (Equation 6). The formula calculates the

probability of a share entering the index and weights the holdings accordingly. This allows the portfolio to hold a higher portion of a share as it appears more likely to enter the index. The results however showed this factor to have very little effect on the portfolio holdings. The weightings rarely drifted from the mean at 50%. This result shows that the ability to predict the share entering was difficult to achieve accurately. This supports the accuracy results discussed in section 9.2 above.

The specific shares held (*Appendix 3*) were analysed to gain a deeper understanding for how the portfolio was generating the returns. This analysis showed a tendency for the shares being held to alternate between certain shares back and forth. In some cases the share would enter the portfolio for a single day before being replaced. This shows that the scoring criteria for multiple shares were very closely matched and hence could easily displace one another. The momentum and volatility factors do not change rapidly and as such are not the cause of the strategy changing the selected share. The factor varying in the short term is the size of the free float market capitalisation. This is driven by changes to the share price which can vary significantly in the short term. The behaviour of the shares prices rising very closely matched to one another would suggest that a similar level of return would be produced by each share. This would then suggest that by holding additional shares in the portfolio similar returns would be generated. However this was not observed in the results. The results show a sharp decline in the returns as additional shares are included. This is displayed in *Table 3* above. This is due to the dilution of the invested capital into additional shares. The dilution factor is out weighing the return generated by repeated switches. This return does not include the added cost of the higher volume of switches. This effect is analysed below.

An analysis of performance would be incomplete without comparing the volatility of the portfolio. The results of the volatility comparison are presented in *Table 4* above. The optimal strategy produced the results with a significantly higher volatility level when compared to the benchmark indexes. The J201 index offered a volatility of just 13.67%. This is less than half of the volatility generated by the optimal strategy at 28.20%. The J200 index showed a volatility of 20.85% over the same period. This is

higher than the volatility of the J201 index. This is an unusual result in that the J201 produced a higher return and investors typically expect a higher return for tolerating higher volatility. The J200 is also comprised of larger shares than the J201. Larger shares are ordinarily associated with lower volatility. The indexes do not appear to be behaving in the expected manner. This could be explained by the market concentration in the largest shares in the index. This effect was explored by Muller and Ward (2018) as a phenomenon they called Active Share. This effect is causing an abnormal quantity of trading to occur in a limited pool of shares which may be contributing to the higher volatility in these shares. In their study Muller and Ward agreed that the Top40 index experienced abnormally high volatility.

The optimal strategy achieved its results with a high level of volatility. This factor does not in itself suggest that portfolio is not outperforming the benchmark indexes. The volatility is typically considered in terms of whether it is appropriate for the investor. In the criteria set out for this study an investor has not been specified and as such the volatility is deemed to be within a plausibly investable range. The final aspect to consider in relation to volatility is the associated return. Given a choice between two strategies that produce a return at the same level, a rational investor would select the portfolio with the lower volatility. However when offered higher return for higher volatility certain investors would opt for such an investment. In this pre cost analysis the optimal strategy with higher volatility can still be said to have outperformed the benchmark due to the significantly higher return.

9.4. Proposition 3

While many studies have analysed events on share inclusions and how various factors influence one another this study has gone a step further and is analysing whether these observations can be practically applied. In order to understand what can and cannot be applied practically it is critical to have a target which must be achieved. In the case of this study, the target was a strategy that could outperform a benchmark, which was selected to be the J200 and J201 indexes. The performance

of the strategies were unpacked in the previous section. The target being performance is important because the optimisation criteria are not focused on producing a practical strategy but rather a performant strategy. The practicality is a constraint.

The study applied numerous practicality constraints on the strategies that were tested. However certain constraints could only be analysed afterwards through backwards testing.

The Style 1 strategy was a reactive one and hence the key criteria to ensure that it was practical was to control how information was fed into the model. The model could not utilise any information which was not yet available at the time to any investor when selecting shares to include. This was also taken a step further to analyse whether an investor could practically react to the information with the requisite speed to place an investment. The simplicity of the Style 1 strategy allowed these conditions to be easily monitored and verified.

A secondary round of tests were run to ensure that nothing had inadvertently broken these criteria. This included analysing the share selections (*Appendix 2*), to ensure that none were placed prior to the information, which would have logically led to their selection, being available. In all cases the strategy was found to satisfy the practicality requirements as set out in section 7.6 above.

The analysis of Style 2, which included many more variables, required more detailed testing. Much of the analysis mirrored that of Style 1 most notably the testing that the model was not reacting to information that should not have been available. It was found to be correctly utilising information that was practically available at the time of selecting the share.

A notable result was the volume of trades required in order to enact the optimal solution. This was found to be 1941 or 11.8 trades per month. In order to test whether this broke the practicality criteria the cost of these trades was analysed. The cost of the trades was found to average 2.35% per month which is highly significant and rendered many of the variations tested, impractical.

The high volume of trades was an unexpected result. It was initially expected that the criteria for a share would remain relatively stable as it approached the index. This was found to be incorrect and in fact numerous shares closely matched one another on the critical criteria. This result may also explain the poor prediction accuracy results discussed in Section 9.2 above.

The high expenses experienced in running the high volume of trades meant that the strategies could not be considered practical. The optimised portfolio produced a negative return once the high fee levels had been factored in. This result was reinforced by the result that even with a fee at 50% of the lowest that could be found in the market, the strategy would underperform the index. In order to match the performance of the index a fee discount of 58.25% would need to be secured. At this level the rational investor would however opt for the lower volatility of the index and as such the strategy would still be deemed to have underperformed. With the inclusion of any reasonable trading cost the strategy was found to break the practicality constraint as it was unable to outperform once this constraint was included.

Numerous stock brokers have begun to offer commission free trading. While this is not available in the South African market at this point, it could allow the strategy to become more practical. However the method by which these brokers are able to offer commission free trading can result in higher buy and lower sale prices. A more complete analysis would be required to determine whether they do in fact provide a mechanism to enable this strategy to be practically implemented.

9.5. Discussion

In determining whether the two styles analysed were able to achieve the requirements, they have all been considered independently. The results have shown that the model was not particularly accurate at predicting the share expected to enter the index. The optimal performing strategy was only able to achieve a 48.1% accuracy. While the model was optimised for overall return this was still a poor result.

The variables utilised in the model allowed sufficient scope to select additional shares and hence increase the probability of selecting the share that would enter the market. Since the model was optimised for ultimate return this shows that the ultimate return is not determined by the portfolios ability to include the share that would enter the index. While the model did not consider certain events, most notably shares being spun off that would be included in the index, this event was sufficiently rare so as not to significantly skew the results.

The return performance of the style 1 model was not able to consistently outperform the benchmark indexes. It did not behave as predicted by the literature. Miller and Ward (2015) found that a shares price will decline for the 120 days after inclusion into the index. The returns generated by style 1 were roughly in line with the benchmark indexes. The results of the Miller and Ward study are further called into question as they suggest that the downward movement they found was caused by traders taking advantage of the pricing anomaly. This study has found the price does not drop and was unable to produce a strategy to practically trade the event. This may suggest that the pricing anomaly is being caused by another as yet not fully understood market force.

The style 2 model was able to produce very large returns way in excess of the index in certain configurations. It was also able to outperform the indexes in 34.1% of the configurations tested. Finally the volatility was also considered. In this metric the indexes were able to produce their return with lower volatility however the return out performance of the optimal strategy was of a level that could be acceptable for a well matched investor.

In order to determine whether the strategy, that had been produced, could be practically implemented numerous constraints were applied through the testing phase. In addition numerous other factors were analysed as described above. The practicality constraint was found to be easily acceptable for all factors other than trading costs. The strategy required a very high volume and value of trades in order

to be implemented. The costs were ultimately determined to be unsustainable once they were applied to the returns.

The excess returns produced, before costs, demonstrates that the market is experiencing some form of pricing anomaly. This is suspected to be due to speculation in a similar manner to what this strategy is attempting or the active share notion discussed above. It is important to note that these explanations are not mutually exclusive and could be combining to create or amplify the anomaly.

There are numerous ways that the strategy could potentially be adjusted in order to take advantage of the pricing anomaly however a reduction in cost would likely yield the best results. By reducing the volume or value of the trades, the costs would be reduced and this would enable some of the excess upside to be extracted. This could be practically achieved by rebalancing less frequently than daily, as was used in this strategy, or by rebalancing only a percentage of the portfolio each day. The tendency of holdings to move back and forth between the same set of shares suggests that a strategy of this nature would only marginally reduce the returns. A full analysis would be required to determine whether the reduction in performance can be sufficiently offset with the cost reduction. As stock broker services become more competitive and pricing is driven down it may become possible to implement the strategy.

Finally it could be argued that the strategies developed strayed away from the initial event that was being targeted. This is one explanation of the high return coupled with the low prediction accuracy. This is not an entirely accurate analysis. The optimised strategy was found to generate returns by only utilising approximately half the shares that would enter the index and as such much of the returns were attributable to other causes. However the non-optimised strategy variations that were also tested, operated utilising a greater proportion of shares linked to the index entry event. These strategies were however found to be sub optimal. The purpose of this study was to determine whether this event could be practically and successfully traded. By showing that even under optimised conditions this was not possible this result extends to the other variations that were sub optimal.

10. Conclusion

The findings of this research provide unique insight into the real world implications of much of the research that has come before. The practicality element in particular appears to have been incorrectly assumed to bear no significance in the existing literature. These findings are explored below.

In addition the limitations of the study have been acknowledged and interpreted. Finally the areas in which further research could add value have been explored. These take the form of enhancements to this study as well as extensions or deeper analysis in areas in which the findings of this study could not be fully explained.

10.1. Principal findings

Proposition 1 – Not confirmed

In predicting the share expected to enter the index the model was able to narrow down the options to a small subset. The size of the free float was able to reduce the subset to a narrow set of options. The momentum was then critical to determine whether a share was moving toward or away from the index. The results of the holdings over time showed that the model was not able to determine the exact share expected to enter the index.

Proposition 2 - Confirmed

The style 1 strategy did not produce a consistent out performance. The reactive nature of this strategy resulted in all pricing anomalies having already been priced into the market before the strategy included the share.. This strategy did, however support the imperfect substitute hypothesis, as detailed in the literature, that suggests the price would not decline during the phase that this portfolio was invested.

The fact that style 1 did not outperform shows that the expected liquidity shock is not taking place as predicted. This could be explained by the South African stock market having a relatively low percentage of investors using passive investment when compared to international markets. Alternatively the market could be smoothing the

shock due to the large investors entering the shares as they reach sufficient size to become tradable. This effect would also explain the high returns generated by style 2. As such rather than a liquidity shock the shares are experiencing an increase due to more investors being willing or able to invest in them. This differs in that it is spread out over a longer time frame and also that the demand is more permanent, not simply a temporary spike. This strongly supports the selection criteria hypothesis which suggests that it is the underlying fundamentals of the share rather than the inclusion event itself that is driving the out performance. This would also explain why the model optimised at a point with low prediction accuracy. This finding suggests that the index inclusion is not itself causing the price distortion but rather that the price distortion is leading to the inclusion. This is the only hypothesis found in literature which can explain the results of this study.

The style 2 strategy was able to produce very large returns over the index performance. The strategy was also able to do so consistently over the full time span. While the strategy did experience higher volatility this was considered an acceptable level considering the level of return.

Proposition 3 – Not confirmed

Ultimately neither strategy was able to offer a practically implementable strategy that could outperform the index consistently over time. In the case of style 2 this was solely based on trading costs. With reduced costs the strategy would be capable of a large out performance. The solutions explored were not able to arrive at a practical option for a retail investor however only the trading costs prevented this and the cost variable is likely one that could be solved by other investors. An investment manager that was able to process the trades in house could plausibly utilise this strategy. Similarly with a tweaked version of this strategy it could potentially be implemented. It is therefore possible that an investor could be trading on a similar strategy however with the available data and fees the practicality could not be confirmed.

10.2. Implications for management

An asset manager would need to understand the implications of the results of this study. The manager of a passive fund or an active fund investing in this section of the market stand to be prejudiced. The potential for an investor to solve the cost problem remains plausible and as such the excess return generated would reduce the performance of other investors. However while it is possible that there will be market participants who are able to utilise a strategy like this it is not simple to implement and as such it will likely be limited to a small quantity of investors.

