

Investor sentiment as a market-timing tool

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Abstract

Studies in financial markets have moved away from seeking rational and numeric ways of valuing individual shares to investigating ways and means of quantifying investor behavior that in itself effects share prices.

Central to the understanding of behavioural finance approaches is the role of investor sentiment. This research attempts to apply a new method of quantifying prevailing investor sentiment on the Johannesburg Stock Exchange, the South African Volatility Index, as a market-timing tool to combine momentum and mean reversion trading strategies.

Synthetic portfolios were constructed and analysed using a time-series methodology. Momentum strategies with short holding periods of three months were found to generate the highest cumulative returns and the South African Volatility Index investigated to determine correlation with periods of poor performance of momentum portfolios in assessing its suitability as a market-timing tool.

No significant relationship was established between investor sentiment as a leading indicator or contemporaneous effect with short term momentum returns.

Keywords

Momentum, mean reversion, investor sentiment

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.

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1 Introduction to the Research Problem

1.1 Research Title

Market timing with investor sentiment

1.2 Research Problem

Financial markets have previously been assumed to be rational. This implies that the trading prices of shares fully and accurately represent all available information, which would not allow for an excess return to be earned, without accepting greater common risk factors.

Behavioral finance attempts to explain the causes for asset prices deviating from their intrinsic value or permanent component. The role of investor sentiment is central to this field as it is an unobservable and difficult to quantify variable that has been empirically proven to lead market performance.

Given that prevailing levels of sentiment affect asset prices, the challenge is now how best to harness this knowledge in portfolio formation to allow investors to earn excess returns.

1.3 Background to the Research

1.3.1 Classical finance models

Investors have always sought methods to beat market returns, but this has proven to be an exceptionally difficult task, leading to the formation of the Efficient Market Hypothesis (EMH). The EMH stated that no investor is able to earn returns in excess of those of the market, without accepting greater common risk factors (Fama, 1970) and takes three forms:

- Weak form – where information on historical prices is available

- Semi-strong form – company specific information is available
- Strong form – certain investors or groups have monopolistic access to information

It is this hypothesis that much of the academic literature seeks to disprove. Other seminal works in classical finance theory have reiterated the notion that financial markets are efficient and that asset prices have a “correct” or quantifiable fair value and that the relationship between an expected return on a share and its risk is a simple, linear relationship (Banz, 1981, p. 3). Most notable among these are the Capital Asset Pricing Model (CAPM) (partly developed by Sharpe (1964), Treynor (1961), Litner (1965), Mossin (1966) and Jensen (1968)) which values assets at their risk free rate in addition to a market risk premium and the Sharpe Ratio which quantifies the levels of risk for each asset (Sharpe, 1964).

Locally, Van Rensburg (2003a) tested style based anomalies against the CAPM on the Johannesburg Stock Exchange (JSE). He found the CAPM to be without any empirical backing and the anomalies reported to be “void of any theoretical backing” (2003a, p.10). He added was a significant improvement from following an asset pricing model void of any empirical evidence.

1.3.2 Behavioural finance models

Behavioural finance theories accept that investors do not always make decisions that are perfectly rational and several anomalies to the EMH were empirically observed in the market. It acknowledges a human component in asset pricing and that irrational supply and demand factors have an influence on asset prices. Rational investors are also able to learn from past price observations and, as a result, factor momentum and reversal patterns into share prices (Adam, Marcet & Nicolini, 2016).

Basu (1977) found that shares with lower price-earnings (P/E) ratios were found to outperform those with higher P/E ratios which was attributed to “exaggerated investor expectations” (p. 680) while De Bondt & Thaler (1985) investigated the market’s efficiency to determine whether or not share prices overreact to sudden or dramatic news events. They found that the returns from loser portfolios far exceeded those of winners in the long run, attributable to the adverse effect of an overreaction to negative news events.

Banz (1981) contributed to the growing evidence of inefficient markets by establishing the relationship between the size (market capitalization) of firms and their expected returns. It was found that, after adjusting for risk, smaller firms tended to outperform larger ones, although there is no evidence of this size effect on the JSE (Muller & Ward, 2013).

The ability of historical prices to determine future returns directly contradicts the weak form of the EMH and is the basis for the momentum and mean reversion anomalies. Momentum, the “premier anomaly” (Fama & French, 2008, p. 1653) refers to the tendency of past “winner” shares to earn excess returns in the short run, before reverting back to a historical mean over a longer period. Muller and Ward (2013) found that momentum was the most successful of the individual styles-based approaches when applied to historic data on the JSE.

The most damning evidence to contradict the EMH must surely be research that finds evidence against it in its weakest form. Poterba & Summers (1989) and Jegadeesh and Titman (1993) both found that excess returns could be earned by forming asset portfolios, based on the past behavior of share prices. Jegadeesh and Titman (1993) contributed what is perhaps the seminal work in the study of the momentum anomaly. They found that buying share that had performed well in the past, or “winner” shares (mainly a 12 month period with a one month lag) and selling (shorting) “loser” lead to excess returns, although they advocated the use of short holding periods, as returns tend to revert to their mean in longer holding periods.

Conversely, mean reversion refers to the investment philosophy of buying shares that have performed poorly in the recent past and shorting recent winners. This is in the anticipation that the portfolio’s returns will correct and revert back to a historical mean. Poterba and Summers (1989) found that this method generated excess returns, but made use of longer holding periods that momentum policies, normally using several years.

Given the plethora of empirical evidence supporting the anomalies to the efficient market hypothesis, academic literature has moved from trying to disprove the EMH to finding explanations for the observed anomalies.

A potentially important component of investor’s prevailing attitudes and perceptions is the notion of investor sentiment. Investor sentiment has been described as “a belief about future cash flows and investment risks that is not justified by the facts at hand” (Baker & Wurgler,

2007, p. 129). It has also been defined as “whether an individual, for whatever extraneous reason, feels excessively optimistic or pessimistic about a situation” (Antoniou, Doukas & Subrahmanyam, 2013, p.4).

1.3.3 Investor sentiment

Given the success behavioural or style-based approaches and the potentially lucrative implications, vast amounts of academic literature is available to explain the reasons for the relative success or failures of these approaches. Investor sentiment is now widely acknowledged to lead market performance and the focus of academic research is now in how to quantify it and how to apply the concept to a market timing or investment philosophy.

Broadly, there are two different measures of sentiment: direct and indirect measures. Direct measures are typically survey or index based, whereas indirect measures make use of a proxy perceived to represent investor sentiment. In a South African context, there are presently three measures of investor sentiment, namely the FNB/BER Consumer Confidence Index (CCI), the FNB/BER Business Confidence Index (BCI) and the South African Volatility Index (SAVI) from the JSE. While the CCI has been used in prior studies in investor sentiment (Solanki & Seetheram, 2014; Viljoen, 2016), the BCI and SAVI are yet to be examined. This research makes use of the SAVI, as it is a direct measure of investor sentiment, as opposed to the opinions of business owners or consumers. It is also the JSE’s attempt to quantify the current investment environment, rather than the greater macroeconomic implications of the CCI and BCI. It could also be argued that a relatively small percentage of South Africans are actively engaged in investing on the JSE, so the opinions of the general public and business reported in the CCI and BCI respectively may not necessarily be indicative of investor perceptions.

1.4 Problem Statement

Can changes in prevailing investor sentiment be used as a market-timing tool for switching between behavioral finance approaches?

Momentum strategies are prone to crashes, whereas mean reversion profits take longer to materialize. Ideally, an investor would make use of a momentum approach, except in portfolio formation periods immediately prior to stock market crashes, where momentum policies have been shown to suffer large losses. If investor sentiment can suggest an appropriate point to switch to a mean reversion policy, it would help to overcome these losses.

1.5 Significance of the Study

The academic significance of the study is in the novelty in using the SAVI. Studies into investor sentiment in South Africa have previously made use of direct measures of investor sentiment, but both used the CCI. Viljoen (2016) used the CCI and regressed its results against the returns generated by residual momentum portfolios, to decrease the volatility inherent in a conventional momentum strategy. Solanki & Seetheram investigated Granger causality and found that investor sentiment leads market performance in a South African context.

Academically, this research seeks to build on these previous works, by investigating investor sentiment's potential as a market-timing strategy and applying it to both momentum and mean reversion strategies, in an attempt to reduce the drawdown associated with momentum portfolios during market crashes. Combining mean reversion and momentum strategies could reduce the concentration of high beta shares in times of a stock market crash, making a market-timing signal potentially beneficial in adverse economic conditions.

Further to this, the research is also of interest academically, as the majority of the literature suggests that shares that are smaller in terms of market capitalization and more difficult to arbitrage are the most likely to be effected by investor sentiment (Baker & Wurgler, 2006;

Antoniou, Doukas & Subrahmanyam, 2013). It is not certain whether this will hold true on the JSE, as there is no historic size effect present on the local bourse.

The business relevance of the study lies in the changing landscape that the investment and asset management professions operate. The recent increase in online share trading and the advent of exchange traded funds (ETFs) has meant that individual investors have become both more informed and more demanding of institutional investors. If institutional investors are unable to generate returns in excess of what the market offers, it brings into question their relevance as ETFs offer a more cost effective way for the public to invest in the JSE. Institutional investors need to generate returns that far exceed those of the market to justify their fees and this research aims to add to the body of knowledge that assists them in achieving these better than market returns.

1.6 Limitations

There are several limitations to this research that should be noted. Firstly, the SAVI was only introduced in 2009, leading to a smaller sample size than other, similar research. Mean reversion relies on longer holding periods, so the amount of synthetic portfolios that were able to be generated was limited.

Combining mean reversion and momentum in the same study also presents a challenge in the number of portfolios that need to be generated. Generally, momentum profits arise with shorter holding periods and mean reversion with longer ones. Optimising the formation and holding periods for the portfolios represents a significant challenge.

Finally, this research is based on historic data and the results or any additional new theory that can be generated from it are extrapolated from this old information and may not necessarily produce the same returns going forward.

2. Literature Review

2.1 Introduction

This literature review aims to investigate and explain the pertinent literature for each of the three major components of this study, namely: investor sentiment, momentum and mean reversion. It is arranged as follows:

Figure 1: Literature Review Summary

<u>Investor sentiment</u>	
2.2.1	Investor sentiment explained
2.2.2	Challenges in applying investor sentiment
2.2.3	Investor sentiment's application and market timing
2.2.4	The shares most effected by investor sentiment
2.2.5	How investor sentiment relates to behavioural finance strategies
<u>Momentum</u>	
2.3.1	Momentum explained
2.3.2	Potential causes of the momentum anomaly
2.3.3	Potential disadvantages of applying momentum strategies
2.3.4	How momentum relates to sentiment and mean reversion
<u>Mean reversion</u>	
2.4.1	Mean reversion explained
2.4.2	Potential causes of mean reversion
2.4.3	Potential disadvantages in applying mean reversion strategies
2.4.4	How mean reversion relates to sentiment and momentum

2.2 Investor Sentiment

2.2.1 Investor Sentiment Explained

Contemporary academic studies have moved away from seeking fully rational explanations to explain share price behavior, towards examining the roles that investor behavior and psychological biases. This is mainly attributable to two factors: the inability of classical finance models to fully explain share price behavior and the growing body of evidence to support the assertion that these behavioural traits exert an influence on market efficiency (Daniel & Hirshleifer, 2015).

Classical finance theory fails to take into account the role of investor sentiment. While it is evident that mispricing exists in financial markets, it is attributed to uniformed demand shocks and barriers to arbitrage (Baker & Wurgler, 2006). Theoretically, financial markets consist of rational arbitrageurs, who are free from sentiment and irrational traders who are prone to sentiment. Mispricing has been attributed to a change in sentiment in irrational traders or limits to arbitrage experienced by rational traders (Baker & Wurgler, 2007), while other studies have found that investor sentiment is consistent with, and leads to, mispricing (Hengelbrock, Theissen & Westheide, 2013). It is extremely unlikely that any investor, even institutional investors, are perfectly rational and devoid of any kind of behavioural bias.

The intensity of prevailing levels of investor sentiment is influenced by both internal and external (macroeconomic) factors. Some of the internal factors that may influence levels of sentiment are: expected returns, risk and misevaluation (Hirshleifer, 2001; Xu & Green, 2013), overconfidence (Chang, Chen & Fuh, 2013; Daniel & Hirshleifer, 2015), the effect of “noise” traders (Mendel & Schleifer, 2012) and preferences for lottery-style payoffs (Fong & Toh, 2014).

At a macroeconomic level, it has been found that investor sentiment has predictive abilities in relation to the market, but that investor sentiment is a result of the broader economy. In normal periods of the economy, if investor sentiment is negative, the market still gains, but in recession and expansionary periods, the markets follow sentiment (Ayban & Murat, 2017).

Other studies have found that investor sentiment could provide incremental predictability in share returns under extreme market conditions only (Li, Guo & Park, 2017).

2.2.2 Challenges in Applying Investor Sentiment

The criticisms regarding the usefulness of investor sentiment in financial analysis have been twofold: contradictory academic literature exists in ascertaining whether the measures of investor sentiment lead or follow market performance and investor sentiment is an “unobservable phenomenon” (Chan, Durnad, Khuu & Smales, 2016, p. 1), which has led to the adoption of various proxies to measure it. It has also been suggested that that existing proxies for investor sentiment may not be useful in forecasting returns, but only in determining the anticipated trading volume and volatility (Kim & Kim, 2014; Siganos, Vegganas-Nanos & Verwijmeren, 2014; Tetlock, 2007; Schnedler, Heiden, Heiden & Hamid, 2017).

In determining whether or not investor sentiment leads market performance, the FNB Consumer Confidence Index has been used as a proxy in a South African context. There was no evidence of a contemporaneous effect and investor sentiment was found to lead market performance (Solanki & Seetheram, 2014; Viljoen, 2016).

Further evidence supporting the assertion that investor sentiment leads market performance has been found in when applying it with high frequency, or applying shorter formation periods. Prevailing sentiment on a Sunday has been found to effect returns on the following Monday (Siganos, Vegganas-Nanos & Verwijmeren, 2014) and even shorter formation periods of half an hour have been shown to have predictive power (Sun, Najand & Shen, 2016).

While having such short holding periods may indicate causation and be of academic interest, it is unlikely that this strategy could be applied practically, as such high-frequency trading would lead to transaction costs that are likely to exceed the returns that could be achieved in such a short period of time. However, the use of short-term formation periods could be a viable investment strategy.

The relationship between investor sentiment and returns has been attributed to investors' loss aversion and herding behavior (Li et al., 2017). It has also been hypothesized that, while

investor sentiment may lead market performance, it is a self-fulfilling business-cycle, as sentiments towards shares of high output and high demand companies increase the price of capital, leading to a boom in real output (Benhabib, Liu & Wang, 2015). Investor sentiment was also found to be useful in predicting market performance, but was actually a contrarian predictors of returns (Baker, Wurgler & Yuan, 2012).

While the studies mentioned above found that investor sentiment leads market performance, there is little consensus regarding this. Investor sentiment was found to be useful in forecasting levels of trading activity and volatility, but showed little predictive power in forecasting returns and it was suggested that investor sentiment actually follows market returns (Kim & Kim, 2014). Similar research concluded also showed that investor sentiment is only useful in forecasting volatility and trading activity (Gong, Wen, He, Yang, Yang & Pan, 2016; Siganos et al., 2014; Lee, Jiang & Indro, 2002). Others have suggested that past returns are an important component of investor sentiment, but that the effect is contemporaneous (Brown & Cliff, 2004; Lee et al., 2002).

Further evidence that investor sentiment may follow market returns was found on measuring market response to publications on investor sentiment. The response was consistent with an initial under-reaction to cash flow news, or for investor sentiment to be related to mispricing, but were inconsistent with the explanation that investor sentiment leads to market performance (Hengelbrock et al., 2013).

However, on balance, the majority of the academic literature finds that market performance does follow investor sentiment. This is, in part, attributable to investor's individual assessments of risk and return.

The perception of both risk and return is influenced by sentiment, which in turn effects market prices (Shefrin, 2015). There is substantial empirical evidence to imply a leading relationship and the challenge facing researchers now is not in whether sentiment leads or follows market performance, but rather in how to reliably quantify it (Baker & Wurgler, 2007).

Broadly, there are two different types of measurement for investor sentiment: direct and indirect measures. Direct investor sentiment refers to investor's moods or perceptions about the future and is normally measured through a survey or questionnaire, whereas indirect

investor sentiment normally takes the form of a number of variables, perceived to act as a proxy (Solanki & Seetheram, 2014).

Most notably, consumer confidence surveys have been found to correlate well with prevailing investor sentiment and are viewed as being a suitable direct measure (Qiu & Welch, 2004). Direct measures that have been proposed as suitable proxies for investor sentiment include the use of an investor's intelligence index (Lee et al., 2002), consumer confidence indexes (Schmelling, 2008; Solanki & Seetheram, 2014) and a Markov regime switching model applied to monthly data from the BIST 100 return index, Bloomberg confidence index, TUIK confidence index and the real sector confidence index (Ayban & Murat, 2017).

Conversely, it has been stated that, whilst direct measures of sentiment are central to creating effective proxies, the indexes themselves have little predictive power (Zhang, Swanson & Prombutr, 2012).

The seminal work in the study of investor sentiment resulted in the most commonly used indirect measure - the Baker & Wurgler sentiment index. The index comprises of six metrics: the average closed-end fund discount, NYSE share turnover, number of IPOs, the average of first-day returns on IPOs, the equity share in new issues and the dividend premium (Baker & Wurgler, 2006). Share turnover was later excluded from the index. Owing to the increase in institutional high-frequency trading, it was no longer as useful a metric as it had previously been (Wurgler, 2017).

The Baker-Wurgler sentiment index is updated by the authors and available on their website. The index now takes on two forms: the first uses the original five metrics, whereas the second index is based on the original five metrics and they are arranged in respect of seven macroeconomic indicators, namely: the industrial production index, nominal durables consumption, nominal nondurables consumption, nominal services consumption, the NBER recession indicator, employment and the consumer price index. The original methodology was later applied across six different markets (Baker, Wurgler & Yuan, 2012).

Many studies of investor sentiment have used the Baker-Wurgler sentiment index, either as a stand-alone measure of investor sentiment, or in conjunction with another proxy. Notably, the index has been used in conjunction with the University of Michigan's survey on investor

sentiment in an attempt to combine direct and indirect measures (Bathia, Bredin & Nitzsche, 2016; Li et al., 2017).

Whilst being the seminal work and most commonly used measure of investor sentiment, the Baker-Wurgler sentiment index has not escaped criticism. “Different proxies for the same underlying phenomena should be correlated” (Chan, Durand, Khuu & Smales, 2016, p. 1). When comparing text-based proxies to the metrics employed by Baker and Wurgler, it was found that there was no correlation to the metrics used by Baker and Wurgler and that potentially none of the proxies used were valid (Chan et al., 2016). This however, does not exclude the possibility that the more recent research is the work including invalid proxies.

The increase in the use of technology and social media has led to a plethora of new proxies for investor sentiment being proposed. A dataset of over 32 million messages, posted by retail investors about 91 firms was retrieved from Yahoo finance in the construction of a sentiment index, attempting to measure returns, volatility and trading volume (Kim & Kim, 2014).

The use of microblogging sites, such as StockTwits and Twitter has also been used to construct portfolios based on observable changes to investor sentiment (Hill-Kleespie, 2017). Twitter has been used to quantify investor sentiment, although it only proved to be accurate in some sentiment periods and for some prevailing emotions (Mittal & Goel, 2012).

A combination of newswires, internet news and social media was found to support short-term predictability in individual commodity returns (Shen, Najand, Dong & He, n.d.) and Facebook’s Gross National Happiness Index was used to examine daily sentiment and trading behavior across 20 international markets (Siganos et al., 2014).

While social media has the benefit of being real-time and easily accessible, the use of Twitter and other social media in constructing sentiment indexes has received criticism, as they can potentially identify a spurious sentiment pattern from a particular topic, rather than any real phenomena (Thelwell, Buckley and Peltoglou, 2012).

Using a combination of news wires, internet sources and social media was also suggested as a suitable proxy for obtaining high frequency measure of prevailing investor sentiment (Sun et al., 2016). Microblogging sites have also been used to construct momentum portfolios, based on observable changes in investor sentiment (Hill-Kleespie, 2017; Checkley, Anon Higon & Alles, 2017). Hill-Kleespie (2017) formed momentum portfolios using

microblogging sites to determine observable changes in investor sentiment. It found a significant relationship between lagged measures of sentiment and returns from the portfolios.

Additional indirect measures of investor sentiment include the construction of the FEARS (Financial and Economic Attitudes Revealed by Search) index, which examines the quantity of household internet searches for keywords that could indicate macroeconomic concerns (recession, unemployment, bankruptcy etc.) (Da, Engelberg & Dao, 2013) and an index examining the changes to daily trading volumes across international indices (Uyger & Tas, 2012).

The use of daily column from the Wall Street Journal in constructing an indirect measure of sentiment was also found to be a suitable proxy (Tetlock, 2007) and the use of positive and negative words in two columns of the New York Times was found to have predictive powers for returns, particularly during recessionary periods (Garcia, 2013).

A method of constructing indexes from internet message boards by introducing four new methodological improvements (using self-disclosed messages, excluding reply messages, using balanced classes and applying a unique class assignment algorithm) and adding two probability measurements was also found to be a suitable indirect measure of investor sentiment (Zhang et al., 2012).

2.2.3. Investor Sentiment's Application and Market Timing

Given the overwhelming academic research in support of the use of investor sentiment to predict market returns, it is highly unlikely that any excess returns are attributable to a spurious regression bias (Stamburgh, Yu & Yuan, 2014).

The challenge for investors now is how to apply the understanding of this anomaly to an investment strategy which achieves returns that exceed those of the market. The existing academic literature currently offers various suggested market timing strategies in applying investor sentiment, with little consensus as to what is the preferred strategy for the differing periods of optimism or pessimism. Further consensus on the classification of these periods,

as well as their application in market timing strategies would significantly increase the practicality of existing investor sentiment indexes.

With any market timing strategy, the challenge timing of the sale of an asset is that the decision is based on incomplete information (Ekstron & Lindberg, 2013). In a South African context, sentiment was found to influence the effectiveness of a value-growth timing strategy when using a sales/price ratio in determining value and growth shares (Hodnett, 2014).

Investor sentiment was also found to show an effect on momentum and residual momentum approaches, with residual momentum strategies showing the most significant returns following pessimistic formation periods and momentum strategies having greater returns after more optimistic periods (Viljoen, 2016).

Internationally, tactical asset allocation, based on levels of investor sentiment was able to produce excess returns when used in the South Korean market, even with the use of “very crude asset allocation strategies” (Kim & Kang, 2015, p. 191). The study made use of both a time-series analysis and cross-sectional returns and generated significant returns after adjusting of risk and transaction costs.

In examining the relationship between investor sentiment and anomalies, it was found that a long-short strategy is more profitable after periods of high investor sentiment, with the profits being attributable to the short leg, while the long leg showed no relation to sentiment (Stamburgh, Yu & Yuan, 2012). Additionally, in examining the role of consensus among investors, it was found that high levels of disagreement correlates with lower returns in high sentiment periods, whereas there is no significant correlation between returns when there are high levels of disagreement in periods of low sentiment (Kim, Ryu & Seo, 2014).

Periods of high investor sentiment were also found to be correlated with relatively lower future returns and markets that exhibited more herd-like behavior found to be those most effected (Schmelling, 2008).

The use of high-frequency investor sentiment showed significant economic value when evaluated with market-timing strategies (Sun et al., 2016). As mentioned previously, high frequency analysis of investor sentiment and trading strategies may offer some academic interest, but the practicality of these strategies is undermined by transaction costs acting as

a barrier to arbitrage. A high frequency strategy is also complicated by the accessibility of any proxy or index to measure investor sentiment, as there is typically a time delay in retrieving what are acknowledged to be reliable measures of investor sentiment.

The use of investor sentiment has also been applied to foreign exchange markets. Institutional investors appear to correctly identify the direction of the market in the medium term, whereas private investors seem contrarian on first sight, although the findings were very sample dependent (Heiden, Klein & Zwergel, 2013).

2.2.4 The Shares Most Effected by Investor Sentiment

While it is not the intention of this research to identify individual shares that may be more susceptible to the effects of investor sentiment than others, the analysis may offer some interest due to seemingly opposing academic literature.

During periods of low investor sentiment, smaller stocks earn higher subsequent returns, but the effect disappears during periods of higher sentiment (Baker & Wurgler, 2006), indicating a size effect. Historically, there is no evidence to suggest a size effect on the JSE (Muller & Ward, 2013) and the findings of Baker & Wurgler were taken from US data.

In addition to the size effect, high volatility, unprofitable, non-dividend-paying, extreme growth and distressed shares were also found to experience higher returns following periods of low sentiment, which fully reversed during periods of higher sentiment (Baker & Wurgler, 2006).

Similarly, it has been found that the returns on small-cap, value, lower institutional ownership and lower priced stocks are more prone to changes in investor sentiment (Kumar & Lee, 2006; Cheema & Nartae, 2017; Baker et al., 2012).

2.2.5 How Investor Sentiment Relates to Behavioural Finance Strategies

While the evidence of using a momentum strategy during optimistic periods is seemingly well established, there is a noticeable shortage of literature regarding what is a suitable strategy

during pessimistic or relatively neutral periods of investor sentiment. The exception to this was in the Chinese market, where local sentiment is a reliable momentum predictor at a monthly frequency and a contrarian predictor in the long-run (Han & Li, 2017).

In studying the role of investor sentiment in the success of momentum strategies, momentum was found to be stronger under periods of optimism and that momentum profits would only arise during these periods (Antoniou et al., 2013). There was support for this assertion when applied to the JSE, as both individual and institutional investors favoured high growth stocks, with low value multiples in periods of optimism (MacKinnon & Kruger, 2014).

In the real estate investment trust (REIT) market, the profitability of a 52-week high momentum strategy varied with the level of investor sentiment, earning significantly positive returns after periods of optimism and negative returns after pessimistic periods (Hao, Chu, Ko & Lin, 2016). This suggests that there would have been a significant opportunity for profits to arise through short-selling during these pessimistic periods.

Further to this, a bear stock market was found to be predictable when combining market momentum and investor sentiment. Most economic fundamentals lose their significance when accounting for these two factors (Chen & Vincent, 2017).

2.3 Momentum

2.3.1 Momentum Explained

A momentum strategy involves the buying of past “winner” shares and selling of “loser” shares. Most of the literature makes use of relatively short, quarterly holding and portfolio formation periods of between three and twelve months.

Seminally, this method was found to provide returns exceeding those of the market, although the returns dissipate and mean revert in holding periods longer than 12 months (Jegadeesh & Titman, 1993). Critically in the debate opposing classical finance theory, the returns from this strategy are not attributable to any systematic risk.