The style 2 model displayed excess returns were occurring and as such a pricing anomaly is occurring. This anomaly is occurring earlier than initially predicted however the upside is almost fully experienced before the share enters the index. This suggests that the asset managers who purchase the share after it enters the index are missing out on potential upside. If the manager is able to secure a mandate which includes the shares earlier they would be able to receive the benefit of the upside on offer. At present the opportunity identified shows an area that a passive manager is losing potential upside.

The results also have implications for an active asset manager. By utilising the factors and methodology identified while managing costs an excess return could be generated. A boutique investment manager would likely be the best suited to this style however a large manager could also run a small fund in this style to achieve excess return.

The model is difficult to implement and it cannot be rolled out at too large a scale without affecting the market in such a way that could change the basis on which the trades are being made. This means only a sophisticated investor with access to near zero trading costs, and that is willing to trade at low scale, is able to implement this strategy. The cross section of investors who match this profile is very small and as such it is unlikely to become a broad market investment trend if it is implemented at all.

The model showed a distinct pricing anomaly occurring within this segment of the market. This effect was not caused by the event initially predicted and hence there is another driver at work. If this driver can be identified it could potentially be better predicted and controlled. The general assumption was that the liquidity spike was causing the anomaly however this has been disproved and hence managers should be wary of any decisions which are built on that assumption.

The results also hold implications for the management team of a listed entity which is currently trading within this subset of the market. The company's shares are likely to receive an abnormal boost at this point in the market. This would present the management team with various options. It might present an opportunity for shares to be issued if they believe the valuation is above fair value. This could allow the management to optimise the financing structure of the business. The team should also be aware of the effect that is occurring. It is important that they do not misattribute the performance. If this effect is not recognised it could lead to poor management decision making which could have severe consequences for the business.

10.3. Limitations

While every effort was made to produce robust and fully considered results, numerous limitations have been identified. These are items that could be further considered in refining this analysis.

The nature of utilising historical data to determine a forward looking strategy implicitly makes numerous assumptions that the future will be sufficiently similar to the past. While this is a common methodology that has proven effective it is prudent to acknowledge the potential limitations. Numerous "black swan" events throughout the history of investment markets have proven this assumption to be limited.

The effect of the costs was not anticipated to have such a drastic effect on the returns. It was for this reason that they were analysed as a practicality criteria rather

than being included in the optimisation. While the exclusion allowed the assumption of specific costs to be excluded, it did introduce a limitation. By including the cost into the calculations before optimisation a slightly different result configuration may have emerged.

The findings were conducted with only the JSE and no consideration was given to other markets. This was a decision taken due to numerous abnormalities that have been identified in the JSE which affect the phenomenon within which this strategy is based. This does not however preclude other markets from containing similar abnormalities and opportunities. The results of this study however cannot be applied directly to other exchanges either in South Africa (ZARX) or internationally.

The results have not accounted for any secondary effects. That is to say the reaction of the market and other investors has not been considered. Once an investor begins to trade in the manner described above other investors may become aware of what the strategy is doing and may choose to react. The reaction of these investors may have a moderating effect on the returns. The ability to predict may also be affected by other investors actions. These effects could occur in a very broad range of ways which are not easily predicted. This entire effect has not been controlled for.

The effect on demand and liquidity as a result of this strategy was deemed to have a negligible effect on the market. If this strategy were adopted on a sufficiently large scale this assumption would likely break down. As large trades are made it would likely drive up the price and a subsequent sale could be difficult to execute without driving the price down.

While trading costs have been considered no other costs have been included. This was deemed negligible by comparison.

10.4. Suggestions for future research

There are a large number of areas that could be researched further. These typically align to reducing the effect of the limitations discussed above. This study also

produced numerous results which were in conflict to the expected outcome. These all offer opportunities for further research. These items are detailed below along with potential methodologies.

The model demonstrated a poor ability to predict the share which would enter the market. This aspect could be analysed to determine the factors that are most important. This would have significant implications for the management teams of listed companies seeking to enter the index. This could be achieved through a similar methodology to the one used by this study. The optimisation criteria would be changed to be the accuracy and numerous other factors could be introduced. Some factors that could have an effect are: Director dealings, sector performance or sector momentum, financial results or key ratios among others.

The finding that passive investors are missing a lot of upside provides an opportunity to understand how they could possibly incorporate that return. As passive investment has become more popular, variations in their mandate are starting to occur. A study to understand what variations exist and how they compare would provide great insight. It could be extended to determine what other variations could be run to allow for an enhanced return. This could use a similar method to this study however the variables would be markedly different. The potential options would need to be determined as factors an investor would be willing to allow within a principally passive mandate.

This strategy being run could have a modifying effect on the market. These effects are not yet understood. A study could attempt to predict what these effects might be. This study would likely lean heavily on existing literature and the effect that similar strategies have caused within the market.

This study could be repeated on international markets to determine whether the strategy would be successful in another context. The methodology would be best repeated exactly which would allow for comparison with this study.

The above study could then be extended to understand what factors are driving the effect and any differences between the results. If these factors could be well

understood it would allow for not only shares to be selected for investment but also which market is best suited. There also remains a possibility that the strategy could use multiple markets. Global trends could be included as input to assist with this analysis.

The main weakness of the strategy identified was the high volume of trades. The methodology could be tweaked to try and reduce this effect and hence reduce the trading cost. If this is possible without reducing the return excessively a highly profitable and practical strategy could be achieved. This could build on the methodology of this study but integrate the cost into the model prior to optimisation. This would allow the trade volume to be considered as a primary factor and hence the return after cost would be optimised.

The cause of the pricing anomaly has not been precisely uncovered in this study. The reasons suggested in the literature do not appear to adequately explain the behaviour. A study to accurately explain this phenomenon would be highly valuable for investors and management alike. This could be achieved by identifying shares that display the anomalous return and identify common characteristics. These should provide insight into what is causing the pricing to vary from the norm.

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12. Appendices

Appendix 1 - Style 2 Software Code

```
1. Option Explicit
2.
3. Public OldCode As String
4. Public NewCode As String
5. Public Name As String
6. Public MarketCap As Double
7. Public FreeFloat As Double
8. Public Size As Double
9. Public Momentum12m As Double
10. Public Momentum12mRank As Long
11. Public Momentum12mRelative As Double ' Subtracted the J200 12m Return
12. Public Nd1 As Double
13. Public Weight As Double
14. Public CloseAmount As Double
15.
16.
17. Option Explicit
18.
19. Function Dereference(x As Variant)
20.     Dereference = x.CloseAmount
21. End Function
22.
23.
24. Option Explicit
25.
26. Function Dereference(x As Variant)
27.     Dereference = x.Momentum12m
28. End Function
29.
30.
31. Option Explicit
32.
33. Function Dereference(x As Variant)
34.     Dereference = x.Nd1
35. End Function
36.
37.
38. Option Explicit
39.
40. Function Dereference(x As Variant)
41.     Dereference = x.Size
42. End Function
43.
44.
45.
46. Option Explicit
47.
48. Dim Db As Database
49. Dim rs As Recordset
50.
51. Sub InitialiseMe()
52.     Static Initialized As Boolean
```

```

53.
54.     If Not Initialized Then
55.         Set Db = OpenDatabase("C:\Work\Wits Business School\Equity Investing -
           Elective\2019 Q1\InclusionsExclusions.accdb")
56.
57.         Set rs = Db.OpenRecordset("Timeseries")
58.         rs.Index = "Timeseries"
59.
60.         Initialized = True
61.     End If
62.
63. End Sub
64.
65. Sub RunThemAll()
66.     Dim NoToKeepBySize As Long
67.     Dim PctToKeepByMom As Double
68.     Dim MomentumMonths As Long
69.     Dim Directions As New Collection
70.     Dim Direction As Variant
71.     Dim OldTime As Variant
72.
73.     Directions.Add "Long"
74.     Directions.Add "Short"
75.
76.     For Each Direction In Directions
77.         For NoToKeepBySize = 10 To 1 Step -1
78.             For PctToKeepByMom = 10 To 40 Step 10
79.                 For MomentumMonths = 3 To 18 Step 3
80.                     Debug.Print CStr(Direction), NoToKeepBySize, PctToKeepByMo
           m / 100, MomentumMonths, Time(), (Now() - OldTime) * 24 * 60 * 60
81.
82.                     OldTime = Now()
83.                     TradeTheInclusions CStr(Direction), NoToKeepBySize, PctToK
           eepByMom / 100, MomentumMonths
84.                 Next
85.             Next
86.         Next
87.     Next
88.
89. End Sub
90.
91. Sub TradeTheInclusions(Direction As String, NoToKeepBySize As Long, PctToKeepB
           yMom As Double, MomentumMonths As Long)
92.     Dim StartDate As Date
93.     Dim CurDate As Date
94.     Dim PrevDate As Date
95.     Dim EndDate As Date
96.     Dim QuarterEnd As Date
97.     Dim LastQuarter As Date
98.     Dim AnnounceDate As Date
99.     Dim Dates As Worksheet
100.     Dim Top40 As CollectionX
101.     Dim Top40Current As CollectionX
102.     Dim MidCap As CollectionX
103.     Dim Candidates As CollectionX
104.     Dim CandidateTable As CollectionX
105.     Dim Top40Table As CollectionX

```

```

106.         Dim StrikeShare      As String
107.         Dim StrikeSize       As Double
108.         Dim Nd1Sum           As Double
109.         Dim Unit              As Double
110.         Dim Wb                As Workbook
111.         Dim ws                As Worksheet
112.         Dim t                  As Long
113.         Dim Dict              As Dictionary
114.         Dim Names             As New Collection
115.
116.         Names.Add "Unit"
117.         Names.Add "J200T"
118.         Names.Add "J201T"
119.         Names.Add "OurRelative"
120.         Names.Add "J201Rel"
121.         Names.Add "OurRelOverJ201Rel"
122.
123.         InitialiseMe
124.
125.         Set Dates = ThisWorkbook.Worksheets("Dates")
126.
127.         StartDate = DateValue("1 Apr 2015")
128.
129.         EndDate = DateValue("5 Sep 2019")
130.
131.         PrevDate = StartDate
132.         CurDate = NextTradingDay(PrevDate)
133.
134.         Unit = 1
135.
136.
137.
138.         Do While CurDate <= EndDate
139.             DoEvents
140.
141.
142.
143.             AnnounceDate = NextAnnouncementDate(CurDate)
144.
145.             LastQuarter = AddMonth(EoQuarter(AnnounceDate), -3)
146.
147.             Set Top40 = NewCollectionX()
148.             Top40.FromVariantArray Application.Run("aJbIndexConstituentsByI
indexCodeOnDate", "J200", LastQuarter)
149.
150.             Set Top40Current = ConvertToCurrentCodes(Top40)
151.
152.             Set MidCap = JseCodesThatExistBetween(LastQuarter, LastQuarter)
153.
154.             Set Candidates = MidCap.NoIntersect(Top40Current)
155.
156.             Set CandidateTable = PopulateCandidateTable(Candidates, PrevDat
e, MomentumMonths)
157.             Set CandidateTable = RemoveSizeZeroes(CandidateTable)
158.
159.             CandidateTable.Sort New derefSize, "Descending"

```

```

160.         Set CandidateTable = ApplySizeFilter(CandidateTable, NoToKeepBy
      Size)
161.
162.         Set CandidateTable = ApplyMomentumFilter(CandidateTable, PctToK
      eepByMom)
163.
164.         '-----
165.         Set Top40Table = PopulateCandidateTable(Top40Current, PrevDate,
      MomentumMonths)
166.
167.         Top40Table.Sort New derefSize, "Ascending"
168.
169.         Set Top40Table = RemoveSizeZeroes(Top40Table)
170.         '-----
171.
172.         StrikeShare = Top40Table.Head.Code
173.         StrikeSize = Top40Table.Head.Size
174.
175.         ApplyNd1 CandidateTable, PrevDate, AnnounceDate, StrikeSize
176.         Set CandidateTable = RemoveSizeZeroes(CandidateTable)
177.
178.         Nd1Sum = CandidateTable.Sum(New derefNd1)
179.
180.         ApplyWeights CandidateTable, Nd1Sum
181.
182.         CalculateCloseAmounts CandidateTable, Unit, PrevDate, CurDate
183.
184.         Unit = CandidateTable.Sum(New derefCloseAmount)
185.
186.         Set Dict = NewDictionary()
187.
188.         Dict.AddItem "Unit", Unit
189.         Dict.AddItem "J200T", SharePrice("J200T", CurDate) / SharePrice
      ("J200T", StartDate)
190.         Dict.AddItem "J201T", SharePrice("J201T", CurDate) / SharePrice
      ("J201T", StartDate)
191.         Dict.AddItem "OurRelative", Unit / Dict.AccessItem("J200T")
192.         Dict.AddItem "J201Rel", Dict.AccessItem("J201T") / Dict.AccessI
      tem("J200T")
193.         Dict.AddItem "OurRelOverJ201Rel", Dict.AccessItem("OurRelative"
      ) / Dict.AccessItem("J201Rel")
194.
195.         Dim Item As Variant
196.
197.         For Each Item In Names
198.             With rs
199.                 .Seek "=", CStr(Item), Direction, NoToKeepBySize, PctTo
      KeepByMom, MomentumMonths, CurDate
200.
201.                 If .NoMatch Then
202.                     .AddNew
203.                     !SeriesName = CStr(Item)
204.                     !Direction = Direction
205.                     !NoToKeepBySize = NoToKeepBySize
206.                     !PctToKeepByMom = PctToKeepByMom
207.                     !MomentumMonths = MomentumMonths
208.                     !Date = CurDate