Locally, in a comparison of style-based approaches on the JSE, momentum was found to be the most effective individual investment style (Muller & Ward, 2013).

In an examination of anomalies to the EMH, momentum (along with net stock issues and accruals) was found to be present in all size groups in a cross-section regression, but asset growth and profitability were found to be less robust (Fama & French, 2008). Momentum was also advocated, in conjunction with size (Fama & French, 2012) and the momentum effect described as the “premier anomaly” (Fama & French, 2008, p.1653) to the EMH.

While the concept of momentum is well established, there have been several different methodologies applied in its measurement. The seminal work made use of various holding periods between three and 12 months and applied buying “winners” and selling “losers” in a long-short portfolio (Jegadeesh & Titman, 1993).

Locally three technical indicators of momentum have been applied to shares on the JSE Top 40, namely: the simple moving average, the exponential moving average and the relative strength indicator (Bolton & Von Boetticher, 2015). Using a 52 week high price as the indicator was found to outperform conventional momentum strategies that make use of recent and intermediate historical price movements (Bhootra & Hur, 2013).

The differing methodologies in determining momentum are evidence of the need to further refine a standardization criteria, as they could lead to estimation biases. Typically, intermediate term momentum is overestimated and recent past momentum is underestimated (Gong, Liu & Liu, 2015).

An important factor to consider in evaluating the success of momentum strategies is to not merely evaluate their absolute returns, but to contrast these to the amount of systematic risk. Using industry return momentum has been found to improve the performance of momentum strategies when using the Sharpe ratio to determine the comparable level of risk across different methodologies applied to portfolio formation (Behr, Guettler & Truebenbach, 2012).

2.3.2 Potential Causes of the Momentum Anomaly

Price momentum can be attributed to the reaction of the share price to new information (Bolton & Von Boetticher, 2015) and this adjustment can be broken down into four parts: under-reaction, adjustment, overreaction and reversion.

Momentum traders seek to beat market returns by timing their portfolios to coincide with the share's adjustment, overreaction and reversion. Sentiment driven over-pricing has also been proposed as a partial explanation of the relative success of momentum strategies (Min & Kim, 2016).

Overreaction is largely explained by the concept of "herding". Retail investors, in particular, move in concert (Kumar & Lee, 2006). Uninformed traders chase "noise", moving the price of shares away from the value of its fundamentals (Mendel & Schleifer, 2012).

Of particular importance in examining the role of herding in momentum portfolios is the fact that the performance of momentum portfolios is dependent on the prevalence of momentum traders in the market – when they are less active, momentum traders have been found to always lose (He & Li, 2015).

The preference of investors for momentum and reversion shares and how this collectively influences a shares price is, in part, explained by salience theory (Bordalo, Gennaioli & Shleifer, 2013). Salience theory implies that investors are most drawn to the shares that are different, as seek to have large payoffs in accepting risk. This implies that growth (momentum) shares are typically overpriced, as they have large salient upsides, implying that investors are drawn to these shares, while value (reversion) shares are underpriced as a result of salient downsides (Bordalo et al., 2013).

The intensity of the herding depends on both the past return and market sentiment – this confirms both the rational and emotional factors in herding (Blasco, Corredor & Ferreruela, 2012). The preference that investors have for shares with lottery-like payoffs has also been described as the "MAX effect" and has also been found to be present in institutional investors (Fong & Toh, 2014). Investors' loss aversion and herding behavior explains how sentiment gives predictability to stock returns under extreme market circumstances (Li, Guo & Park, 2017).

Novy-Marx (2012) found that momentum is primarily attributable to a firm's performance over the preceding seven to 12 month period, not momentum itself. It also relates specifically to the largest and most liquid shares. Despite the reported dependency on the firm's intermediate historical results, the same study found that momentum was also a viable investment strategy when applied to commodity and currency markets.

It has also been proposed that, in relation to these large, liquid stocks, that momentum arises as a result of flows between investment funds and that the flows themselves are initiated as a result of changes in fund manager's efficiency (Vayanos & Wooley, 2013).

2.3.3 Potential Disadvantages in Applying Momentum Strategies

Despite the evidence of momentum's excess cumulative returns in the long-run (Jegadeesh & Titman, 1993; Muller & Ward, 2013), of the differing style-based approaches to investing, momentum has proven to be the most volatile, giving investors the highest Sharpe ratio (Barroso & Santa-Clara, 2015). While delivering the best returns, momentum portfolios are prone to infrequent, but persistent runs of negative returns (Daniel & Moskowitz, 2016).

The volatility of the strategy makes it unappealing to investors that are naturally more risk-averse, such as those favouring value strategies as a result of adverse macro-economic experiences when they were growing up (Cronqvist, Siegel & Yu, 2015). It is generally an unsuitable strategy for those investors who dislike negative skewness and kurtosis (Barroso & Santa-Clara, 2015). The volatility of the strategy places an emphasis on effective market timing, as it is potentially unsuitable for those investors with shorter term horizons such as individuals nearing retirement age.

The success of momentum strategies determined, in part, by the prevailing economic state of the markets in which they operate (Min & Kim, 2016). They generally correlate with the market's overall performance, experiencing large losses in adverse economic states and significant gains in stronger economic states (Min & Kim, 2016). However, the crashes are forecastable, as they follow panic states in the market as a result of market declines and high volatility and are contemporaneous with the market rebound (Daniel and Moskowitz, 2016).

An overall bear market is forecastable by periods of momentum and investor sentiment (Chen & Vincent, 2017). A dynamic momentum strategy has been proposed to counteract these market declines, based on a forecast of the momentum portfolio's mean and variance that doubles the alpha and Sharpe ratio of a static momentum strategy (Daniel & Moskowitz, 2016).

The co-movement with the overall market raises the question of how do these portfolios perform in severely adverse conditions, such as the recent global financial crisis. Stock market crash represents a significant opportunity for mean reversion, as the market risk premium is higher, but can momentum traders profit from this?

After the 2008 global financial crisis, the JSE Top 40 returned 261% between the periods of 1 March 2009 and 8 April 2014 (Bolton & Von Boetticher, 2015), although applying simple moving average, the exponential moving average and the relative strength indicator as measures of momentum did not match these returns.

2.3.4 How Momentum Relates to Investor Sentiment and Mean Reversion

The disadvantage of a pure momentum strategy (the severe volatility) and the disadvantage of a mean reversion strategy (excess returns only occur over the long-run) facilitated the need to study the potential for combining the two opposing methodologies.

Momentum strategies have been found to provide excess returns when used over a short-term horizon and reversal provides excess returns over a longer-horizon (He & Li, 2015). Momentum strategies were initially found to be effective when short holding periods of between three and 12 months were applied, but found to mean-revert after the initial period (Jegadeesh & Titman, 1993; Moskowitz, Ooi & Pederson, 2012).

The performance of momentum strategies is determined by (along with the market dominance of momentum traders) their time-horizon, with profit opportunities arising for momentum traders when using a short-term horizon and applying a long-term horizon for reversal strategies (He & Li, 2015).

A large, mean-reverting component of a share's price (it's permanent component) induces a negative autocorrelation in returns, with a time period typically exceeding 12 months (Fama & French, 1988). Combining the strategies outperformed either individually, which revealed the importance of controlling and exploiting both simultaneously (Balvers and Wu, 2006). Vayanos & Wooley (2013) found that momentum and reversal are a result of flows between investment funds and the resulting momentum or reversal are either inferred or observed directly by investors as a result of past performance.

While the concept of value does not necessarily imply that a share is trading at a price below its historic mean, there may be significant overlapping shares in forming value and mean reversion portfolios. Value and momentum are more positively correlated across asset classes than passive exposure and negatively correlated within and across asset classes (Asness, Moskowitz & Pederson (2013) found the returns from value and momentum to be positively correlated across different asset classes than a passive exposure, but negatively correlated within the different asset classes. The returns on value stocks were found to exceed those of the returns on growth (momentum) stocks across the Asia Pacific, Japan, Europe and North America, but the premium was found to decrease as the share increases in market capitalization (Fama & French, 2012). Momentum was found to be present in every region (except Japan) and decreases with an increase in size (Fama & French, 2012). There is no evidence of a size effect on the JSE (Muller & Ward, 2013), so a comparative between the relative successes of the two strategies is necessary.

As momentum profits are more likely to be realized in favourable economic circumstances (Min & Kim, 2016), the returns from those stocks in "loser" portfolios are more likely to be affected in a recession (Kim, Roh, Min & Byun, 2014). If the investor understands what stage of the greater macro-economic cycle the market is in, their chances of beating the market would be increased through effective market-timing, switching between the two strategies.

The idea of combining the two, seemingly opposite strategies has been applied to other asset classes. A combination of momentum and mean reversion significantly outperformed "single-sort" strategies in commodity futures (Bianchi, Drew & Fan, 2015). The combination of the two approaches resulted in a 20.24% per annum return, compared to momentum's return of 11.14%. They attribute the results to global funding liquidity, as the results can't be explained by standard risk factors. A similar approach to combining momentum and mean reversion

was applied to foreign exchange markets (Serban, 2010) and found to outperform the same strategy when applied to the equities market. It also significantly outperformed existing strategies in foreign exchange markets, “such as carry trades and moving average rules” (Serban, 2010, p. 2720).

Momentum relates to market sentiment as sentiment leads market performance (Solanki & Seetheram, 2014) and a sentiment index has been found to predict the return on momentum strategies (Min & Kim, 2016). The expected returns of “winner” stocks have been found to be influenced by the aggregate economy to a greater degree than “loser” stocks in an expansionary state, while “loser” stocks are more affected during a recession (Kim et al., 2014). Momentum can experience large negative returns in adverse economic states, but experience significant gains in stronger economic conditions and profits on momentum strategies arise “mainly during periods of investor optimism” (Min & Kim, 2016, S105). During such periods, momentum investors have been found to profit at the expense of hedgers (Moskowitz et al., 2012).

Initial returns on momentum portfolios have been found to dissipate after the first 12 months, which is consistent with sentiment theories regarding an initial under-reaction and subsequent delayed over-reaction (Moskowitz et al., 2012). The initial under-reaction, momentum occurs as a result of inertia (Vayanos & Wooley, 2013). Conversely, it has been found that the strong momentum profits that arise under periods of optimism are largely attributable to the strong momentum in losing stocks and that news that contradicts investor’s sentiment causes cognitive dissonance, which slows the signals that oppose the prevailing investor sentiment (Antonioni et al., 2013).

Schmeling (2008) found that markets that have less market integrity and that are more prone to herd-like behaviour are more likely to be impacted by a change in investor sentiment. Investor sentiment increases the chances of a stock market crisis and is more likely in countries that are “culturally more prone to herd-like behavior, overreaction and low institutional involvement” (Zouaoui, Nouyrigat & Beer, 2011, p. 723). In applying herding to an analysis of perceived chances of success in constructing momentum portfolios, it was found that investors overestimate intermediate past momentum and underestimate recent past momentum (Gong, Liu & Liu, 2015) and they stated that momentum is really just short term momentum.

In an argument against the use of investor sentiment in the analysis of momentum and reversion strategies, it has been found that, along with other standard risk factors, it doesn't explain the success of a combination of the two strategies when applied to a commodity futures market (Bianchi et al., 2015).

2.4 Mean Reversion

2.4.1 Mean Reversion Explained

Given the string empirical evidence supporting the success of momentum strategies, it is unsurprising that literature on mean reversion is less abundant. Mean reversion refers to the phenomenon of share prices that have performed exceedingly well or poorly in the recent past to eventually revert to their historic mean. Of course, the challenge with applying this theory is twofold, in that: the reversion occurs over a significantly longer period than the excess profits attributable to momentum strategies and the concept of any individual asset price having a historic mean is flawed by the notion that a current asset price is an accumulation of historic means in itself, so how does an individual investor accurately determine a mean?

In investigating what was, at the time, the developing theory of mean reversion, Lo and MacKinlay (1988) strongly rejected the random walk hypothesis, but found that the cause for their rejection was mainly attributable to the behavior of small stocks. They added that a rejection of the random-walk theory was not necessarily an acceptance of reversal.

Returns from mean reversion strategies have been found to be positively correlated with short-term horizons and negatively correlated with long-term horizons (Poterba & Summers, 1987; Cecchetti, Lam & Mark, 1990). This implies that a momentum strategy will be more successful with short-term horizons, but a reversal will eventually happen. These findings were disputed and attributed to the time period selected for study (Kim, Nelson & Startz, 1988) with mean reversion found to be a feature of the subperiod between 1926 and 1946, but absent in other periods in the study.

The validity of a mean-reverting model was applied to emerging markets and found a contrarian portfolio to be the best portfolio investment strategy (Akarim & Sevim, 2013), implying that emerging markets are not efficient, even in their weak form. In a South African context, as an emerging market, these findings suggest that an opportunity exists to identify these mispricings and profit from them.

2.4.2 Potential Causes of Mean Reversion

There are two proposed causes of the reversal phenomenon: time-varying required returns and “price fads” causing shares to deviate from their fundamental values (Poterba & Summers, 1987). Whereas Poterba & Summers (1987) view the temporary part of an individual share price as being the result of a fad, Fama & French (1988) “view them as being business cycle fundamentals” (Balvers, Hu & Huang, 2012, p 489). They add that shocks to an individual share price represent an opportunity to investors as these temporary deviations tend to revert to historic means (Balvers et al. 2012).

De Bondt and Thaler (1985) hypothesized that the stock market overreacts to negative news events and underreacts to changes in the fundamentals of a particular asset. In relation to mean reversion and the defining of what a historic mean, they also question “what is an appropriate reaction?” (1985, p.793).