```

```

209.             !Value = Dict.AccessItem(CStr(Item))
210.             .Update
211.         Else
212.             .Edit
213.             !Value = Dict.AccessItem(CStr(Item))
214.             .Update
215.         End If
216.     End With
217. Next
218.
219.     PrevDate = CurDate
220.     CurDate = NextTradingDay(CurDate)
221. Loop
222.
223. End Sub
224.
225. Function NextAnnouncementDate(TheDate As Date)
226.     Dim ws As Worksheet
227.     Dim r As Long
228.
229.     Set ws = ThisWorkbook.Worksheets("Dates")
230.     r = 3
231.
232.     Do While ws.Cells(r, 2) < TheDate
233.         r = r + 1
234.         NextAnnouncementDate = ws.Cells(r, 2)
235.     Loop
236.
237. End Function
238.
239. Private Sub TestNextAnnouncementDate()
240.     Debug.Print NextAnnouncementDate(DateValue("2 Jun 2018"))
241. End Sub
242.
243. Function PopulateCandidateTable(Candidates As CollectionX, TheDate As D
ate, MomentumMonths As Long) As CollectionX
244.     Dim Struc As StrucCandidate
245.     Dim aCandidate As Variant
246.     Dim MomMonths As Long
247.     Dim J200Return As Double
248.
249.     Set PopulateCandidateTable = NewCollectionX()
250.
251.     For Each aCandidate In Candidates
252.         Set Struc = New StrucCandidate
253.
254.         With Struc
255.             .NewCode = CStr(aCandidate)
256.
257.             .OldCode = .NewCode ' Just While OldCode() doesn't exist.
258.
259.             .Name = ShortName(.NewCode)
260.             .MarketCap = MarketCap(.NewCode, TheDate) / 10 ^ 8
261.             .FreeFloat = Application.Run("JbFreeFloat", .Code, AddMonth
(Eom(TheDate), -1))
262.             .Size = .MarketCap * .FreeFloat

```

```

263.
264.         MomMonths = Min(MomentumMonths, Int((TheDate - EarliestTsda
te(.NewCode)) / 365.25 * 12) - 1)
265.
266.         .Momentum12m = SharePrice(.NewCode, TheDate) / SharePrice(.
NewCode, AddMonth(TheDate, -MomMonths)) - 1
267.
268.         J200Return = SharePrice("J200", TheDate) / SharePrice("J200
", AddMonth(TheDate, -MomMonths)) - 1
269.
270.         .Momentum12mRelative = (1 + .Momentum12m) / (1 + J200Return
) - 1
271.         End With
272.
273.         PopulateCandidateTable.Add Struc
274.     Next
275.
276. End Function
277.
278. Sub ApplyNd1(CandidateTable As CollectionX, CurDate As Date, EndDate As
Date, StrikeSize As Double)
279.     Dim Struc As StrucCandidate
280.     Dim Vol As Double
281.     Dim Rf As Double
282.     Dim t As Double
283.
284.     Rf = 7 / 100
285.
286.     For Each Struc In CandidateTable
287.         If CurDate - EarliestTsdate(Struc.NewCode) > 20 Then
288.             Vol = Volatility(Struc.NewCode, CurDate, 60)
289.             t = (EndDate - CurDate) / 365.25
290.             Struc.Nd1 = Application.WorksheetFunction.Norm_S_Dist((Log(
Struc.Size / StrikeSize) + (Rf + Vol ^ 2 / 2) * t) / (Vol * Sqr(t)), True)
291.         Else
292.             Struc.Size = 0
293.         End If
294.     Next
295.
296. End Sub
297.
298. Sub ApplyWeights(CandidateTable As CollectionX, Nd1Sum As Double)
299.     Dim Struc As StrucCandidate
300.
301.     For Each Struc In CandidateTable
302.         Struc.Weight = Struc.Nd1 / Nd1Sum
303.     Next
304.
305. End Sub
306.
307. Sub CalculateCloseAmounts(CandidateTable As CollectionX, Unit As Double
, FromDate As Date, ToDate As Date)
308.     Dim Struc As StrucCandidate
309.
310.     For Each Struc In CandidateTable
311.         With Struc

```

```
312.         .CloseAmount = .Weight * Unit * (1 + ShareTotalReturn(.NewC
ode, FromDate, ToDate))
313.         End With
314.     Next
315.
316. End Sub
317.
318. Function RemoveSizeZeroes(Top40Table As CollectionX) As CollectionX
319.     Dim Struc As StrucCandidate
320.     Dim NewTable As CollectionX
321.
322.     Set NewTable = NewCollectionX()
323.
324.     For Each Struc In Top40Table
325.         If Struc.Size <> 0 Then
326.             NewTable.Add Struc
327.         End If
328.     Next
329.
330.     Set RemoveSizeZeroes = NewTable
331.
332. End Function
333.
334. Function ApplyMomentumFilter(Table As CollectionX, PctToKeepByMom As Do
uble) As CollectionX
335.
336.     Table.Sort New derefMomentum12m, "Descending"
337.
338.     Set ApplyMomentumFilter = Table.TopNPercent(100 * PctToKeepByMom)
339.
340. End Function
341.
342. Function ApplySizeFilter(Table As CollectionX, NoToKeepBySize As Long)
As CollectionX
343.
344.     Set ApplySizeFilter = Table.TopN(NoToKeepBySize)
345.
346. End Function
347.
348. Function ConvertToCurrentCodes(Table As CollectionX) As CollectionX
349.     Dim NewTable As CollectionX
350.     Dim aItem As Variant
351.
352.     Set NewTable = NewCollectionX()
353.
354.     For Each aItem In Table
355.         NewTable.Add CurrentCode(CStr(aItem))
356.     Next
357.
358.     Set ConvertToCurrentCodes = NewTable
359.
360. End Function
```


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Appendix 2 - Style 1 Holdings

Date	Shares
2006/01/31	APN
2006/02/28	APN
2006/03/31	ABL
2006/04/30	ABL
2006/05/31	ABL
2006/06/30	ABL
2006/07/31	ABL
2006/08/31	ABL
2006/09/30	RLO, EXX, KIO
2006/10/31	RLO, EXX, KIO
2006/11/30	RLO, EXX, KIO
2006/12/31	LON
2007/01/31	LON
2007/02/28	LON
2007/03/31	ARI, WHL, MUR
2007/04/30	ARI, WHL, MUR
2007/05/31	ARI, WHL, MUR
2007/06/30	MND
2007/07/31	MND
2007/08/31	MND
2007/09/30	ACL
2007/10/31	ACL
2007/11/30	ACL
2007/12/31	AEG
2008/01/31	AEG
2008/02/29	AEG
2008/03/31	ABL
2008/04/30	ABL
2008/05/31	ABL
2008/06/30	ABL
2008/07/31	ABL
2008/08/31	ABL
2008/09/30	SHP, BTI, CFR, REI, LBH, GRT, PIK
2008/10/31	SHP, BTI, CFR, REI, LBH, GRT, PIK
2008/11/30	SHP, BTI, CFR, REI, LBH, GRT, PIK
2008/12/31	SHP, BTI, CFR, REI, LBH, GRT, PIK

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2009/01/31	SHP, BTI, CFR, REI, LBH, GRT, PIK
2009/02/28	SHP, BTI, CFR, REI, LBH, GRT, PIK
2009/03/31	APN, DSY, VOD
2009/04/30	APN, DSY, VOD
2009/05/31	APN, DSY, VOD
2009/06/30	APN, DSY, VOD
2009/07/31	APN, DSY, VOD
2009/08/31	APN, DSY, VOD
2009/09/30	SHF
2009/10/31	SHF
2009/11/30	SHF
2009/12/31	SHF
2010/01/31	SHF
2010/02/28	SHF
2010/03/31	MND, MNP, CSO
2010/04/30	MND, MNP, CSO
2010/05/31	MND, MNP, CSO
2010/06/30	MSM, TRU
2010/07/31	MSM, TRU
2010/08/31	MSM, TRU
2010/09/30	MSM, TRU
2010/10/31	MSM, TRU
2010/11/30	MSM, TRU
2010/12/31	MSM, TRU
2011/01/31	MSM, TRU
2011/02/28	MSM, TRU
2011/03/31	MSM, TRU
2011/04/30	MSM, TRU
2011/05/31	MSM, TRU
2011/06/30	ASR
2011/07/31	ASR
2011/08/31	ASR
2011/09/30	WHL
2011/10/31	WHL
2011/11/30	WHL
2011/12/31	BTI
2012/01/31	BTI
2012/02/29	BTI
2012/03/31	BTI

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2012/04/30	BTI
2012/05/31	BTI
2012/06/30	IPL
2012/07/31	IPL
2012/08/31	IPL
2012/09/30	MPC
2012/10/31	MPC
2012/11/30	MPC
2012/12/31	MDC, ITU
2013/01/31	MDC, ITU
2013/02/28	MDC, ITU
2013/03/31	DSY
2013/04/30	DSY
2013/05/31	DSY
2013/06/30	BGA
2013/07/31	BGA
2013/08/31	BGA
2013/09/30	BGA
2013/10/31	BGA
2013/11/30	BGA
2013/12/31	CCO, LHC
2014/01/31	CCO, LHC
2014/02/28	CCO, LHC
2014/03/31	REI
2014/04/30	REI
2014/05/31	REI
2014/06/30	REI
2014/07/31	REI
2014/08/31	REI
2014/09/30	MPC
2014/10/31	MPC
2014/11/30	MPC
2014/12/31	NTC, RMI
2015/01/31	NTC, RMI
2015/02/28	NTC, RMI
2015/03/31	NTC, RMI
2015/04/30	NTC, RMI
2015/05/31	NTC, RMI
2015/06/30	BAT, CPI, MMI

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2015/07/31	BAT, CPI, MMI
2015/08/31	BAT, CPI, MMI
2015/09/30	RDF, MRP, SNH
2015/10/31	RDF, MRP, SNH
2015/11/30	RDF, MRP, SNH
2015/12/31	FFA, FFB, PSG, ANG, MEI
2016/01/31	FFA, FFB, PSG, ANG, MEI
2016/02/29	FFA, FFB, PSG, ANG, MEI
2016/03/31	BID
2016/04/30	BID
2016/05/31	BID
2016/06/30	BID
2016/07/31	BID
2016/08/31	BID
2016/09/30	BVT, GFI, IMP, LHC, SGL
2016/10/31	BVT, GFI, IMP, LHC, SGL
2016/11/30	BVT, GFI, IMP, LHC, SGL
2016/12/31	SAP
2017/01/31	SAP
2017/02/28	SAP
2017/03/31	TRU
2017/04/30	TRU
2017/05/31	TRU
2017/06/30	CPI
2017/07/31	CPI
2017/08/31	NRP
2017/09/30	NRP
2017/10/31	NRP
2017/11/30	RNI, RES
2017/12/31	RNI, RES
2018/01/31	RNI, RES
2018/02/28	RNI, RES
2018/03/31	IPL, SPP, TFG, TRU
2018/04/30	IPL, SPP, TFG, TRU
2018/05/31	CLS, NTC, OMU, ABG
2018/06/30	CLS, NTC, OMU, ABG
2018/07/31	CLS, NTC, OMU, ABG
2018/08/31	CLS, NTC, OMU, ABG
2018/09/30	RNI, BHP

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2018/10/31	RNI, BHP
2018/11/30	RNI, BHP
2018/12/31	PSG
2019/01/31	PSG
2019/02/28	MCG, AMS, GFI
2019/03/31	MCG, AMS, GFI
2019/04/30	MCG, AMS, GFI
2019/05/31	MCG, AMS, GFI
2019/06/30	MCG, AMS, GFI

Appendix 3 - Style 2 Holdings

Date	Holdings
2006/01/03	APN, LON
2006/01/04	APN, LON
2006/01/05	APN, LON
2006/01/06	APN, LON
2006/01/09	APN, LON
2006/01/10	APN, LON
2006/01/11	APN, LON
2006/01/12	APN, LON
2006/01/13	APN, LON
2006/01/16	APN, LON
2006/01/17	APN, LON
2006/01/18	APN, LON
2006/01/19	APN, LON
2006/01/20	APN, LON
2006/01/23	APN, LON
2006/01/24	APN, LON
2006/01/25	APN, LON
2006/01/26	APN, LON
2006/01/27	APN, LON
2006/01/30	APN, LON
2006/01/31	APN, LON
2006/02/01	APN, LON
2006/02/02	APN, LON
2006/02/03	APN, LON
2006/02/06	APN, LON
2006/02/07	APN, LON
2006/02/08	APN, LON
2006/02/09	APN, LON
2006/02/10	APN, LON
2006/02/13	APN, LON
2006/02/14	APN, LON
2006/02/15	APN, LON
2006/02/16	APN, LON
2006/02/17	APN, LON
2006/02/20	APN, LON
2006/02/21	APN, LON

2006/02/22	APN, LON
2006/02/23	APN, LON
2006/02/24	APN, LON
2006/02/27	APN, LON
2006/02/28	APN, LON
2006/03/02	APN, LON
2006/03/03	APN, LON
2006/03/06	APN, LON
2006/03/07	APN, LON
2006/03/08	APN, LON
2006/03/09	LON, RLO
2006/03/10	LON, RLO
2006/03/13	LON, RLO
2006/03/14	LON, RLO
2006/03/15	LON, RLO
2006/03/16	LON, RLO
2006/03/17	LON, RLO
2006/03/20	LON, RLO
2006/03/22	LON, RLO
2006/03/23	LON, RLO
2006/03/24	LON, RLO
2006/03/27	LON, RLO
2006/03/28	LON, RLO
2006/03/29	LON, RLO
2006/03/30	LON, RLO
2006/03/31	LON, RLO
2006/04/03	LON, RLO
2006/04/04	LON, RLO
2006/04/05	LON, RLO
2006/04/06	LON, RLO
2006/04/07	LON, RLO
2006/04/10	LON, RLO
2006/04/11	LON, RLO
2006/04/12	LON, RLO
2006/04/13	LON, RLO
2006/04/18	LON, RLO
2006/04/19	LON, RLO

2006/04/20	LON, RLO
2006/04/21	LON, RLO
2006/04/24	LON, RLO
2006/04/25	LON, RLO
2006/04/26	LON, RLO
2006/04/28	LON, RLO
2006/05/02	LON, RLO
2006/05/03	LON, RLO
2006/05/04	LON, RLO
2006/05/05	LON, RLO
2006/05/08	LON, RLO
2006/05/09	LON, RLO
2006/05/10	LON, RLO
2006/05/11	LON, RLO
2006/05/12	LON, RLO
2006/05/15	LON, RLO
2006/05/16	LON, RLO
2006/05/17	LON, RLO
2006/05/18	LON, RLO
2006/05/19	LON, RLO
2006/05/22	LON, RLO
2006/05/23	LON, RLO
2006/05/24	LON, RLO
2006/05/25	LON, RLO
2006/05/26	LON, RLO
2006/05/29	LON, RLO
2006/05/30	LON, RLO
2006/05/31	LON, RLO
2006/06/01	LON, RLO
2006/06/02	LON, RLO
2006/06/05	LON, RLO
2006/06/06	LON, RLO
2006/06/07	LON, RLO
2006/06/08	LON, SHP
2006/06/09	LON, RLO
2006/06/12	LON, RLO
2006/06/13	LON, RLO

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2006/06/14	LON, RLO
2006/06/15	LON, RLO
2006/06/19	LON, RLO
2006/06/20	LON, SHP
2006/06/21	LON, RLO
2006/06/22	LON, SHP
2006/06/23	LON, SHP
2006/06/26	LON, SHP
2006/06/27	LON, SHP
2006/06/28	LON, SHP
2006/06/29	LON, SHP
2006/06/30	LON, RLO
2006/07/03	LON, RLO
2006/07/04	LON, RLO
2006/07/05	LON, RLO
2006/07/06	LON, RLO
2006/07/07	LON, SHP
2006/07/10	LON, RLO
2006/07/11	LON, RLO
2006/07/12	LON, RLO
2006/07/13	LON, RLO
2006/07/14	LON, RLO
2006/07/17	LON, RLO
2006/07/18	LON, RLO
2006/07/19	LON, RLO
2006/07/20	LON, RLO
2006/07/21	LON, RLO
2006/07/24	LON, RLO
2006/07/25	LON, RLO
2006/07/26	LON, RLO
2006/07/27	LON, RLO
2006/07/28	LON, RLO
2006/07/31	LON, RLO
2006/08/01	LON, RLO
2006/08/02	LON, RLO
2006/08/03	AQP, LON
2006/08/04	LON, RLO
2006/08/07	AQP, LON
2006/08/08	AQP, LON

2006/08/10	AQP, LON
2006/08/11	LON, RLO
2006/08/14	LON, RLO
2006/08/15	LON, RLO
2006/08/16	LON, RLO
2006/08/17	LON, RLO
2006/08/18	LON, RLO
2006/08/21	LON, RLO
2006/08/22	LON, RLO
2006/08/23	LON, RLO
2006/08/24	LON, RLO
2006/08/25	LON, RLO
2006/08/28	LON, RLO
2006/08/29	LON, RLO
2006/08/30	LON, RLO
2006/08/31	LON, RLO
2006/09/01	LON, RLO
2006/09/04	LON, RLO
2006/09/05	LON, RLO
2006/09/06	LON, RLO
2006/09/07	ACL, LON
2006/09/08	AQP, LON
2006/09/11	AQP, LON
2006/09/12	ACL, LON
2006/09/13	ACL, LON
2006/09/14	AEG, LON
2006/09/15	AEG, LON
2006/09/18	AEG, LON
2006/09/19	AEG, LON
2006/09/20	AEG, LON
2006/09/21	AEG, LON
2006/09/22	AEG, LON
2006/09/26	AEG, LON
2006/09/27	LON, SHP
2006/09/28	ACL, LON
2006/09/29	LON, SHP
2006/10/02	LON, SHP
2006/10/03	LON, SHP
2006/10/04	LON, SHP

2006/10/05	LON, SHP
2006/10/06	LON, SHP
2006/10/09	LON, SHP
2006/10/10	LON, SHP
2006/10/11	ACL, LON
2006/10/12	ACL, LON
2006/10/13	LON, MUR
2006/10/16	ACL, LON
2006/10/17	LON, MUR
2006/10/18	ACL, LON
2006/10/19	ACL, LON
2006/10/20	ACL, LON
2006/10/23	ACL, LON
2006/10/24	ACL, LON
2006/10/25	ACL, LON
2006/10/26	LON, SHP
2006/10/27	LON, MUR
2006/10/30	LON, MUR
2006/10/31	LON, MUR
2006/11/01	LON, MUR
2006/11/02	LON, MUR
2006/11/03	LON, MUR
2006/11/06	LON, MUR
2006/11/07	ACL, LON
2006/11/08	ACL, LON
2006/11/09	ACL, LON
2006/11/10	ACL, LON
2006/11/13	ACL, LON
2006/11/14	ACL, LON
2006/11/15	ACL, LON
2006/11/16	ACL, LON
2006/11/17	ACL, LON
2006/11/20	ACL, LON
2006/11/21	AQP, LON
2006/11/22	AQP, LON
2006/11/23	ACL, LON
2006/11/24	ACL, LON
2006/11/27	ACL, LON
2006/11/28	ACL, LON

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2006/11/29	ACL, LON
2006/11/30	ACL, LON
2006/12/01	ACL, LON
2006/12/04	LON, MUR
2006/12/05	ACL, LON
2006/12/06	AQP, LON
2006/12/07	ACL, AEG
2006/12/08	ACL, AEG
2006/12/11	ACL, AEG
2006/12/12	ACL, SUI
2006/12/13	ACL, SHP
2006/12/14	ACL, SHP
2006/12/15	ACL, SHP
2006/12/18	ACL, SHP
2006/12/19	ACL, SHP
2006/12/20	ACL, SUI
2006/12/21	ACL, TRU
2006/12/22	ACL, TRU
2006/12/27	ACL, SUI
2006/12/28	ACL, SUI
2006/12/29	ACL, SHP
2007/01/02	ACL, SUI
2007/01/03	ACL, SHP
2007/01/04	ACL, SUI
2007/01/05	ACL, SUI
2007/01/08	ACL, SUI
2007/01/09	ACL, SUI
2007/01/10	ACL, SUI
2007/01/11	ACL, SUI
2007/01/12	ACL, SUI
2007/01/15	ACL, NPK
2007/01/16	ACL, NPK
2007/01/17	ACL, AQP
2007/01/18	AQP, MUR
2007/01/19	AQP, MUR
2007/01/22	AQP, MUR
2007/01/23	ACL, AQP
2007/01/24	AQP, MUR
2007/01/25	AQP, MUR

2007/01/26	AQP, MUR
2007/01/29	AQP, MUR
2007/01/30	AQP, MUR
2007/01/31	AQP, MUR
2007/02/01	AQP, MUR
2007/02/02	AQP, MUR
2007/02/05	AQP, MUR
2007/02/06	AQP, MUR
2007/02/07	AQP, MUR
2007/02/08	AQP, MUR
2007/02/09	AQP, MUR
2007/02/12	AQP, MUR
2007/02/13	AQP, MUR
2007/02/14	AQP, MUR
2007/02/15	AQP, MUR
2007/02/16	AQP, MUR
2007/02/19	AQP, MUR
2007/02/20	AQP, MUR
2007/02/21	AQP, MUR
2007/02/22	AQP, MUR
2007/02/23	AQP, MUR
2007/02/26	AQP, MUR
2007/02/27	AQP, MUR
2007/02/28	AQP, MUR
2007/03/01	AQP, MUR
2007/03/02	AQP, MUR
2007/03/05	AQP, MUR
2007/03/06	AQP, MUR
2007/03/07	AQP, MUR
2007/03/08	AQP, MUR
2007/03/09	AQP, MUR
2007/03/12	AQP, MUR
2007/03/13	AQP, MUR
2007/03/14	AQP, MUR
2007/03/15	AQP, MUR
2007/03/16	AQP, MUR
2007/03/19	AQP, MUR
2007/03/20	AQP, MUR
2007/03/22	AQP, MUR

2007/03/23	AQP, MUR
2007/03/26	AQP, MUR
2007/03/27	AQP, MUR
2007/03/28	AQP, MUR
2007/03/29	AQP, MUR
2007/03/30	AQP, MUR
2007/04/02	AQP, MUR
2007/04/03	AQP, MUR
2007/04/04	AQP, MUR
2007/04/05	AQP, MUR
2007/04/10	AQP, MUR
2007/04/11	AQP, MUR
2007/04/12	AQP, MUR
2007/04/13	AQP, MUR
2007/04/16	AQP, MUR
2007/04/17	AQP, MUR
2007/04/18	AQP, MUR
2007/04/19	AQP, MUR
2007/04/20	AQP, MUR
2007/04/23	AQP, MUR
2007/04/24	AQP, MUR
2007/04/25	AQP, MUR
2007/04/26	AQP, MUR
2007/04/30	AQP, MUR
2007/05/02	AQP, MUR
2007/05/03	AEG, MUR
2007/05/04	AEG, MUR
2007/05/07	AEG, MUR
2007/05/08	AEG, MUR
2007/05/09	AEG, MUR
2007/05/10	AEG, MUR
2007/05/11	AQP, MUR
2007/05/14	AQP, MUR
2007/05/15	AQP, MUR
2007/05/16	AQP, MUR
2007/05/17	AQP, MUR
2007/05/18	AQP, MUR
2007/05/21	AQP, MUR
2007/05/22	AQP, MUR