The methodology used by De Bondt and Thaler was applied in a South African context from the period of 1983-2005. It was found that historic “loser” portfolios outperformed both “winner” portfolios and the market over a five year holding period, giving annualized returns of 11.5%. This was again attributed to an overreaction to news events and a relative indifference in changes to company fundamentals (Cubin, Eidne & Firer, 2006).

These findings were supported by Savor (2012) who found that news events could lead to a drift in an individual share’s returns when the news is accompanied by relevant information but a reversion where there is no accompanying information, due to an overreaction by investors. These findings again illustrate the power that behavioural traits have to influence asset prices and show the inability of classical finance models to accurately capture this non-financial information into a share’s price.

Long-term reversals could also partially be explained by the rational reactions of investors who are constrained by capital gains (George & Hwang, 2007). The study found that predictors based on capital gains have predictive power, but predictions from overreaction don't. To examine the hypothesis, they used data from Hong-Kong, where investment income is not taxed. Bhootra (2013) directly contradicts this, stating that locked in capital gains do not explain reversal on historic winners, when winners are based on intangible information. This study claims that the overreaction hypothesis still explains reversal when applied to the US market.

2.4.3 Potential Disadvantages in Applying Mean Reversion Strategies

While the existence of reversal is well supported, the major challenge with adopting the strategy is the comparatively longer time horizons for realising returns. Fama & French (1988) observed a week auto-correlation between prices and returns when applying daily or weekly holding periods, but stronger correlations when examining three to five year returns. Cubin et al. (2006) supported these findings locally by reporting the previously mentioned excess returns attributable to a five year holding period.

Holding periods of even longer than this have been advocated. Zakamulin (2016) found that returns from holding periods of shorter than ten years were purely anecdotal and suggested that a matching approach of formation periods of 15 to 17 years could predict the subsequent returns over equally long holding periods.

2.4.4 How Mean Reversion Relates to Investor Sentiment and Momentum

The greatest potential benefit for a market-timing tool to combine these two approaches is that it would allow for the excess returns generated from momentum investing to be realized, while controlling for risk through periods of diversification into a mean reversion strategy

The literature offers contradicting views as to the results of mean reversion strategies. Bhootra (2013) found that reversal of historic winners does not occur when the winner portfolios achieved these returns as a result of intangible information. This intangible information could include investor's heuristics, biases and personal preferences – sentiment among them.

Conversely, returns that are unexplained by a change in the company's fundamentals have been found to be more likely to mean revert in the short run (Da, Liu & Schaumberg, 2013). The study found that these short-term reversals are attributable to investor sentiment on the short side.

Generally, mean reversion is acknowledged to occur over longer holding periods than momentum strategies and occurs as a result of an overreaction by investors to adverse news about a firm, without an accompanying change in its fundamentals. This overreaction hypothesis has even been extended to the overall market in the case of sudden and adverse economic conditions (like a stock market crash) with the same pattern of an initial overreaction and subsequent, delayed reversion to a historic mean present on the entire market (Dumont de Chassart & Firer, 2001). The same study found that momentum portfolios are more susceptible to market crashed and this study suggested that a market timing strategy is a viable option during certain market conditions. They make use of traditional timing, bull and bear timing.

Combining mean reversion and momentum is not unique to equities markets and has been applied to other asset classes. When applied to the foreign exchange market, it was found that combining the two differing methodologies achieved returns that outperformed either strategy individually as well as outperforming the combination approach on the equities market.

Excess returns by combining the approaches was found to be prevalent across 18 international markets (Balvers & Wu, 2006). Importantly from a practical application perspective, the results of this study continued to hold after adjusting for the effects of transaction costs.

Another potential benefit of combining the two approaches is that individual investors have different appetites for risk. The risk/return relationship is well established and prevalent in

momentum portfolios – while they tend to offer the highest returns when rebalancing after short holding periods, they are prone to crashes (Daniel & Moskowitz, 2013).

While it is fair to assume that most investors seek to maximize returns, the switching approach to a mean reversion strategy, which typically offers smaller returns at a reduced volatility is likely to be appealing to a more cautious investor. It has been found that an individual's preference for a particular investment style is something that is ingrained since birth and the preference to choose a value or growth approach has a biological basis (Cronqvist, Siegel & Yu, 2015). The study found that those investors that grew up poorer, or with adverse socio-economic circumstances, are more likely to favour investment approaches that offer value, rather than the promise of excess growth.

A quantifiable, numeric market-timing tool will also assist investors in reducing “noise” that can affect their decisions regarding when to switch strategies. Andrei & Cujean (2017) studies how word-of-mouth communication (what they termed “investor flows”) affects investors with heterogeneous trading strategies that switch between contrarian and momentum approaches. They found that information flow is a prerequisite for momentum portfolios to generate excess returns, but not necessary for mean reversion approaches.

This again suggests the accuracy of the overreaction hypothesis that short term movements, which typically result in momentum gains or losses, are an overreaction to short term news and not based on the fundamentals of the underlying asset. Investing in the intrinsic value of the share or company is central to the success of mean reversion strategies.

In applying mean reversion strategies to the JSE, the contradicting literature should be noted. Muller & Ward (2013) found no evidence of a size effect on the JSE and the local bourse is typically dominated by larger shares, listed on the All Share Index, although their study was not explicitly related to mean reversion. Mean reversion has been found to exhibit a significant size effect (Nordal & Naes, 2012) and the firm size is included in the Three-Factor-Model (Fama & French, 2008) indicating that it may be an important component in determining future returns.

3 Research question

The overall research question to be answered is, “Can investor sentiment be used as a market-timing tool for switching between momentum and mean reversion strategies?” This research attempts to use the SAVI as a direct measure of sentiment and apply it as a tool to switch between the two approaches.

In answering this, it needs to be determined during which periods momentum was a more profitable strategy than mean reversion and vice versa. Several studies have documented that momentum has been the most successful individual style-based trading strategy (Jegadeesh & Titman, 1993; Muller & Ward 2013), but it is prone to spectacular crashes (Daniel & Moskowitz, 2013). The cumulative returns from a combination of the two approaches could potentially exceed those of a purely momentum based strategy, if an appropriate indicator of adverse economic conditions can be identified.

It has already been established that momentum profits are attributable to periods of positive investor sentiment (Antoniou et al., 2013), but would adopting a mean reversion strategy during neutral or pessimistic periods provide greater returns, or at least reduce the impact of stock market crashes? Also, the classification of what is an “optimistic” period is largely subjective, but the SAVI offers a numerical measure against which subsequent returns from the differing strategies can be gauged.

To summarise, the research objectives are:

- Determine whether or not the SAVI can be used as a market-timing tool (overall objective), by:
- Determining during which periods mean reversion was a more profitable strategy
- Regress changes in investor sentiment to periods immediately proceeding crashes in momentum portfolios

4 Research Methodology

4.1 Research Design

The research consisted of constructing synthetic portfolios and constructing a time series analysis to determine which periods each individual strategy was comparatively profitable to other approaches. The second part of the analysis was to investigate for changes in prevailing investor sentiment in an event study around the dates on which unprofitable portfolios were formed.

The concepts of momentum, mean reversion and investor sentiment are well defined in the literature, making the deductive approach appropriate (Saunders & Lewis, 2012). The research was an explanatory, deductive, quantitative and experimental in nature.

4.2 Unit of analysis

The unit of analysis were individual shares listed on the JSE throughout the sample period.

4.3 Population

Only shares that were constituents of the JSE All Share Index (ALSI) at the time of forming each portfolio were used. The analysis used both listed and delisted shares to eliminate any potential survivorship bias. The use of the ALSI rather than the entire JSE is suitable, as these shares (normally around 160 shares) constitute around 99% of the total market capitalization on the JSE. Shares that fall outside of the index are considered to illiquid and difficult to arbitrage to be practically included in analysis of this kind.

4.4 Sampling

As the population was limited to the largest 160 shares on the JSE, it allowed for the entire population to be included in the sample. As a point of departure from similar studies of the JSE, the sample included both financial and resources shares. The inclusion was thought prudent, as the aim of this research was to establish a correlation between investor sentiment and the overall market, rather than looking to reduce risk or maximize returns. As a result, these shares, which make up a significant portion of the JSE in numbers and market capitalization were included.

The constituents for the ALSI were retrieved from the Thomson Reuters (Eikon) database and those shares that entered or left the index were added or deleted, including multiple entries and exits.

Daily closing share prices and dividends were retrieved from the commercially available Sharenet.co.za database. The dividend yield for each company was used in calculating total returns to simplify timing concerns over declaration dates and payment dates. Using the dividend yield also simplified the calculation in terms of dual listed entities, where dividends may be paid in foreign currency, making exchange rates and their timing a concern.

4.5 Portfolio formation

Quintile portfolios were created after the data was organized in terms of the individual share's total returns for the formation period. The formation period used was a 12 months, with the most recent month being lagged. This effectively created an 11 month formation period, with the one month lag consistent with academic literature to allow for diffusion of financial and other data that is not available immediately.

It was considered more accurate to only create portfolios with long positions. This was for the same reasons as the inclusion of financial and resource shares, in that, the aim of the research is to establish whether or not a correlation exists that could lead to a timing mechanism – risk diversification and portfolio optimization were not considerations.

The shares were arranged into quintiles and the median quintile was treated as the “balancing” quintile if the number of shares on the ALSI at the point of forming the portfolios wasn’t exactly divisible by five. They were ranked in terms of their previous twelve months returns and labelled as follows:

- Momentum 1 – the quintile with the highest momentum in the formation period
- Momentum 2 – shares ranked 31-60 in terms of momentum
- Neutral – the median portfolio
- Mean reversion 2 – the fourth highest momentum/second worst performing
- Mean reversion 1 – the worst performing quintile

Logarithmic returns were used for both determining the holding period and formation period returns.

While the formation period was held constant at 12 months, the cumulative returns were analysed for three, six, nine, 12, 18 and 24 month holding periods and time series analysis performed for all of these.

4.6 The SAVI Top 40

The South African Volatility Index (SAVI) Top 40 is a direct measure of investor sentiment and enables investors to “guage fear and market sentiment relating to the local equity market” (JSE, 2017) and is intended as a forecasting tool for equity market risk on the JSE. It is modelled on the S&P 500’s VIX index and intended as a measure of the measure of the expected three month volatility.

It offers researchers the benefit of having daily closing values for the index, as opposed to the CCI or BCI, which are survey-based and subsequently only available at quarterly intervals. The daily closing balances of the SAVI were made available on request by the JSE since the inception of the index in 2009.

4.7 Analysis

Momentum strategies with short holding periods have been proven to have the highest cumulative returns. This led to the research essentially having two different parts: a time series analysis to determine in which periods momentum was outperformed by mean reversion portfolios, followed by an event study to check for changes in investor sentiment in the period around the formation date of these poor-performing momentum portfolios.

4.8 Limitations and assumptions

Most empirical finance research needs to make use of, or at least give consideration to certain limitations or assumptions. The limitations and assumptions for this research are: the time period under consideration, the use of a proxy, transaction costs, the treatment of dividends and bid/ask spreads.

4.8.1 Time period under consideration

The time series analysis makes use of data for the period 1 Jan 2000 – 27 October 2017. The first year (2000) is used exclusively as a formation period. As a result, there are only 16 years of data to analyse – less than the 20 recommended. This was due to challenges in obtaining reliable closing share prices from the Thomson Reuters database for data before 2000, so these years were excluded.

The SAVI Top 40 was only introduced as an index in 2009. This means that there are only nine years (including 2009) to analyse the correlation between momentum crashes and changes in the SAVI. Consideration was given to applying either the CCI or the BCI to extend the data prior to 2009, but these results are survey-based and subsequently only provide

quarterly measures of sentiment. This makes reliable measurement of daily changes to sentiment and volatility of sentiment impossible.

4.8.2 The use of a proxy

Any research that tries to quantify an unobservable variable needs to make use of a proxy. The SAVI hasn't been used in previous research and its accuracy is assumed, owing mainly to the reputable source that it came from.

While the JSE expressly states that the index can be used to gauge prevailing investor sentiment, it is primarily a tool for measuring expected three month volatility. While the relationship between volatility and sentiment is well established (Kim & Kim, 2014; Siganos, Veganas-Nanos & Verwijmeren, 2014; Tetlock, 2007; Schnedler, Heiden, Heiden & Hamid, 2017), it would have been preferable to rely on a proxy that expressly states that its main purpose is to measure investor sentiment.

4.8.3 Transaction Costs and Bid/Ask Spreads

Transaction costs were applied at 1% to the portfolios on re-balancing and bid/ask spreads were ignored on the basis that any investor is as likely to receive a small gain or loss on these spreads.

4.8.4 The Treatment of Dividends

Sharenet.co.za did not have dividend history for all old and delisted companies. The average of all other shares' dividend yields (3.13%) was used for these old shares.

5 Results

5.1 Introduction

This chapter will show the full methodology followed and results achieved. The time series analysis to determine periods of poor performance for momentum portfolios will be highlighted and their timing contrasted to changes in investor sentiment to examine for correlation and determine whether or not the SAVI is a leading indicator of the success of these portfolios.

5.2 Tests for Correlation

The first, most obvious test for determining whether or not a proxy can be used as a timing tool is to test for correlation. A multiple regression analysis was run for the levels of sentiment reported by the SAVI against the cumulative logarithmic returns generated by the five portfolios in this analysis.