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2007/05/23	AQP, MUR
2007/05/24	AQP, MUR
2007/05/25	AQP, MUR
2007/05/28	AQP, MUR
2007/05/29	AEG, MUR
2007/05/30	AEG, MUR
2007/05/31	AQP, MUR
2007/06/01	AQP, MUR
2007/06/04	AQP, MUR
2007/06/05	AQP, MUR
2007/06/06	AQP, MUR
2007/06/07	AEG, AQP
2007/06/08	AEG, AQP
2007/06/11	AEG, AQP
2007/06/12	AEG, AQP
2007/06/13	AEG, AQP
2007/06/14	AEG, AQP
2007/06/15	AEG, AQP
2007/06/18	AEG, AQP
2007/06/19	AEG, AQP
2007/06/20	AEG, AQP
2007/06/21	AEG, AQP
2007/06/22	AEG, AQP
2007/06/25	AEG, AQP
2007/06/26	AEG, AQP
2007/06/27	AEG, AQP
2007/06/28	AEG, AQP
2007/06/29	AEG, AQP
2007/07/02	AEG, AQP
2007/07/03	AEG, AQP
2007/07/04	AEG, AQP
2007/07/05	AEG, AQP
2007/07/06	AEG, AQP
2007/07/09	AEG, AQP
2007/07/10	AEG, AQP
2007/07/11	AEG, AQP
2007/07/12	AEG, AQP
2007/07/13	AEG, AQP
2007/07/16	AEG, AQP

2007/07/17	AEG, AQP
2007/07/18	AEG, AQP
2007/07/19	AEG, AQP
2007/07/20	AEG, AQP
2007/07/23	AEG, AQP
2007/07/24	AEG, MSM
2007/07/25	AEG, MSM
2007/07/26	AEG, AQP
2007/07/27	AEG, AQP
2007/07/30	AEG, MSM
2007/07/31	AEG, MSM
2007/08/01	AEG, AQP
2007/08/02	ACL, AEG
2007/08/03	ACL, AEG
2007/08/06	AEG, MSM
2007/08/07	AEG, MSM
2007/08/08	AEG, MSM
2007/08/10	AEG, MSM
2007/08/13	AEG, AQP
2007/08/14	AEG, AQP
2007/08/15	ACL, AEG
2007/08/16	ACL, AEG
2007/08/17	AEG, AQP
2007/08/20	ACL, AEG
2007/08/21	AEG, AQP
2007/08/22	AEG, AQP
2007/08/23	AEG, AQP
2007/08/24	AEG, MSM
2007/08/27	ACL, AEG
2007/08/28	AEG, AQP
2007/08/29	AEG, AQP
2007/08/30	AEG, AQP
2007/08/31	AEG, AQP
2007/09/03	AEG, AQP
2007/09/04	AEG, AQP
2007/09/05	AEG, AQP
2007/09/06	AEG, AQP
2007/09/07	AEG, AQP
2007/09/10	AEG, AQP

2007/09/11	AEG, AQP
2007/09/12	AEG, AQP
2007/09/13	AEG, AQP
2007/09/14	AEG, AQP
2007/09/17	AEG, AQP
2007/09/18	AEG, AQP
2007/09/19	AEG, AQP
2007/09/20	AEG, AQP
2007/09/21	AEG, AQP
2007/09/25	AEG, AQP
2007/09/26	AEG, AQP
2007/09/27	AEG, AQP
2007/09/28	AEG, AQP
2007/10/01	AEG, AQP
2007/10/02	AEG, AQP
2007/10/03	AEG, AQP
2007/10/04	AEG, AQP
2007/10/05	ACL, AEG
2007/10/08	ACL, AEG
2007/10/09	ACL, AEG
2007/10/10	ACL, AEG
2007/10/11	AEG, AQP
2007/10/12	AEG, AQP
2007/10/15	AEG, AQP
2007/10/16	AEG, AQP
2007/10/17	AEG, AQP
2007/10/18	AEG, AQP
2007/10/19	AEG, AQP
2007/10/22	AEG, AQP
2007/10/23	AEG, AQP
2007/10/24	AEG, AQP
2007/10/25	AEG, AQP
2007/10/26	AEG, AQP
2007/10/29	AEG, AQP
2007/10/30	AEG, AQP
2007/10/31	AEG, AQP
2007/11/01	AEG, AQP
2007/11/02	AEG, AQP
2007/11/05	AEG, AQP

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2007/11/06	AEG, AQP
2007/11/07	AEG, AQP
2007/11/08	AEG, AQP
2007/11/09	AEG, AQP
2007/11/12	AEG, AQP
2007/11/13	AEG, AQP
2007/11/14	AEG, AQP
2007/11/15	AEG, AQP
2007/11/16	ACL, AEG
2007/11/19	ACL, AEG
2007/11/20	ACL, AEG
2007/11/21	ACL, AEG
2007/11/22	ACL, AEG
2007/11/23	ACL, AEG
2007/11/26	ACL, AEG
2007/11/27	ACL, AEG
2007/11/28	ACL, AEG
2007/11/29	AEG, SHP
2007/11/30	AEG, SHP
2007/12/03	AEG, SHP
2007/12/04	AEG, SHP
2007/12/05	AEG, SHP
2007/12/06	AEG, SHP
2007/12/07	AEG, SHP
2007/12/10	AEG, SHP
2007/12/11	AEG, SHP
2007/12/12	AEG, SHP
2007/12/13	AQP, SHP
2007/12/14	AQP, SHP
2007/12/18	AQP, SHP
2007/12/19	AQP, SHP
2007/12/20	AQP, SHP
2007/12/21	AQP, SHP
2007/12/24	AQP, SHP
2007/12/27	AQP, SHP
2007/12/28	AQP, SHP
2007/12/31	AQP, SHP
2008/01/02	AQP, SHP
2008/01/03	AQP, SHP

2008/01/04	AQP, SHP
2008/01/07	AQP, SHP
2008/01/08	AQP, SHP
2008/01/09	AQP, SHP
2008/01/10	AQP, SHP
2008/01/11	AQP, SHP
2008/01/14	AQP, SHP
2008/01/15	AQP, SHP
2008/01/16	AQP, SHP
2008/01/17	AQP, SHP
2008/01/18	AQP, SHP
2008/01/21	ASR, SHP
2008/01/22	AQP, SHP
2008/01/23	ASR, SHP
2008/01/24	AQP, SHP
2008/01/25	AQP, SHP
2008/01/28	AQP, SHP
2008/01/29	AQP, SHP
2008/01/30	AQP, SHP
2008/01/31	AQP, EPS
2008/02/01	AQP, EPS
2008/02/04	AQP, EPS
2008/02/05	AQP, EPS
2008/02/06	AQP, ASR
2008/02/07	AQP, ASR
2008/02/08	AQP, ASR
2008/02/11	AQP, ASR
2008/02/12	AQP, ASR
2008/02/13	AQP, ASR
2008/02/14	AQP, ASR
2008/02/15	AQP, ASR
2008/02/18	AQP, ASR
2008/02/19	AQP, ASR
2008/02/20	AQP, ASR
2008/02/21	AQP, ASR
2008/02/22	AQP, ASR
2008/02/25	AQP, ASR
2008/02/26	ASR, EPS
2008/02/27	ASR, SHP

2008/02/28	AQP, ASR
2008/02/29	AQP, ASR
2008/03/03	AQP, ASR
2008/03/04	AQP, ASR
2008/03/05	AQP, ASR
2008/03/06	AQP, ASR
2008/03/07	AQP, ASR
2008/03/10	AQP, ASR
2008/03/11	ASR, EPS
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2008/04/16	AQP, ASR
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2008/04/18	AQP, ASR
2008/04/21	AQP, ASR
2008/04/22	AQP, ASR
2008/04/23	AQP, ASR
2008/04/24	AQP, ASR

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2008/04/25	AQP, ASR
2008/04/29	AQP, ASR
2008/04/30	AQP, ASR
2008/05/05	AQP, ASR
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2008/05/09	AQP, ASR
2008/05/12	AQP, ASR
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2008/06/24	AQP, ASR

2008/06/25	ASR, MCZ
2008/06/26	AQP, ASR
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2008/08/11	ASR, SHP
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2008/08/15	ASR, SHP
2008/08/18	ASR, SHP

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2008/10/07	APN, ASR
2008/10/08	APN, ASR
2008/10/09	APN, ASR
2008/10/10	APN, ASR
2008/10/13	ASR, MSM

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2008/10/14	ASR, TRU
2008/10/15	ASR, MSM
2008/10/16	ASR, MSM
2008/10/17	ASR, MSM
2008/10/20	APN, ASR
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2009/01/28	APN, TRU
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2009/02/03	APN, TRU
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2009/02/05	APN, TRU
2009/02/06	APN, TRU
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2009/03/25	MSM, TRU
2009/03/26	MSM, TRU
2009/03/27	MSM, TRU
2009/03/30	MSM, TRU
2009/03/31	MSM, TRU

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2009/04/01	MSM, TRU
2009/04/02	TFG, TRU
2009/04/03	MSM, TRU
2009/04/06	MSM, TRU
2009/04/07	MSM, TRU
2009/04/08	TFG, TRU
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2009/05/25	NTC, TRU
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2009/05/28	NTC, TRU
2009/05/29	NTC, TRU
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2009/06/02	MSM, TRU
2009/06/03	MSM, TRU
2009/06/04	NTC, TRU
2009/06/05	NTC, TRU
2009/06/08	NTC, TRU
2009/06/09	NTC, TRU
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2009/07/15	NTC, TRU
2009/07/16	NTC, TRU
2009/07/17	NTC, TRU
2009/07/20	IPL, TRU
2009/07/21	NTC, TRU
2009/07/22	NTC, TRU
2009/07/23	NTC, TRU
2009/07/24	NTC, TRU
2009/07/27	IPL, NTC

2009/07/28	IPL, NTC
2009/07/29	IPL, NTC
2009/07/30	IPL, NTC
2009/07/31	NTC, TRU
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2009/09/14	RDF, TRU
2009/09/15	IPL, TRU
2009/09/16	IPL, TRU
2009/09/17	IPL, TRU
2009/09/18	RDF, TRU
2009/09/21	RDF, TRU

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2009/09/22	RDF, TRU
2009/09/23	RDF, TRU
2009/09/25	RDF, TRU
2009/09/28	MSM, TRU
2009/09/29	RDF, TRU
2009/09/30	MSM, TRU
2009/10/01	MSM, TRU
2009/10/02	RDF, TRU
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2009/11/10	ASR, IPL
2009/11/11	ASR, IPL
2009/11/12	ASR, IPL
2009/11/13	ASR, IPL
2009/11/16	ASR, IPL

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2009/11/18	AQP, ASR
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2010/02/11	AQP, ASR
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2010/02/17	ASR, IPL
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2010/03/03	ASR, IPL
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2010/03/08	ASR, IPL
2010/03/09	ASR, IPL

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2010/03/10	ASR, IPL
2010/03/11	ASR, IPL
2010/03/12	ASR, IPL
2010/03/15	ASR, IPL
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2010/05/07	ASR, IPL

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2010/05/11	ASR, IPL
2010/05/12	IPL, WHL
2010/05/13	IPL, WHL
2010/05/14	IPL, WHL
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2010/05/21	IPL, WHL
2010/05/24	DDT, IPL
2010/05/25	IPL, TRU
2010/05/26	IPL, WHL
2010/05/27	IPL, WHL
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2010/08/23	DDT, WHL
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2010/08/25	DDT, WHL
2010/08/26	DDT, WHL
2010/08/27	DDT, WHL

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2011/02/10	MTM, UUU
2011/02/11	MTM, UUU

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2011/02/16	UUU, WHL
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2011/08/01	BTI, TFG
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2011/11/16	BTI, RNI
2011/11/17	BTI, RNI
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2012/01/25	MRP, TFG
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2013/02/20	LHC, NTC
2013/02/21	LHC, NTC
2013/02/22	LHC, NTC

2013/02/25	LHC, NTC
2013/02/26	LHC, NTC
2013/02/27	LHC, TSG
2013/02/28	LHC, NTC
2013/03/01	LHC, NTC
2013/03/04	LHC, NTC
2013/03/05	LHC, NTC
2013/03/06	LHC, NTC
2013/03/07	LHC, NTC
2013/03/08	LHC, NTC
2013/03/11	LHC, NTC
2013/03/12	NTC, TSG
2013/03/13	LHC, TSG
2013/03/14	NTC, TSG
2013/03/15	LHC, TSG
2013/03/18	NTC, TSG
2013/03/19	NTC, TSG
2013/03/20	NTC, TSG
2013/03/22	LHC, TSG
2013/03/25	LHC, NTC
2013/03/26	LHC, NTC
2013/03/27	NTC, TSG
2013/03/28	LHC, TSG
2013/04/02	LHC, TSG
2013/04/03	NTC, TSG
2013/04/04	LHC, NTC
2013/04/05	LHC, TSG
2013/04/08	LHC, TSG
2013/04/09	LHC, TSG
2013/04/10	LHC, TSG
2013/04/11	LHC, TSG
2013/04/12	LHC, TSG
2013/04/15	LHC, TSG
2013/04/16	LHC, TSG
2013/04/17	LHC, NTC
2013/04/18	LHC, NTC
2013/04/19	LHC, NTC
2013/04/22	DGH, NTC
2013/04/23	DGH, NTC