Figure 2: Test for Correlation – All portfolios and SAVI

SUMMARY OUTPUT

<i>Regression Statistics</i>								
Multiple R	0.4411049							
R Square	0.1945735							
Adjusted R Square	0.0396838							
Standard Error	0.1082224							
Observations	32							

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	0.073564	0.0147128	1.256207	0.312317822
Residual	26	0.3045142	0.0117121		
Total	31	0.3780782			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0479132	0.0267641	1.7902058	0.0850742	-0.007101141	0.1029275	-0.0071011	0.1029275
Mean Reversion 1	0.569457	0.3474679	1.6388764	0.1132853	-0.14477355	1.2836875	-0.1447735	1.2836875
Mean Reversion 2	-0.9566761	0.8604304	-1.1118576	0.2763751	-2.725316109	0.8119639	-2.7253161	0.8119639
Momentum 1	0.5355806	0.4323214	1.238848	0.2264698	-0.353068884	1.42423	-0.3530689	1.42423
Momentum 2	0.4495915	0.7400048	0.6075521	0.5487548	-1.071510143	1.9706931	-1.0715101	1.9706931
Neutral	-0.7122583	0.93593	-0.7610166	0.4534945	-2.636089978	1.2115735	-2.63609	1.2115735

The above is for a three month holding period. The analysis for the remaining holding periods is included in the appendix. The level of significance in the ANOVA (0.31) indicates that the model is not a good fit and the R square suggests that only 19% of the dependent variables' outcomes are explained by the changes in investor sentiment. A linear regression of changes in sentiment to the returns of the ALSI as a whole offered similarly uninspiring results.

Figure 3: Test for Correlation – Changes in Sentiment and the J203

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.166082
R Square	0.0275832
Adjusted R Square	0.0175583
Standard Error	0.1052818
Observations	99

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.030498	0.030498	2.751468	0.1003954
Residual	97	1.0751731	0.0110843		
Total	98	1.1056711			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>	
Intercept	-0.0114491	0.0109596	-1.0446641	0.2987746	-0.0332009	0.0103027	-0.0332009	0.0103027	
	0.095520433	0.5277158	0.3181397	1.658755	0.1003954	-0.1037034	1.159135	-0.1037034	1.159135

Figure 4: Changes in Sentiment and J203 Returns



5.3 Time Series Analysis

A complete time series analysis was performed for the period of January 2000 – October 2017 to include all shares that were in the ALSI at the time that the respective portfolios were formed. The shares were ranked in terms of their preceding 12 month returns and allocated into quintile portfolios, based on this momentum. The following were the results:

Figure 5: Cumulative and Annualised Returns

Cumulative Returns

	Momentum 1	Momentum 2	Neutral	Mean Reversion 2	Mean Reversion 1	J 203
3 Months	937.87%	795.24%	923.17%	362.28%	-32.21%	392.88%
6 Months	309.25%	530.36%	528.64%	199.33%	10.88%	394.75%
9 Months	420.95%	494.24%	562.99%	273.93%	-14.70%	334.25%
12 Months	354.58%	442.45%	571.66%	314.77%	86.05%	376.98%
18 Months	480.07%	555.28%	361.52%	262.23%	127.33%	368.04%
24 Months	257.77%	541.03%	586.71%	306.34%	186.30%	336.37%

Annualised Returns

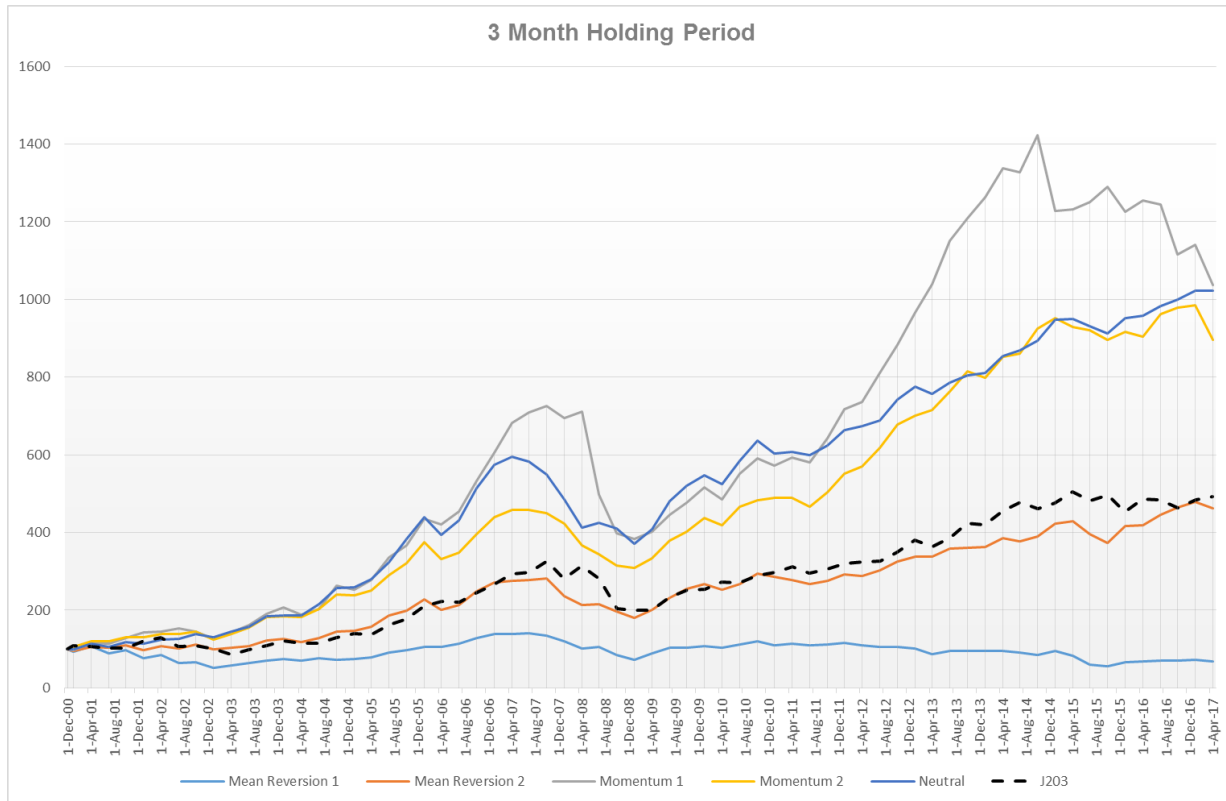
	Momentum 1	Momentum 2	Neutral	Mean Reversion 2	Mean Reversion 1	J 203
3 Months	15.24%	14.21%	15.14%	9.72%	-2.33%	10.15%
6 Months	8.92%	11.80%	11.79%	6.87%	0.63%	10.18%
9 Months	10.52%	11.41%	12.15%	8.32%	-0.96%	9.31%
12 Months	9.61%	10.79%	12.24%	9.00%	3.83%	9.93%
18 Months	11.24%	12.07%	9.71%	8.11%	5.10%	9.81%
24 Months	8.03%	11.92%	12.39%	8.87%	6.58%	9.34%

The reason for the differing returns in the J203 is that, due to the length of the holding periods varying, there are a different amount of completed portfolios for each holding period.

The results were consistent with the literature on momentum portfolios, illustrating the excess returns earned by a short holding period, with regular rebalancing. In the time-series analysis, the most profitable tactic was one of a quarterly rebalancing, which yielded an annualized return of 15.24%, after taking into account the 1% transaction cost on each quarterly rebalancing. The analysis for other holding periods is contained in the appendix to this research.

The graphical representation of the time-series analysis for the three month holding period is as follows:

Figure 6: Time Series Analysis of Three Month Holding Periods



The time-series data clearly shows that the Momentum1 portfolio achieved the highest returns over the period, but there has been a significant loss experienced by the portfolio since the end of 2014. These periods, as well as the significant downturn in 2008, are the kinds of periods that this research seeks to be able to identify, to allow investors to adopt a less volatile strategy, until periods of relative optimism are available again for momentum trading to exploit.

5.4 Individual Periods of Poor Performance

Having confirmed that the strategy of buying past winners and using a three month holding and rebalancing tactic has yielded the highest returns, we can now investigate the individual periods (quarterly) where the Momentum 1 portfolio was outperformed by mean reversion strategies. An analysis of periods where the Momentum 1 portfolio was outperformed by mean reversion strategies is as follows:

Figure 7: Momentum Performance During Financial Crisis

	1-Apr-10	1-Jan-15	1-Jan-16	1-Jul-16	1-Oct-16	1-Apr-17
Mean Reversion 1	-4.13%	10.89%	18.96%	2.23%	1.83%	-4.88%
Mean Reversion 2	-5.42%	8.77%	11.80%	6.48%	4.42%	-3.30%
Momentum 1	-5.86%	-13.77%	-5.04%	-0.82%	-10.34%	-9.00%

What is immediately noticeable, and alarmingly so for momentum investors, is the concentration of these poor performances over the past two years. It should however be noted that the portfolios included resource stocks and are formed on a long-only basis. Introducing a short-leg would likely reduce these recent reversals.

5.5 Event Study

An event study was performed around the formation dates of these poor performing momentum portfolios. It is well reported in the academic literature that profits from momentum portfolios occur primarily during periods of positive sentiment, but this sample shows a relative indifference to the levels of investor sentiment during the three month period, prior to the formation of these portfolios.

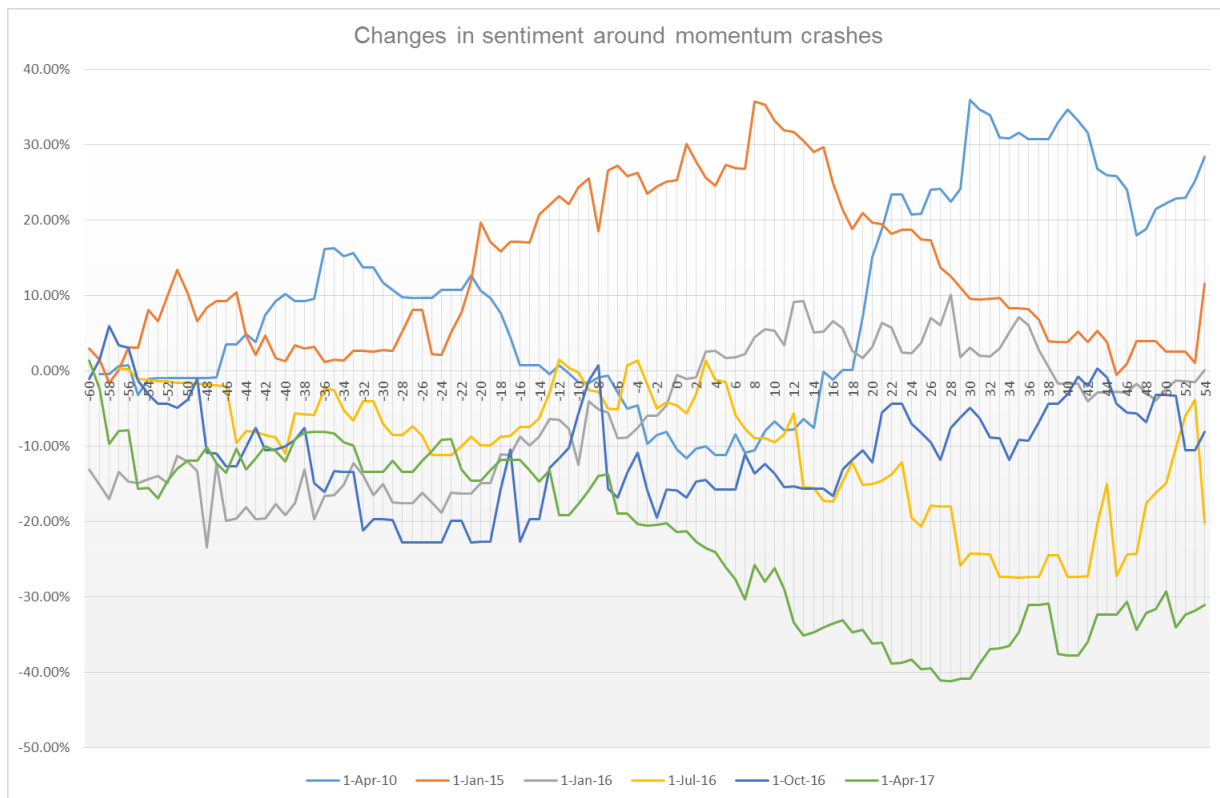
The methodology used by Antoniou et al. (2013) was followed and break points for the classification of sentiment periods were set at the 30% and 70% levels for periods of high and low sentiment respectively, with the median 40% being considered to be neutral.