2013/04/24	DGH, TSG
2013/04/25	DGH, NTC
2013/04/26	DGH, NTC
2013/04/29	DGH, NTC
2013/04/30	DGH, NTC
2013/05/02	DGH, NTC
2013/05/03	DGH, NTC
2013/05/06	DGH, NTC
2013/05/07	DGH, NTC
2013/05/08	DGH, NTC
2013/05/09	DGH, NTC
2013/05/10	MTM, NTC
2013/05/13	MTM, NTC
2013/05/14	MTM, NTC
2013/05/15	MTM, NTC
2013/05/16	MTM, NTC
2013/05/17	MTM, NTC
2013/05/20	MTM, NTC
2013/05/21	MTM, NTC
2013/05/22	MTM, NTC
2013/05/23	MTM, NTC
2013/05/24	MTM, NTC
2013/05/27	MTM, NTC
2013/05/28	MTM, NTC
2013/05/29	MTM, NTC
2013/05/30	DGH, NTC
2013/05/31	DGH, NTC
2013/06/03	NTC, RNI
2013/06/04	NTC, RNI
2013/06/05	NTC, TSG
2013/06/06	NTC, TSG
2013/06/07	NTC, RNI
2013/06/10	NTC, TSG
2013/06/11	NTC, RNI
2013/06/12	NTC, TSG
2013/06/13	NTC, RNI
2013/06/14	NTC, UUU
2013/06/18	NTC, RNI
2013/06/19	NTC, TSG

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2013/06/20	NTC, TSG
2013/06/21	NTC, TSG
2013/06/24	NTC, TSG
2013/06/25	NTC, TSG
2013/06/26	NTC, UUU
2013/06/27	DGH, NTC
2013/06/28	DGH, NTC
2013/07/01	DGH, NTC
2013/07/02	DGH, NTC
2013/07/03	DGH, NTC
2013/07/04	DGH, NTC
2013/07/05	DGH, NTC
2013/07/08	DGH, NTC
2013/07/09	DGH, NTC
2013/07/10	DGH, NTC
2013/07/11	NTC, TSG
2013/07/12	DGH, NTC
2013/07/15	DGH, NTC
2013/07/16	DGH, NTC
2013/07/17	DGH, NTC
2013/07/18	NTC, TSG
2013/07/19	NTC, UUU
2013/07/22	NTC, TSG
2013/07/23	NTC, UUU
2013/07/24	DGH, NTC
2013/07/25	NTC, TSG
2013/07/26	NTC, TSG
2013/07/29	NTC, TSG
2013/07/30	NTC, TSG
2013/07/31	NTC, UUU
2013/08/01	DGH, NTC
2013/08/02	DGH, NTC
2013/08/05	DGH, NTC
2013/08/06	NTC, TSG
2013/08/07	NTC, TSG
2013/08/08	NTC, TSG
2013/08/12	NTC, TSG
2013/08/13	NTC, TSG
2013/08/14	NTC, TSG

2013/08/15	NTC, TSG
2013/08/16	DGH, NTC
2013/08/19	NTC, TSG
2013/08/20	DGH, NTC
2013/08/21	NTC, TSG
2013/08/22	NTC, UUU
2013/08/23	NTC, TSG
2013/08/26	NTC, TSG
2013/08/27	NTC, TSG
2013/08/28	NTC, TSG
2013/08/29	NTC, TSG
2013/08/30	NTC, TSG
2013/09/02	DGH, NTC
2013/09/03	NTC, UUU
2013/09/04	DGH, NTC
2013/09/05	DGH, NTC
2013/09/06	DGH, NTC
2013/09/09	DGH, TSG
2013/09/10	NTC, RNI
2013/09/11	NTC, RNI
2013/09/12	DGH, RNI
2013/09/13	DGH, RNI
2013/09/16	DGH, TSG
2013/09/17	DGH, TSG
2013/09/18	DGH, TSG
2013/09/19	DGH, TSG
2013/09/20	DGH, NTC
2013/09/23	DGH, TSG
2013/09/25	DGH, TSG
2013/09/26	DGH, NTC
2013/09/27	DGH, NTC
2013/09/30	DGH, NTC
2013/10/01	DGH, NTC
2013/10/02	DGH, NTC
2013/10/03	DGH, NTC
2013/10/04	DGH, NTC
2013/10/07	DGH, NTC
2013/10/08	DGH, NTC
2013/10/09	DGH, TSG

2013/10/10	DGH, TSG
2013/10/11	DGH, TSG
2013/10/14	DGH, TSG
2013/10/15	DGH, TSG
2013/10/16	DGH, TSG
2013/10/17	DGH, TSG
2013/10/18	DGH, TSG
2013/10/21	DGH, NTC
2013/10/22	NTC, TSG
2013/10/23	DGH, NTC
2013/10/24	DGH, NTC
2013/10/25	DGH, NTC
2013/10/28	DGH, NTC
2013/10/29	DGH, NTC
2013/10/30	DGH, NTC
2013/10/31	DGH, NTC
2013/11/01	DGH, NTC
2013/11/04	DGH, NTC
2013/11/05	DGH, NTC
2013/11/06	DGH, NTC
2013/11/07	DGH, NTC
2013/11/08	DGH, NTC
2013/11/11	DGH, NTC
2013/11/12	DGH, NTC
2013/11/13	DGH, NTC
2013/11/14	DGH, NTC
2013/11/15	DGH, NTC
2013/11/18	DGH, NTC
2013/11/19	DGH, NTC
2013/11/20	DGH, NTC
2013/11/21	DGH, NTC
2013/11/22	DGH, NTC
2013/11/25	DGH, NTC
2013/11/26	DGH, NTC
2013/11/27	LHC, NTC
2013/11/28	DGH, NTC
2013/11/29	DGH, NTC
2013/12/02	DGH, NTC
2013/12/03	DGH, NTC

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2013/12/04	DGH, NTC
2013/12/05	DGH, NTC
2013/12/06	DGH, NTC
2013/12/09	DGH, NTC
2013/12/10	DGH, NTC
2013/12/11	DGH, NTC
2013/12/12	DGH, NTC
2013/12/13	DGH, NTC
2013/12/17	DGH, NTC
2013/12/18	DGH, NTC
2013/12/19	DGH, NTC
2013/12/20	DGH, NTC
2013/12/23	DGH, NTC
2013/12/24	DGH, NTC
2013/12/27	DGH, NTC
2013/12/30	DGH, NTC
2013/12/31	DGH, NTC
2014/01/02	DGH, NTC
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2014/01/06	DGH, NTC
2014/01/07	DGH, NTC
2014/01/08	DGH, NTC
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2014/01/10	DGH, NTC
2014/01/13	DGH, NTC
2014/01/14	DGH, NTC
2014/01/15	DGH, NTC
2014/01/16	DGH, NTC
2014/01/17	DGH, NTC
2014/01/20	DGH, MRP
2014/01/21	DGH, MRP
2014/01/22	DGH, MRP
2014/01/23	DGH, MRP
2014/01/24	DGH, MRP
2014/01/27	DGH, MRP
2014/01/28	DGH, RNI
2014/01/29	DGH, NTC
2014/01/30	DGH, NTC
2014/01/31	DGH, RNI

2014/02/03	DGH, RNI
2014/02/04	DGH, RNI
2014/02/05	DGH, RNI
2014/02/06	DGH, RNI
2014/02/07	DGH, RNI
2014/02/10	DGH, RNI
2014/02/11	DGH, RNI
2014/02/12	DGH, RNI
2014/02/13	DGH, RNI
2014/02/14	DGH, RNI
2014/02/17	DGH, RNI
2014/02/18	DGH, RNI
2014/02/19	DGH, RNI
2014/02/20	DGH, RNI
2014/02/21	DGH, RNI
2014/02/24	DGH, RNI
2014/02/25	DGH, RNI
2014/02/26	DGH, RNI
2014/02/27	DGH, RNI
2014/02/28	DGH, RNI
2014/03/03	MRP, RNI
2014/03/04	MRP, RNI
2014/03/05	MRP, RNI
2014/03/06	DGH, MRP
2014/03/07	DGH, MRP
2014/03/10	DGH, MRP
2014/03/11	DGH, MRP
2014/03/12	DGH, MRP
2014/03/13	DGH, MRP
2014/03/14	DGH, MRP
2014/03/17	DGH, MRP
2014/03/18	DGH, MRP
2014/03/19	DGH, MRP
2014/03/20	DGH, MRP
2014/03/24	DGH, MRP
2014/03/25	DGH, MRP
2014/03/26	MRP, NTC
2014/03/27	DGH, MRP
2014/03/28	DGH, MRP

2014/03/31	DGH, MRP
2014/04/01	MRP, NTC
2014/04/02	MRP, NTC
2014/04/03	MRP, NTC
2014/04/04	MRP, NTC
2014/04/07	MRP, NTC
2014/04/08	MRP, NTC
2014/04/09	MRP, NTC
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2014/04/30	MRP, NTC
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2014/05/05	MRP, NTC
2014/05/06	MRP, NTC
2014/05/08	CML, NTC
2014/05/09	CML, NTC
2014/05/12	MRP, NTC
2014/05/13	MRP, NTC
2014/05/14	MRP, NTC
2014/05/15	MRP, NTC
2014/05/16	MRP, NTC
2014/05/19	MRP, NTC
2014/05/20	MRP, NTC
2014/05/21	MRP, NTC
2014/05/22	MRP, NTC
2014/05/23	MRP, NTC
2014/05/26	MRP, NTC
2014/05/27	MRP, NTC
2014/05/28	MRP, NTC
2014/05/29	MRP, NTC

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2014/05/30	MRP, NTC
2014/06/02	MRP, NTC
2014/06/03	MRP, NTC
2014/06/04	MRP, NTC
2014/06/05	MRP, NTC
2014/06/06	MRP, NTC
2014/06/09	MRP, NTC
2014/06/10	MRP, NTC
2014/06/11	MRP, NTC
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2014/07/18	MRP, NTC
2014/07/21	MRP, NTC
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2014/07/23	MRP, NTC
2014/07/24	MRP, NTC

2014/07/25	MRP, NTC
2014/07/28	MRP, NTC
2014/07/29	MRP, NTC
2014/07/30	MRP, NTC
2014/07/31	MRP, NTC
2014/08/01	MRP, NTC
2014/08/04	MRP, NTC
2014/08/05	MRP, NTC
2014/08/06	MRP, NTC
2014/08/07	MRP, NTC
2014/08/08	MRP, NTC
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2014/08/21	MRP, NTC
2014/08/22	MRP, NTC
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2014/08/26	MRP, NTC
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2014/08/29	MRP, NTC
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2014/09/04	MTM, NTC
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2014/09/08	MTM, NTC
2014/09/09	MTM, NTC
2014/09/10	MTM, NTC
2014/09/11	MTM, NTC
2014/09/12	MTM, NTC
2014/09/15	MTM, NTC
2014/09/16	GLN, NTC
2014/09/17	GLN, NTC

2014/09/18	GLN, NTC
2014/09/19	GLN, NTC
2014/09/22	GLN, NTC
2014/09/23	GLN, NTC
2014/09/25	GLN, NTC
2014/09/26	GLN, NTC
2014/09/29	GLN, NTC
2014/09/30	GLN, NTC
2014/10/01	GLN, NTC
2014/10/02	GLN, NTC
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2014/10/08	GLN, NTC
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2014/10/10	MTM, NTC
2014/10/13	MTM, NTC
2014/10/14	MTM, NTC
2014/10/15	GLN, NTC
2014/10/16	GLN, NTC
2014/10/17	GLN, NTC
2014/10/20	GLN, NTC
2014/10/21	GLN, NTC
2014/10/22	GLN, NTC
2014/10/23	GLN, NTC
2014/10/24	GLN, NTC
2014/10/27	MTM, NTC
2014/10/28	MTM, NTC
2014/10/29	MTM, NTC
2014/10/30	MTM, NTC
2014/10/31	MTM, NTC
2014/11/03	MTM, NTC
2014/11/04	MTM, NTC
2014/11/05	MTM, NTC
2014/11/06	MTM, NTC
2014/11/07	MTM, NTC
2014/11/10	MTM, NTC
2014/11/11	MTM, NTC
2014/11/12	MTM, NTC