Figure 8: Sentiment Periods Leading to Unprofitable Momentum Returns

Row Labels	Count of Classification
1-Apr-10	59.00
High	36.00
Neutral	23.00
1-Jan-15	60.00
Low	22.00
Neutral	38.00
1-Jan-16	63.00
Neutral	63.00
1-Jul-16	57.00
High	21.00
Neutral	36.00
1-Apr-17	60.00
Low	31.00
Neutral	29.00

With the date of portfolio formation being treated as the event date, the changes in levels of investor sentiment for the 60 days prior and the 60 days subsequent to the event appear as follows:

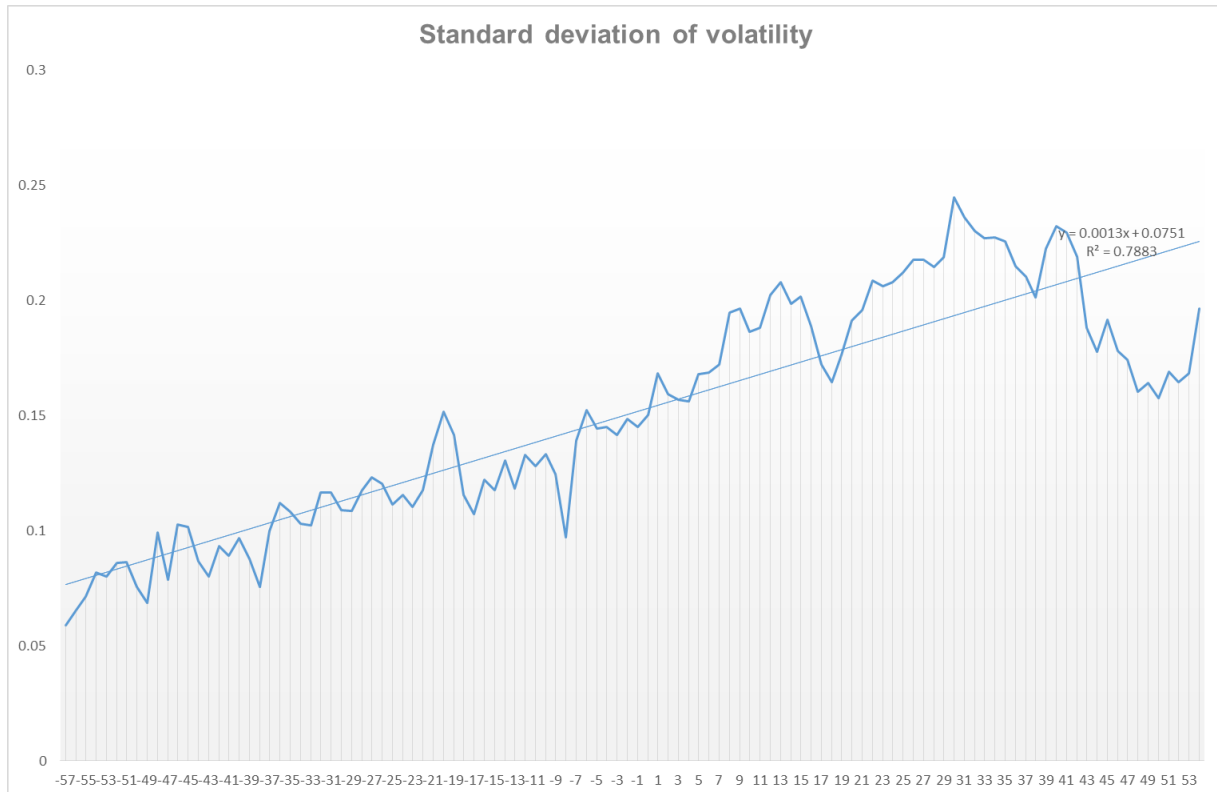
Figure 9: Event Study – Changes in Daily Investor Sentiment Around Momentum Crashes



5.6 Determinants of Poor Performance of Losing Momentum Portfolios

On first sight, it is not immediately apparent that there is any prevalent trend or correlation between the results. What is noticeable is the increased levels of volatility after the event date (the date of portfolio formation). An average standard deviation was used to measure the dispersion of the changes in sentiment and there was a marked increase during the 60 days prior and post the event date.

Figure 10: Dispersion of Daily Volatility Around the Formation of Losing Momentum Portfolios



In a simple linear regression, the increased volatility was found to increase in the 60 day period leading to the event date and continue through the holding period of the three month losing momentum portfolio.

To determine whether or not this observation might be applied to all periods of three month momentum returns, a multiple regression was performed by comparing the standard deviations of the volatility of the SAVI scores in the three months prior to portfolio formulation, as well as the three months of holding the momentum portfolio. This test was done to determine if the relatively high coefficient of determination (0.7883) mentioned above was attributable to the formation or holding period. The descriptive statistics below show that there

is no significant relationship when the data was extended to include periods of relatively normal or good performance in momentum portfolios.

Figure 11: Correlation Between Changes in Investor Sentiment Before and After Formation of Losing Momentum Portfolios

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.4241847
R Square	0.1799326
Adjusted R Square	0.0888141
Standard Error	0.0829002
Observations	31

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	0.0407132	0.0135711	1.9747083	0.141537768
Residual	27	0.185556	0.0068724		
Total	30	0.2262692			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.2779954	0.1269499	2.1898043	0.0373562	0.017515757	0.538475	0.0175158	0.538475
3 Mnth prior changes	-4.4173373	2.3220412	-1.902351	0.0678422	-9.181772284	0.3470977	-9.1817723	0.3470977
3 Mth post changes	-2.3648359	2.3912147	-0.9889685	0.3314591	-7.27120315	2.5415313	-7.2712032	2.5415313
STD Dev on daily changes	-4.3521757	3.1694596	-1.3731602	0.1809996	-10.8553696	2.1510182	-10.85537	2.1510182

From the small sample available, it can't be inferred that there is a direct correlation between volatility leading up to the formation of momentum portfolios, although the sample indicated that there were high levels of volatility in the holding period of poorly performing momentum portfolios. The volatility during the holding period may be of academic interest, but it does not serve the purpose of acting as a market timing tool for investors.

In furthering examining investor sentiment's potential to serve as a market timing tool, the data could be extended by using the BCI.

5.7 Levels of Sentiment and Subsequent returns

As the level of volatility showed no correlation with subsequent returns for the three month portfolios, sentiment periods were investigated to determine if they could serve as a timing tool.

The BCI offers the advantage of extending the data further than the SAVI, having been introduced in 1981. It gives quarterly measures of sentiment, which lends itself more to classifying sentiment periods as either positive, neutral or negative, as volatility (as measured through daily scores) is not possible.

The BCI scores were ranked into these periods, using the 30% and 70% breakpoints as suggested by Antoniou et al. (2013). A multiple regression was then run to determine the correlation between the prior quarter's level of sentiment, current quarter's level of sentiment and the returns from the three months momentum portfolio.

Figure 12: BCI Classifications as Leading and Contemporaneous Effects

SUMMARY OUTPUT

<i>Regression Statistics</i>									
Multiple R	0.06202049								
R Square	0.003846541								
Adjusted R Square	-0.028287441								
Standard Error	0.79920254								
Observations	65								

<i>ANOVA</i>									
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>				
Regression	2	0.152915	0.076457402	0.119703	0.887388				
Residual	62	39.60093	0.638724699						
Total	64	39.75385							

	<i>Coefficients</i>	<i>Standard Err</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.041515412	0.11324	9.197437795	3.41E-13	0.815152	1.267878	0.815152	1.267878
Leading Effect	0.491936757	1.02514	0.479872614	0.633007	-1.55729	2.541163	-1.55729	2.541163
Contemporaneous Effect	-0.015895223	1.036597	-0.015334046	0.987815	-2.08802	2.056232	-2.08802	2.056232

This shows that investor sentiment (as gauged through the BCI) has no significant effect as either a leading indicator of market performance of three month momentum portfolios, or any contemporaneous effect. The table below provides the methodology used in arriving at this conclusion.

Figure 13: Classification into Different Sentiment Periods

Period ends	RMB/BER Business Confidence Index	Percentile	Sentiment Period	Leading Effect	Contemporaneous Effect
Jun-99	15	0.00%	Low		
Sep-99	25	2.70%	Low		
Dec-99	36	16.60%	Low	-1.67%	
Mar-00	44	45.80%	Neutral	19.68%	-1.67%
Jun-00	36	16.60%	Low	-2.44%	19.68%
Sep-00	39	29.10%	Low	13.78%	-2.44%
Dec-00	30	9.70%	Low	9.77%	13.78%
Mar-01	33	12.50%	Low	2.42%	9.77%
Jun-01	39	29.10%	Low	5.50%	2.42%
Sep-01	38	23.60%	Low	-4.93%	5.50%
Dec-01	47	52.70%	Neutral	-13.77%	-4.93%
Mar-02	57	70.80%	High	12.85%	-13.77%
Jun-02	68	77.70%	High	13.20%	12.85%
Sep-02	68	77.70%	High	18.24%	13.20%
Dec-02	64	75.00%	High	9.53%	18.24%
Mar-03	59	72.20%	High	-9.23%	9.53%
Jun-03	50	62.50%	Neutral	7.94%	-9.23%
Sep-03	54	68.00%	Neutral	29.17%	7.94%
Dec-03	61	73.60%	High	-3.59%	29.17%
Mar-04	68	77.70%	High	9.33%	-3.59%
Jun-04	70	81.90%	High	21.27%	9.33%
Sep-04	79	86.10%	High	9.30%	21.27%
Dec-04	87	100.00%	High	18.57%	9.30%
Mar-05	78	84.70%	High	-3.52%	18.57%
Jun-05	82	91.60%	High	8.10%	-3.52%
Sep-05	86	98.60%	High	16.94%	8.10%
Dec-05	84	94.40%	High	14.03%	16.94%
Mar-06	85	95.80%	High	12.35%	14.03%
Jun-06	81	90.20%	High	3.99%	12.35%
Sep-06	85	95.80%	High	2.57%	3.99%
Dec-06	83	93.00%	High	-4.33%	2.57%
Mar-07	80	87.50%	High	2.26%	-4.33%
Jun-07	80	87.50%	High	-29.91%	2.26%
Sep-07	72	83.30%	High	-20.26%	-29.91%
Dec-07	67	76.30%	High	-3.26%	-20.26%
Mar-08	48	56.90%	Neutral	4.53%	-3.26%
Jun-08	45	48.60%	Neutral	10.89%	4.53%
Sep-08	34	15.20%	Low	6.82%	10.89%
Dec-08	33	12.50%	Low	8.23%	6.82%
Mar-09	27	5.50%	Low	-5.86%	8.23%
Jun-09	26	4.10%	Low	13.62%	-5.86%
Sep-09	23	1.30%	Low	7.06%	13.62%
Dec-09	28	6.90%	Low	-2.86%	7.06%
Mar-10	43	41.60%	Neutral	3.36%	-2.86%
Jun-10	36	16.60%	Low	-2.03%	3.36%
Sep-10	47	52.70%	Neutral	10.70%	-2.03%
Dec-10	44	45.80%	Neutral	11.64%	10.70%
Mar-11	55	69.40%	Neutral	2.75%	11.64%
Jun-11	48	56.90%	Neutral	10.03%	2.75%
Sep-11	39	29.10%	Low	9.02%	10.03%
Dec-11	38	23.60%	Low	9.29%	9.02%
Mar-12	52	65.20%	Neutral	7.45%	9.29%
Jun-12	41	34.70%	Neutral	10.81%	7.45%
Sep-12	47	52.70%	Neutral	5.04%	10.81%
Dec-12	46	50.00%	Neutral	4.45%	5.04%
Mar-13	52	65.20%	Neutral	5.96%	4.45%
Jun-13	48	56.90%	Neutral	-0.77%	5.96%
Sep-13	42	38.80%	Neutral	7.28%	-0.77%
Dec-13	43	41.60%	Neutral	-13.77%	7.28%
Mar-14	41	34.70%	Neutral	0.39%	-13.77%
Jun-14	41	34.70%	Neutral	1.42%	0.39%
Sep-14	46	50.00%	Neutral	3.22%	1.42%
Dec-14	51	63.80%	Neutral	-5.04%	3.22%
Mar-15	49	61.10%	Neutral	2.35%	-5.04%
Jun-15	43	41.60%	Neutral	-0.82%	2.35%
Sep-15	38	23.60%	Low	-10.34%	-0.82%
Dec-15	36	16.60%	Low	2.26%	-10.34%
Mar-16	36	16.60%	Low	-9.00%	2.26%
Jun-16	32	11.10%	Low		-9.00%
Sep-16	42	38.80%	Neutral		
Dec-16	38	23.60%	Low		
Mar-17	40	33.30%	Neutral		
Jun-17	29	8.30%	Low		

6 Discussion of Results

The methodology followed in the analysis was to test for the effectiveness of investor sentiment as a market timing tool for switching between a momentum portfolio, with short holding periods of three months, to a mean reversion portfolio.

This was seen as being a viable strategy, as momentum portfolios are prone to severe crashes in adverse economic conditions (Daniel & Moskowitz, 2013; Barroso & Santa-Clara, 2015). The time series analysis established that a momentum strategy with three month holding periods was the most profitable of the different permutations analysed, so the testing was performed against the periods of poor performance in this particular portfolio.

6.1 Analysis of Tests for Correlation

Prior research has found that sentiment leads market performance (Solanki & Seetheram, 2014; Siganos, Veganas-Nanos & Verwijmeren, 2014; Sun, Najand & Shen, 2016).

Testing for correlation between the quintile portfolios and the levels of sentiment reported by SAVI was the most obvious way to determine whether or not investor sentiment has a direct relationship with any of the strategies.

The P-Values returned by the multiple regression confirmed that there is no significant relationship between SAVI and any one approach when applying a 12 month formation period and a three month holding period, at a 95% confidence level. Further to this, the ANOVA Significance F level was also too high at 03123.

The most significant relationship was between SAVI and the Mean Reversion1 portfolio (the weakest performing shares in the 12 month formation). This was however still not statistically significant, with a P-Value of 0.1132, well above the necessary 0.05. The Mean Reversion1 portfolio was also consistently the worst performing portfolio in the time series analysis across the different holding periods, even when the holding periods were extended to 18 and 24

month to allow for mean reversion as it typically takes a longer period to realise returns (Poterba & Summers, 1989; Cubin et al., 2006; Zakamulin, 2016).

The returns of the J203 were also viewed in their totality in a simple linear regression against the values reported in the SAVI. This yielded similarly disappointing results with an R Squared (Pearson) of just 0.027, implying that only 2.7% the dependent variable's (J203 returns) can be explained by the scores reported in the SAVI.