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2014/11/13	MTM, NTC
2014/11/14	MTM, NTC
2014/11/17	NTC, RMI
2014/11/18	MTM, NTC
2014/11/19	MTM, NTC
2014/11/20	MTM, NTC
2014/11/21	MTM, NTC
2014/11/24	MTM, NTC
2014/11/25	NTC, RMI
2014/11/26	MTM, NTC
2014/11/27	MTM, NTC
2014/11/28	NTC, RMI
2014/12/01	NTC, RMI
2014/12/02	MTM, NTC
2014/12/03	MTM, NTC
2014/12/04	CML, GFI
2014/12/05	CML, GFI
2014/12/08	CML, GFI
2014/12/09	CML, GFI
2014/12/10	CML, GFI
2014/12/11	CML, GFI
2014/12/12	CML, GFI
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2014/12/17	CML, GFI
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2014/12/29	CML, GFI
2014/12/30	CML, GFI
2014/12/31	CML, GFI
2015/01/02	CML, GFI
2015/01/05	CML, GFI
2015/01/06	CML, GFI
2015/01/07	CML, GFI
2015/01/08	CML, GFI
2015/01/09	CML, GFI
2015/01/12	CML, GFI

2015/01/13	CML, GFI
2015/01/14	GFI, SPP
2015/01/15	GFI, SPP
2015/01/16	GFI, SPP
2015/01/19	GFI, SPP
2015/01/20	GFI, SPP
2015/01/21	GFI, SPP
2015/01/22	GFI, SPP
2015/01/23	GFI, SPP
2015/01/26	GFI, SPP
2015/01/27	GFI, SPP
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2015/02/10	GFI, SPP
2015/02/11	GFI, SPP
2015/02/12	GFI, SPP
2015/02/13	GFI, SPP
2015/02/16	GFI, TFG
2015/02/17	MTM, TFG
2015/02/18	MTM, SPP
2015/02/19	MTM, TFG
2015/02/20	MTM, SPP
2015/02/23	MTM, SPP
2015/02/24	MTM, SPP
2015/02/25	MTM, SPP
2015/02/26	MTM, SPP
2015/02/27	MTM, SPP
2015/03/02	MTM, SPP
2015/03/03	MTM, SPP
2015/03/04	MTM, TFG
2015/03/05	MTM, SPP
2015/03/06	MTM, SPP

2015/03/09	MTM, TFG
2015/03/10	MTM, SPP
2015/03/11	MTM, SPP
2015/03/12	MTM, SPP
2015/03/13	MTM, TFG
2015/03/16	MTM, TFG
2015/03/17	MTM, TFG
2015/03/18	MTM, TFG
2015/03/19	MTM, TFG
2015/03/20	MTM, TFG
2015/03/23	MTM, SPP
2015/03/24	RDF, TFG
2015/03/25	MTM, TFG
2015/03/26	MTM, TFG
2015/03/27	RDF, SPP
2015/03/30	MTM, SPP
2015/03/31	MTM, SPP
2015/04/01	MTM, SPP
2015/04/02	SPP, TFG
2015/04/07	SPP, TFG
2015/04/08	SPP, TFG
2015/04/09	SPP, TFG
2015/04/10	SPP, TFG
2015/04/13	SPP, TFG
2015/04/14	SPP, TFG
2015/04/15	SPP, TFG
2015/04/16	SPP, TFG
2015/04/17	SPP, TFG
2015/04/20	SPP, TFG
2015/04/21	SPP, TFG
2015/04/22	SPP, TFG
2015/04/23	SPP, TFG
2015/04/24	SPP, TFG
2015/04/28	SPP, TFG
2015/04/29	SPP, TFG
2015/04/30	SPP, TFG
2015/05/04	SPP, TFG
2015/05/05	SPP, TFG
2015/05/06	SPP, TFG

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2015/05/07	SPP, TFG
2015/05/08	SPP, TFG
2015/05/11	SPP, TFG
2015/05/12	SPP, TFG
2015/05/13	SPP, TFG
2015/05/14	SPP, TFG
2015/05/15	SPP, TFG
2015/05/18	SPP, TFG
2015/05/19	ORL, SPP
2015/05/20	BAT, ORL
2015/05/21	BAT, ORL
2015/05/22	BAT, ORL
2015/05/25	BAT, ORL
2015/05/26	BAT, ORL
2015/05/27	BAT, ORL
2015/05/28	BAT, ORL
2015/05/29	BAT, ORL
2015/06/01	BAT, ORL
2015/06/02	BAT, ORL
2015/06/03	BAT, ORL
2015/06/04	ORL
2015/06/05	ORL, SPP
2015/06/08	ORL, SPP
2015/06/09	ORL, SPP
2015/06/10	ORL, S32
2015/06/11	ORL, S32
2015/06/12	ORL, SPP
2015/06/15	ORL, SPP
2015/06/17	ORL, SPP
2015/06/18	ORL, SPP
2015/06/19	ORL, SPP
2015/06/22	ORL, SPP
2015/06/23	ORL, TRU
2015/06/24	ORL, SPP
2015/06/25	ORL, SPP
2015/06/26	ORL, SPP
2015/06/29	ORL, SPP
2015/06/30	ORL, SPP
2015/07/01	ORL, SPP

2015/07/02	ORL, SPP
2015/07/03	ORL, SPP
2015/07/06	ORL, SPP
2015/07/07	ORL, SPP
2015/07/08	ORL, SPP
2015/07/09	ORL, SPP
2015/07/10	ORL, SPP
2015/07/13	ORL, SPP
2015/07/14	ORL, SPP
2015/07/15	ORL, SPP
2015/07/16	ORL, SPP
2015/07/17	ORL, SPP
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2015/07/21	ORL, SPP
2015/07/22	ORL, SPP
2015/07/23	HYP, SPP
2015/07/24	HYP, SPP
2015/07/27	HYP, SPP
2015/07/28	HYP, SPP
2015/07/29	HYP, SPP
2015/07/30	HYP, SPP
2015/07/31	HYP, SPP
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2015/08/04	HYP, SPP
2015/08/05	HYP, SPP
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2015/08/11	HYP, SPP
2015/08/12	HYP, SPP
2015/08/13	HYP, SPP
2015/08/14	HYP, SPP
2015/08/17	HYP, SPP
2015/08/18	HYP, SPP
2015/08/19	HYP, SPP
2015/08/20	HYP, SPP
2015/08/21	SPP, TRU
2015/08/24	SPP, TRU
2015/08/25	SPP, TRU
2015/08/26	SPP, TRU

2015/08/27	SPP, TRU
2015/08/28	SPP, TRU
2015/08/31	SPP, TRU
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2015/09/02	RDF, SPP
2015/09/03	HYP, SPP
2015/09/04	SPP, TRU
2015/09/07	SPP, TRU
2015/09/08	SPP, TRU
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2015/09/11	SPP, TRU
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2015/10/09	SPP, TRU
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2015/10/13	SPP, TRU
2015/10/14	SPP, TRU
2015/10/15	SPP, TRU
2015/10/16	HYP, SPP
2015/10/19	SPP, TRU
2015/10/20	HYP, SPP
2015/10/21	SPP, TRU

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2015/10/22	HYP, SPP
2015/10/23	HYP, SPP
2015/10/26	HYP, SPP
2015/10/27	HYP, SPP
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2015/10/30	HYP, SPP
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2015/11/03	HYP, SPP
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2015/11/10	SPP, TRU
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2016/09/28	S32, SAP

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2017/03/15	CPI, TFG
2017/03/16	CPI, TFG

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2017/09/05	CLS, TFG
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2017/09/07	AVI, CLS
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2017/09/11	CLS, TRU
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2018/02/19	EXX, IPL
2018/02/20	EXX, IPL
2018/02/21	EXX, IPL
2018/02/22	CLS, IPL

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2018/02/23	CLS, IPL
2018/02/26	CLS, IPL
2018/02/27	EXX, IPL
2018/02/28	CLS, EXX
2018/03/01	IPL, TFG
2018/03/02	BAW, CLS
2018/03/05	BAW, CLS
2018/03/06	BAW, CLS
2018/03/07	BAW, CLS
2018/03/08	BAW, CLS
2018/03/09	BAW, CLS
2018/03/12	BAW, CLS
2018/03/13	BAW, CLS
2018/03/14	BAW, CLS
2018/03/15	BAW, CLS
2018/03/16	BAW, CLS
2018/03/19	BAW, CLS
2018/03/20	BAW, CLS
2018/03/22	BAW, CLS
2018/03/23	BAW, CLS
2018/03/26	BAW, CLS
2018/03/27	BAW, CLS
2018/03/28	BAW, CLS
2018/03/29	BAW, CLS
2018/04/03	BAW, CLS
2018/04/04	BAW, CLS
2018/04/05	BAW, CLS
2018/04/06	BAW, CLS
2018/04/09	BAW, CLS
2018/04/10	BAW, CLS
2018/04/11	BAW, CLS
2018/04/12	BAW, CLS
2018/04/13	BAW, CLS
2018/04/16	BAW, CLS
2018/04/17	BAW, CLS
2018/04/18	BAW, CLS
2018/04/19	BAW, CLS
2018/04/20	BAW, CLS
2018/04/23	BAW, CLS

2018/04/24	BAW, CLS
2018/04/25	BAW, CLS
2018/04/26	BAW, CLS
2018/04/30	BAW, CLS
2018/05/02	BAW, CLS
2018/05/03	BAW, CLS
2018/05/04	BAW, CLS
2018/05/07	BAW, CLS
2018/05/08	BAW, CLS
2018/05/09	BAW, CLS
2018/05/10	BAW, CLS
2018/05/11	BAW, CLS
2018/05/14	BAW, CLS
2018/05/15	BAW, CLS
2018/05/16	BAW, CLS
2018/05/17	BAW, CLS
2018/05/18	BAW, CLS
2018/05/21	BAW, CLS
2018/05/22	BAW, CLS
2018/05/23	BAW, CLS
2018/05/24	BAW, CLS
2018/05/25	CLS, EXX
2018/05/28	CLS, EXX
2018/05/29	CLS, EXX
2018/05/30	CLS, EXX
2018/05/31	CLS, EXX
2018/06/01	IPL, VVO
2018/06/04	EXX, IPL
2018/06/05	IPL, VVO
2018/06/06	IPL, VVO
2018/06/07	EXX, IPL
2018/06/08	EXX, IPL
2018/06/11	EXX, IPL
2018/06/12	EXX, IPL
2018/06/13	EXX, IPL
2018/06/14	EXX, IPL
2018/06/15	EXX, IPL
2018/06/18	EXX, IPL
2018/06/19	EXX, IPL

2018/06/20	EXX, IPL
2018/06/21	EXX, IPL
2018/06/22	AVI, IPL
2018/06/25	AVI, IPL
2018/06/26	AVI, IPL
2018/06/27	AVI, IPL
2018/06/28	AVI
2018/06/29	AVI, DGH
2018/07/02	AVI, EXX
2018/07/03	EXX, IPL
2018/07/04	EXX, IPL
2018/07/05	EXX, IPL
2018/07/06	EXX, IPL
2018/07/09	EXX, IPL
2018/07/10	EXX, IPL
2018/07/11	EXX, IPL
2018/07/12	EXX, IPL
2018/07/13	EXX, IPL
2018/07/16	EXX, IPL
2018/07/17	EXX, IPL
2018/07/18	EXX, IPL
2018/07/19	EXX, IPL
2018/07/20	EXX, IPL
2018/07/23	EXX, IPL
2018/07/24	EXX, IPL
2018/07/25	EXX, IPL
2018/07/26	EXX, IPL
2018/07/27	EXX, IPL
2018/07/30	EXX, IPL
2018/07/31	EXX, IPL
2018/08/01	EXX, IPL
2018/08/02	EXX, IPL
2018/08/03	EXX, IPL
2018/08/06	EXX, IPL
2018/08/07	EXX, IPL
2018/08/08	EXX, IPL
2018/08/10	AVI, EXX
2018/08/13	AVI, EXX
2018/08/14	AVI, EXX