6.2 Time Series Analysis

Although the SAVI was first introduced in 2009, data was collected from 1 Jan 2000 to allow for a more accurate time series analysis. The purpose of doing the time series analysis was to determine which combination of the 12 month formation period, various holding period and style-based approach had yielded the highest cumulative returns over this period.

Academic literature has found that momentum strategies with short holding periods generate the highest excess returns (Muller & Ward, 2013; Jegadeesh & Titman, 1993; Fama & French, 2008). This time series analysis corroborated these results, although the relatively recent run of poor performance in the Momentum1 portfolio was noticeable.

The Momentum1 portfolio with a three month holding period returned 937% over the 17 years, giving an annualized rate of 15.24%. The volatility of this approach is illustrated when the holding period is changed. The Momentum2 outperformed the J203, irrespective of the holding period applied and the Neutral portfolio outperformed the benchmark in all but one of the holding periods used. The Momentum1 portfolio, despite offering the highest cumulative returns, displayed quite severe volatility with a simple change in the holding period. Had either a six, 12 or 24 month holding period been applied, the Momentum1 portfolio would have been outperformed by the J203. The reversal in returns over the 12 and 24 month holding periods is perhaps not surprising, as momentum portfolios tend to revert to a historic mean if longer periods are applied (Jegadeesh & Titman, 1993), but the six month performance was surprising.

In addition to the above, the noticeable recent poor performance of the Momentum1 portfolio should be cause for concern for anyone actively engaged in momentum investing.

Since the inception of the SAVI in 2009 there have been only six quarters in which the Momentum1 portfolio was outperformed by mean reversion strategies. This is largely due to the use of the three month holding period, when we know that reversion happens over longer periods, but five of the six periods in which momentum was outperformed have occurred since 2015. In all six instances, not only was the portfolio outperformed, but it experienced negative returns, the most severe being a 13.77% decline in the first quarter of 2015 and a 10.34% loss in the third quarter of 2016. It is perhaps beyond the scope of this research to attribute these severe losses to circumstances in the broader, socio-political environment, but this may have potentially played a role in the increased volatility of the portfolio. It also serves to highlight the potential pitfalls of this approach to investing. The potential downside could, of course, have been reduced by hedging the portfolio to allow short-selling, or potentially by excluding the resources sector from the portfolio.

The time-series data also showed the downturn following the 2008 financial crisis. While all five portfolios felt the effect of the crisis, the effect on the Momentum 1 portfolio appears particularly pronounced during this period.

Closer inspection of the period reveals the full extent of the loss suffered by the Momentum1 portfolio during this period. The third and fourth quarter saw around half of the value of the portfolio lost, compared to the average of the J203 of around 20%. This supports the findings of Daniel & Moskowitz (2013).

Figure 14: Returns of Different Portfolios During 2008 Financial Crisis

Row Labels	1-Jan-08	1-Apr-08	1-Jul-08	1-Oct-08	1-Jan-09	1-Apr-09	1-Jul-09
Mean Reversion 1	-11.79%	-15.22%	4.16%	-20.43%	-14.24%	23.36%	16.32%
Mean Reversion 2	-16.04%	-9.51%	0.80%	-9.03%	-8.12%	11.75%	15.60%
Momentum 1	-4.33%	2.26%	-29.91%	-20.26%	-3.26%	4.53%	10.89%
Momentum 2	-6.22%	-13.12%	-6.50%	-8.14%	-1.83%	7.61%	13.89%
Neutral	-11.45%	-15.09%	3.01%	-3.50%	-9.51%	10.26%	17.56%
J203 Average	-10.00%	-10.17%	-5.56%	-12.03%	-7.39%	11.47%	14.89%

As the multiple regression of the SAVI values and the returns from the differing portfolios returned no significant relationship for the profitable momentum holding period of three months, an event study was conducted to determine the changes in daily sentiment volatility for the 60 days prior and 60 days after the formation of the portfolios.

6.3 Event Study

The relationship between volatility and sentiment has been established in the academic literature (Kim & Kim, 2014; Siganos, Veganas-Nanos & Verwijmeren, 2014; Schnedler, Heiden, Heiden & Hamid, 2017) and it was envisaged that the changes in sentiment could serve as a timing tool for the six periods of poor performance of the Momentum1 portfolio. The JSE states that the SAVI serves as a measure of sentiment and is a tool for forecasting three month volatility (JSE, 2017). Further to this, although the sample is relatively small, there was little to establish any kind of correlation between a prevailing period of sentiment when classified into high, neutral and low periods using 30% and 70% breakpoints, so sentiment period classification did not appear to be a suitable independent variable for the event study. The SAVI offers the benefit of being able to provide high-frequency measures of sentiment, which has been advocated for in much of the literature (Uyger & Tas, 2013; Hill-Kleespie, 2017).

The event study gives a graphic representation of the volatility of changes in daily sentiment. The graph broadly shows that the standard deviation of the changes in daily investor sentiment is much lower in the 60 day period leading to portfolio formation. After the event date (date of portfolio formation) the volatility generally increases.

To examine the observation statistically, a simple linear correlation between the days around the event date and the average standard deviation of the daily changes in investor sentiment was performed. The changes in daily investor sentiment were treated as the dependent variable.

The R-Squared measured was 0.7883, implying that 78% of the volatility of daily changes in investor sentiment can be attributed to the point in time of the event study. Given that these portfolios had performed strongly leading up to the event date and subsequently included in the Momentum1 portfolio, the changes in sentiment could be a result of the poor performance of these portfolios, contradicting the literature that states that sentiment leads performance (Solanki & Seetheram, 2014; Siganos, Veganas-Nanos & Verwijmeren, 2014; Sun, Najand & Shen, 2016).

The encouraging results from this were then extended to all of the quarterly Momentum1 results since the inception of the SAVI and a multiple regression performed to determine whether or not any correlation exists between the volatility of the daily changes in investor sentiment for the 60 days prior to the event, or to the 60 days after the event. This test was performed to determine whether or not the increase in standard deviation particularly correlates with the 60 days prior to the event. The 60 days post the portfolio formation are of little practical use as the rebalancing of the portfolio has already occurred.

The level of significance was found to be more substantial in the 60 days prior to the event (P-Value of 0.067) compared to the 60 days after the event (0.331), but is still not statistically significant at the 95% confidence interval.

6.4 Extending the Analysis with the BCI

Owing to the small sample size allowed by using the SAVI, the analysis was extended to make use of the BCI.

While it offers the advantage of extending the amount of data available for the event study, it can't be deemed to be an accurate measure of changes in sentiment. The BCI is a quarterly announcement of survey results and the infrequency with which it generates results makes it unsuitable for accurately gauging changes in prevailing sentiment and applying them to a market timing philosophy.

It does however, allow for the classification of the quarterly results into the sentiment periods used by Antoniou et al. (2013) and make use of 30% and 70% breakpoints. The timing also

coincides with the quarterly portfolio re-balancing, allowing for an analysis of whether these periods of investor sentiment are a leading indicator of the success of the momentum portfolio, or if the relationship is merely contemporaneous.

The obligatory multiple regression was performed again and no evidence found to support either a leading or contemporaneous effect with the returns of the Momentum1 portfolio.

7 Conclusions and Recommendations

7.1 Conclusion

The overall research question was to determine whether or not the SAVI, serving as a proxy for investor sentiment could be used as a market timing tool in combining momentum and mean reversion strategies.

To answer this a time-series analysis was conducted to determine what had been the most profitable strategy. In line with the existing literature (Muller & Ward, 2013; Jegadeesh & Titman, 1993), a momentum strategy making use of short holding periods of three months was found to generate the highest cumulative returns when examining individual styles. On analyzing the quarterly returns generated by the five quintile portfolios, only six quarters were found where mean reversion returns exceeded those of the momentum portfolio.

This lead to the need for the market-timing tool to only identify the periods where mean reversion generated higher returns. The SAVI was analysed against the individual styles to determine any correlation that may serve as a reliable predictor of the individual portfolios returns, but no correlation was found to either the total returns of the All Share Index or the individual style-based portfolios.

The SAVI was then analysed through an event study to determine whether or not any correlation existed between the changing daily volatility and the returns earned on the poorly performing momentum portfolios, but again no correlation was present. However, the resulting analysis did provide evidence of the JSE's assertion that it is a predictor of the following three months volatility.

The changes in volatility were then segregated into the formation and holding periods to check for correlation suggesting either a leading or a contemporaneous effect and the data sample increased by using the historic records of the FNB Business Confidence Index. Again, no correlation was found.

As a result, the researcher concludes that the SAVI is not a reliable market timing tool for the purposes of combining mean reversion and momentum strategies, but has served as a predictor of increased volatility during periods of poor performance of momentum strategies.

7.2 Areas for Further Research

Further research into investor sentiment's suitability as a market timing tool could be performed. The suggested areas for further research are to exclude the resources sector from a similar analysis and introduce short-selling.

Determining a more suitable proxy for investor sentiment may also be useful and extend the period under study and it should be investigated if a suitable indirect measure, such as the Baker-Wurgler could be created for the JSE.

An analysis of individual share's reactions to changes in investor sentiment could also be performed, as well as an analysis of the size effect by examining small shares outside of the All Share Index.

The potential for mean reversion strategies could also be improved with a lengthier sample period by including longer holding periods in the analysis.

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Appendices:

Cumulative and annualised returns from styles-based portfolios

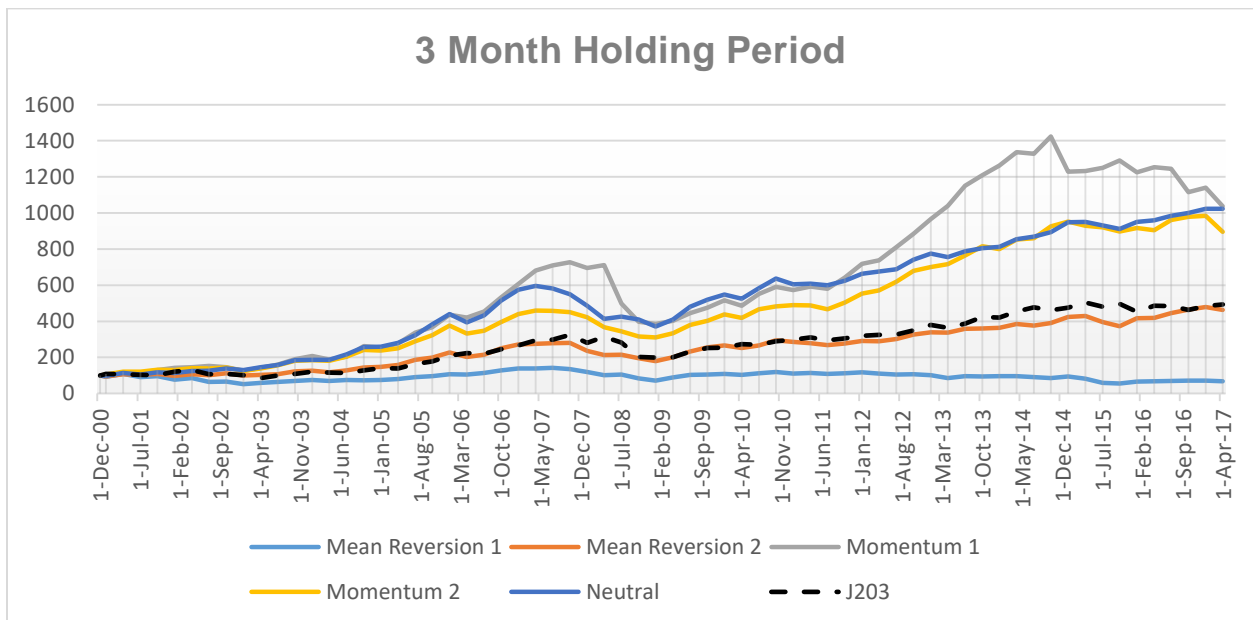
Cumulative Returns

	Momentum 1	Momentum 2	Neutral	Mean Reversion 2	Mean Reversion 1	J 203
3 Months	937.87%	795.24%	923.17%	362.28%	-32.21%	392.88%
6 Months	309.25%	530.36%	528.64%	199.33%	10.88%	394.75%
9 Months	420.95%	494.24%	562.99%	273.93%	-14.70%	334.25%
12 Months	354.58%	442.45%	571.66%	314.77%	86.05%	376.98%
18 Months	480.07%	555.28%	361.52%	262.23%	127.33%	368.04%
24 Months	257.77%	541.03%	586.71%	306.34%	186.30%	336.37%