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2018/08/15	AVI, EXX
2018/08/16	AVI, EXX
2018/08/17	AVI, EXX
2018/08/20	AVI, EXX
2018/08/21	AVI, EXX
2018/08/22	AVI, EXX
2018/08/23	AVI, EXX
2018/08/24	AVI, EXX
2018/08/27	AVI, EXX
2018/08/28	AVI, EXX
2018/08/29	AVI, EXX
2018/08/30	AVI, EXX
2018/08/31	AVI, EXX
2018/09/03	AVI, EXX
2018/09/04	AVI, EXX
2018/09/05	AVI, EXX
2018/09/06	AVI, EXX
2018/09/07	EXX, VVO
2018/09/10	EXX, VVO
2018/09/11	AVI, EXX
2018/09/12	AVI, EXX
2018/09/13	AVI, EXX
2018/09/14	AVI, EXX
2018/09/17	AVI, EXX
2018/09/18	AVI, EXX
2018/09/19	AVI, EXX
2018/09/20	AVI, EXX
2018/09/21	AVI, EXX
2018/09/25	AVI, EXX
2018/09/26	AVI, EXX
2018/09/27	AVI, EXX
2018/09/28	AVI, EXX
2018/10/01	AVI, EXX
2018/10/02	AVI, EXX
2018/10/03	AMS, EXX
2018/10/04	AVI, EXX
2018/10/05	AMS, EXX
2018/10/08	AMS, AVI
2018/10/09	AVI, EXX

2018/10/10	AVI, EXX
2018/10/11	AMS, EXX
2018/10/12	AMS, EXX
2018/10/15	AMS, EXX
2018/10/16	AMS, EXX
2018/10/17	AMS, EXX
2018/10/18	AMS, AVI
2018/10/19	AMS, EXX
2018/10/22	AMS, AVI
2018/10/23	AMS, AVI
2018/10/24	AMS, AVI
2018/10/25	AMS, AVI
2018/10/26	AMS, AVI
2018/10/29	AMS, EXX
2018/10/30	AMS, EXX
2018/10/31	AMS, EXX
2018/11/01	AMS, EXX
2018/11/02	AMS, EXX
2018/11/05	AMS, EXX
2018/11/06	AMS, AVI
2018/11/07	AMS, AVI
2018/11/08	AMS, AVI
2018/11/09	AMS, AVI
2018/11/12	AMS, AVI
2018/11/13	AMS, AVI
2018/11/14	AMS, AVI
2018/11/15	AMS, AVI
2018/11/16	AMS, EXX
2018/11/19	AMS, EXX
2018/11/20	AMS, EXX
2018/11/21	AMS, EXX
2018/11/22	AMS, AVI
2018/11/23	AMS, AVI
2018/11/26	AMS, AVI
2018/11/27	AMS, AVI
2018/11/28	AMS, AVI
2018/11/29	AMS, AVI
2018/11/30	AMS, PIK
2018/12/03	AMS, PIK

2018/12/04	AMS, PIK
2018/12/05	AMS, PIK
2018/12/06	AMS, PIK
2018/12/07	AMS, PIK
2018/12/10	AMS, AVI
2018/12/11	AMS, IMP
2018/12/12	AMS, AVI
2018/12/13	AMS, IMP
2018/12/14	AMS, IMP
2018/12/18	AMS, GFI
2018/12/19	AMS, IMP
2018/12/20	AMS, IMP
2018/12/21	AMS, GFI
2018/12/24	AMS, AVI
2018/12/27	AMS, GFI
2018/12/28	AMS, AVI
2018/12/31	AMS, AVI
2019/01/02	AMS, AVI
2019/01/03	AMS, GFI
2019/01/04	AMS, AVI
2019/01/07	AMS, GFI
2019/01/08	AMS, VVO
2019/01/09	AMS, AVI
2019/01/10	AMS, GFI
2019/01/11	AMS, GFI
2019/01/14	AMS, AVI
2019/01/15	AMS, AVI
2019/01/16	AMS, AVI
2019/01/17	AMS, AVI
2019/01/18	AMS, AVI
2019/01/21	AMS, AVI
2019/01/22	AMS, AVI
2019/01/23	AMS, GFI
2019/01/24	AMS, GFI
2019/01/25	AMS, EXX
2019/01/28	AMS, EXX
2019/01/29	AMS, EXX
2019/01/30	AMS, GFI
2019/01/31	AMS, GFI

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2019/02/01	AMS, EXX
2019/02/04	AMS, EXX
2019/02/05	AMS, IMP
2019/02/06	AMS, IMP
2019/02/07	AMS, IMP
2019/02/08	AMS, IMP
2019/02/11	AMS, IMP
2019/02/12	AMS, IMP
2019/02/13	AMS, IMP
2019/02/14	AMS, IMP
2019/02/15	AMS, IMP
2019/02/18	AMS, IMP
2019/02/19	AMS, IMP
2019/02/20	AMS, IMP
2019/02/21	AMS, IMP
2019/02/22	AMS, IMP
2019/02/25	AMS, IMP
2019/02/26	AMS, IMP
2019/02/27	AMS, IMP
2019/02/28	AMS, IMP
2019/03/01	EXX, IMP
2019/03/04	EXX, IMP
2019/03/05	EXX, IMP
2019/03/06	EXX, IMP
2019/03/07	EXX, IMP
2019/03/08	EXX, IMP
2019/03/11	EXX, IMP
2019/03/12	EXX, IMP
2019/03/13	EXX, IMP
2019/03/14	EXX, IMP
2019/03/15	EXX, IMP
2019/03/18	EXX, IMP
2019/03/19	EXX, IMP
2019/03/20	EXX, IMP
2019/03/22	EXX, IMP
2019/03/25	IMP, SGL
2019/03/26	IMP, SGL
2019/03/27	EXX, IMP
2019/03/28	EXX, IMP

2019/03/29	EXX, IMP
2019/04/01	EXX, IMP
2019/04/02	EXX, IMP
2019/04/03	EXX, IMP
2019/04/04	EXX, IMP
2019/04/05	EXX, IMP
2019/04/08	EXX, IMP
2019/04/09	EXX, IMP
2019/04/10	EXX, IMP
2019/04/11	EXX, IMP
2019/04/12	EXX, IMP
2019/04/15	EXX, IMP
2019/04/16	EXX, IMP
2019/04/17	EXX, IMP
2019/04/18	EXX, IMP
2019/04/23	EXX, IMP
2019/04/24	EXX, IMP
2019/04/25	EXX, IMP
2019/04/26	EXX, IMP
2019/04/29	EXX, IMP
2019/04/30	EXX, IMP
2019/05/02	EXX, IMP
2019/05/03	EXX, IMP
2019/05/06	EXX, IMP
2019/05/07	EXX, IMP
2019/05/09	EXX, IMP
2019/05/10	EXX, IMP
2019/05/13	EXX, IMP
2019/05/14	EXX, IMP
2019/05/15	EXX, IMP
2019/05/16	EXX, IMP
2019/05/17	EXX, IMP
2019/05/20	EXX, IMP
2019/05/21	EXX, IMP
2019/05/22	EXX, IMP
2019/05/23	EXX, IMP
2019/05/24	EXX, IMP
2019/05/27	EXX, IMP
2019/05/28	EXX, IMP

2019/05/29	EXX, IMP
2019/05/30	EXX, IMP
2019/05/31	EXX, IMP
2019/06/03	EXX, IMP
2019/06/04	EXX, IMP
2019/06/05	EXX, IMP
2019/06/06	EXX, IMP
2019/06/07	ANH, IMP
2019/06/10	IMP, RNI
2019/06/11	IMP, SGL
2019/06/12	IMP, RNI
2019/06/13	IMP, SGL
2019/06/14	IMP, SGL
2019/06/18	IMP, SGL
2019/06/19	IMP, SGL
2019/06/20	IMP, VVO
2019/06/21	IMP, SGL
2019/06/24	IMP, SGL
2019/06/25	IMP, SGL
2019/06/26	IMP, SGL
2019/06/27	IMP, SGL
2019/06/28	IMP, SGL
2019/07/01	IMP, SGL
2019/07/02	IMP, SGL
2019/07/03	IMP, SGL
2019/07/04	IMP, SGL
2019/07/05	IMP, SGL
2019/07/08	IMP, SGL
2019/07/09	IMP, SGL
2019/07/10	IMP, SGL
2019/07/11	IMP, SGL
2019/07/12	IMP, SGL
2019/07/15	IMP, SGL
2019/07/16	IMP, SGL
2019/07/17	IMP, SGL
2019/07/18	IMP, SGL
2019/07/19	IMP, SGL
2019/07/22	IMP, SGL
2019/07/23	IMP, SGL

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2019/07/24	IMP, SGL
2019/07/25	IMP, SGL
2019/07/26	IMP, SGL
2019/07/29	IMP, SGL
2019/07/30	IMP, SGL
2019/07/31	IMP, SGL
2019/08/01	IMP, SGL
2019/08/02	IMP, SGL
2019/08/05	IMP, SGL
2019/08/06	IMP, SGL
2019/08/07	IMP, SGL
2019/08/08	IMP, SGL
2019/08/12	IMP, SGL
2019/08/13	IMP, SGL
2019/08/14	IMP, SGL
2019/08/15	IMP, SGL
2019/08/16	IMP, SGL
2019/08/19	IMP, SGL
2019/08/20	IMP, SGL
2019/08/21	IMP, SGL
2019/08/22	IMP, SGL
2019/08/23	IMP, SGL
2019/08/26	IMP, SGL
2019/08/27	IMP, SGL
2019/08/28	IMP, SGL
2019/08/29	IMP, SGL
2019/08/30	IMP, SGL
2019/09/02	IMP, SGL
2019/09/03	IMP, SGL
2019/09/04	IMP, SGL
2019/09/05	IMP, SGL

Appendix 4 - Style 2 Permutation Results

Shares To Keep By Size 10

		Momentum Months					
		3	6	9	12	15	18
% To Keep By Momentum	10%	0.06	0.25	1.72	2.07	4.70	3.05
	20%	0.90	2.70	3.81	12.79	8.70	9.27
	30%	3.57	2.76	4.85	8.44	8.13	9.44
	40%	3.68	5.02	4.38	8.32	6.12	4.66
	50%	4.44	5.90	5.17	5.53	5.50	5.33

Shares To Keep By Size 9

		Momentum Months					
		3	6	9	12	15	18
% To Keep By Momentum	10%	0.10	0.17	1.94	2.24	2.58	3.41
	20%	1.14	2.17	3.61	11.11	8.87	9.82
	30%	3.72	2.84	3.59	5.95	4.71	4.07
	40%	3.61	4.36	3.81	6.77	5.07	3.09
	50%	3.88	4.76	5.16	5.96	5.34	5.21

Shares To Keep By Size 8

		Momentum Months					
		3	6	9	12	15	18
% To Keep By Momentum	10%	0.17	0.52	2.96	4.25	4.89	2.91
	20%	1.49	2.73	4.49	18.17	7.55	8.00
	30%	3.22	4.56	3.81	6.18	4.06	2.63
	40%	3.01	3.90	4.19	5.69	3.95	3.17
	50%	3.01	3.90	4.19	5.69	3.95	3.17

Shares To Keep By Size 7

		Momentum Months					
		3	6	9	12	15	18
% To Keep By Momentum	10%	0.22	0.87	5.82	6.61	6.24	4.20
	20%	1.58	3.37	4.24	21.11	5.87	5.87
	30%	3.26	4.72	3.54	6.63	3.42	3.31
	40%	3.26	4.72	3.54	6.63	3.42	3.31
	50%	4.18	3.68	4.58	4.64	4.22	3.43

Shares To Keep By Size 6

		Momentum Months					
		3	6	9	12	15	18
% To Keep By Momentum	10%	0.36	4.14	13.45	8.99	6.55	6.70
	20%	4.32	5.02	4.69	11.62	3.33	5.92
	30%	4.32	5.02	4.69	11.62	3.33	5.92
	40%	7.64	8.17	7.42	8.13	3.88	4.14
	50%	7.64	8.17	7.42	8.13	3.88	4.14

Shares To Keep By Size 5

		Momentum Months					
		3	6	9	12	15	18
% To Keep By Momentum	10%	0.34	1.45	5.23	3.04	8.92	4.95
	20%	0.34	1.45	5.23	3.04	8.92	4.95
	30%	4.41	3.46	6.76	11.60	3.54	4.61
	40%	4.41	3.46	6.76	11.60	3.54	4.61
	50%	6.56	6.85	8.57	7.45	3.91	4.55