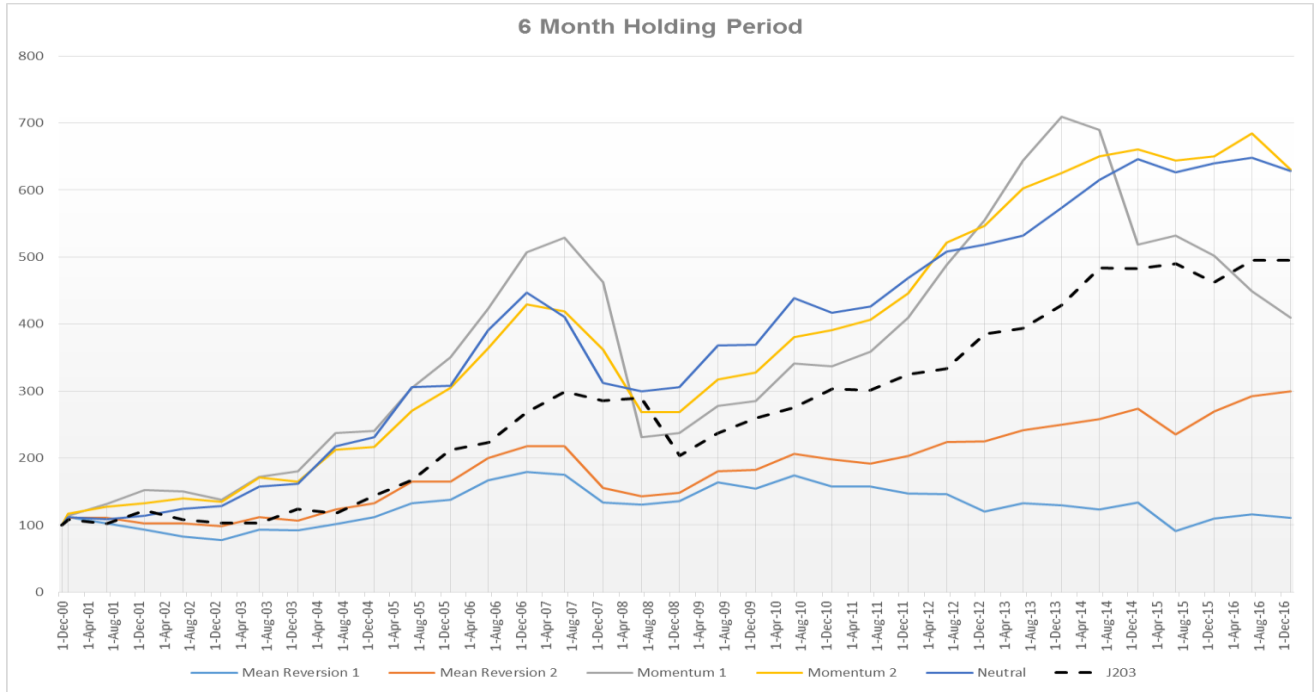
Annualised Returns

	Momentum 1	Momentum 2	Neutral	Mean Reversion 2	Mean Reversion 1	J 203
3 Months	15.24%	14.21%	15.14%	9.72%	-2.33%	10.15%
6 Months	8.92%	11.80%	11.79%	6.87%	0.63%	10.18%
9 Months	10.52%	11.41%	12.15%	8.32%	-0.96%	9.31%
12 Months	9.61%	10.79%	12.24%	9.00%	3.83%	9.93%
18 Months	11.24%	12.07%	9.71%	8.11%	5.10%	9.81%
24 Months	8.03%	11.92%	12.39%	8.87%	6.58%	9.34%

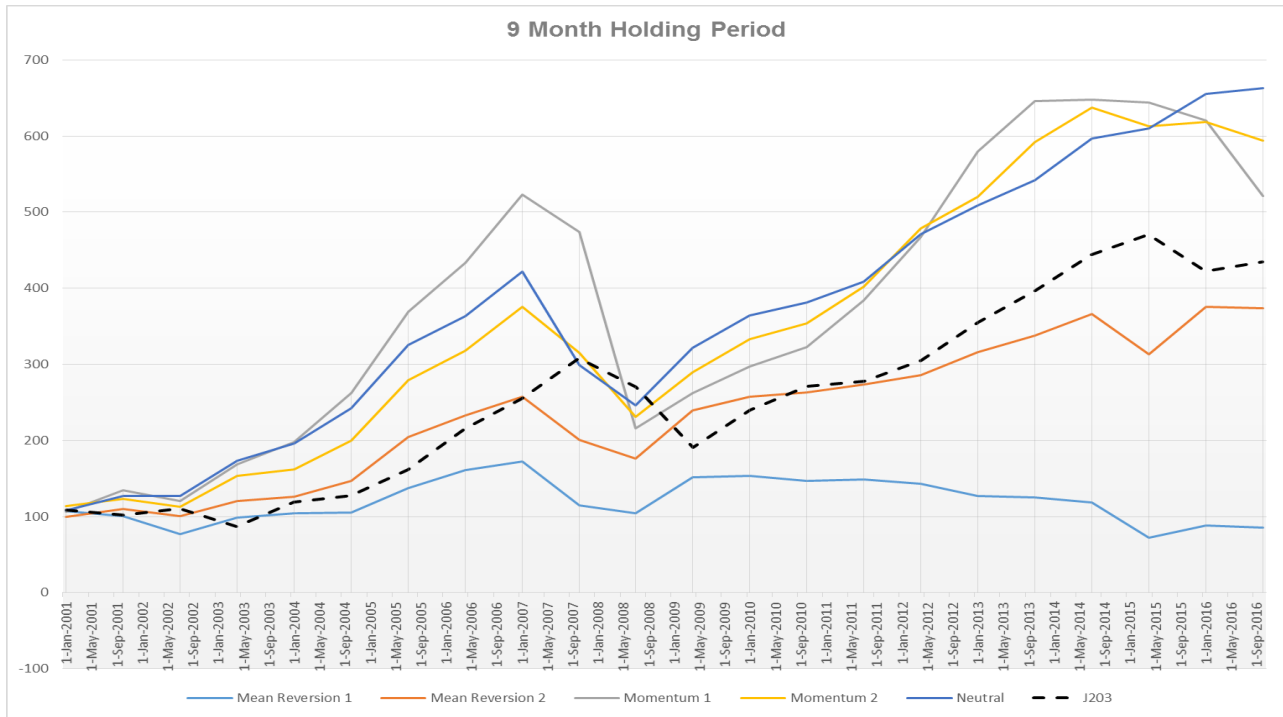
Portfolios with a 3 month holding period



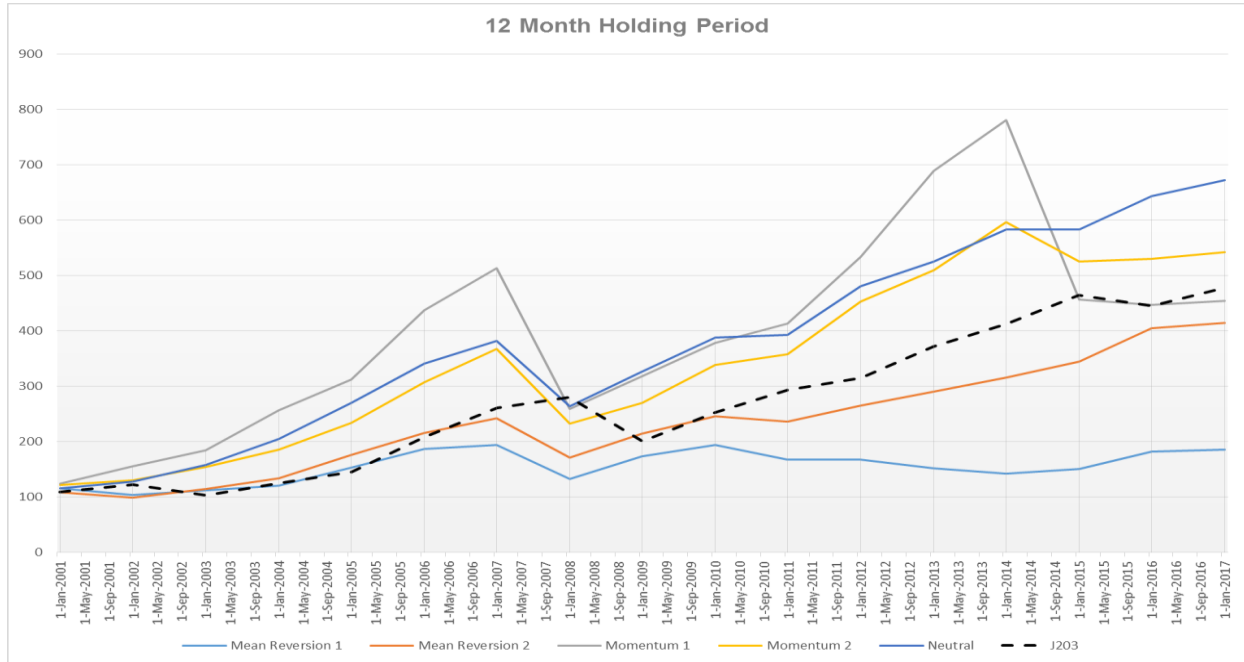
Portfolios with a 6 month holding period



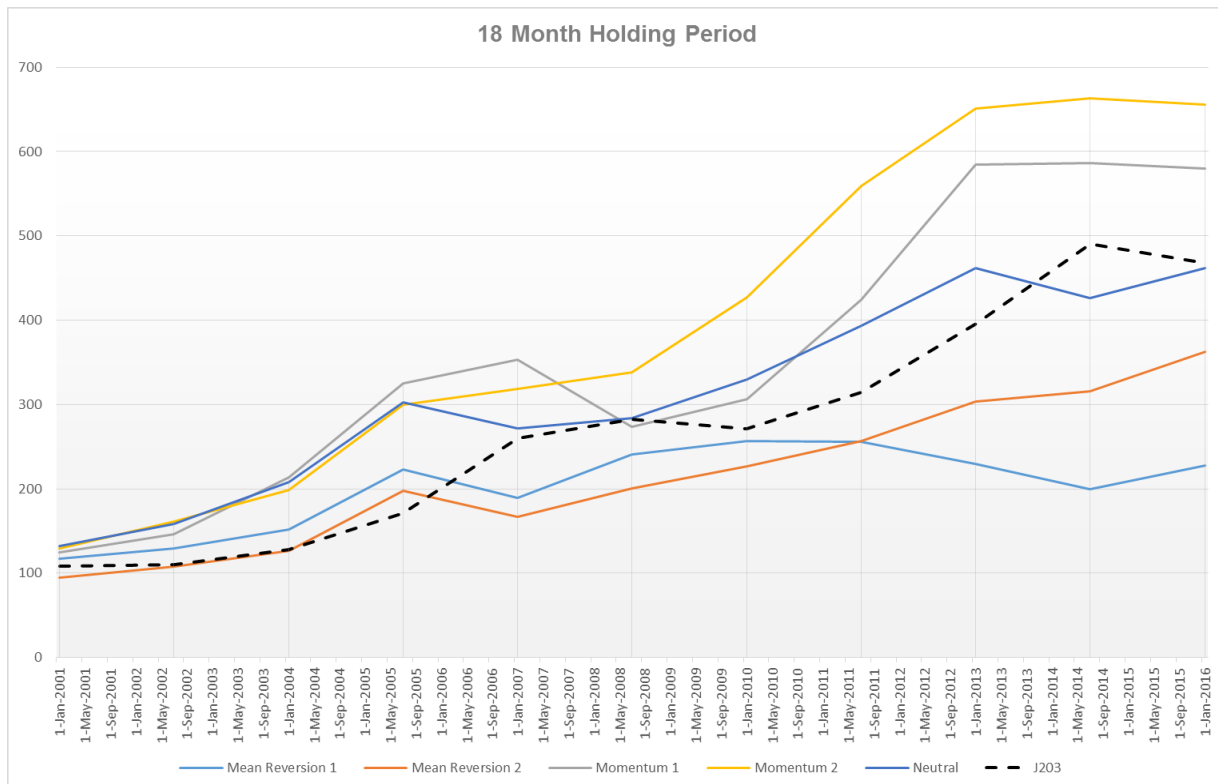
Portfolios with a 9 month holding period



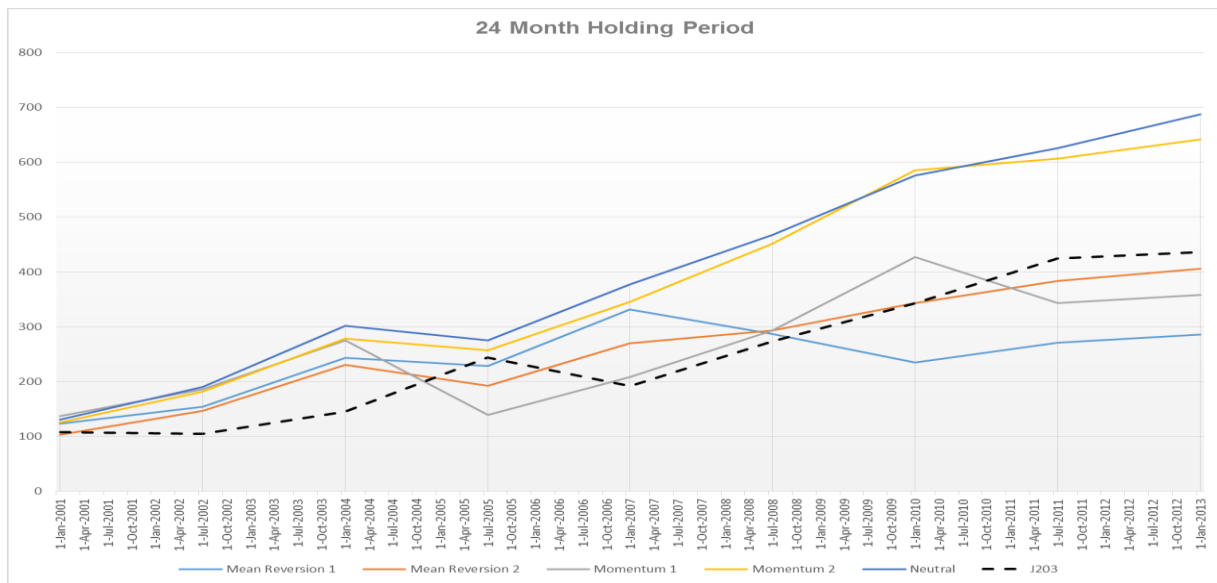
Portfolios with a 12 month holding period



Portfolios with an 18 month holding period



Portfolios with a 24 month holding period



Linear regression analysis: J203 returns and monthly changes in the SAVI



Regression: SAVI and J203

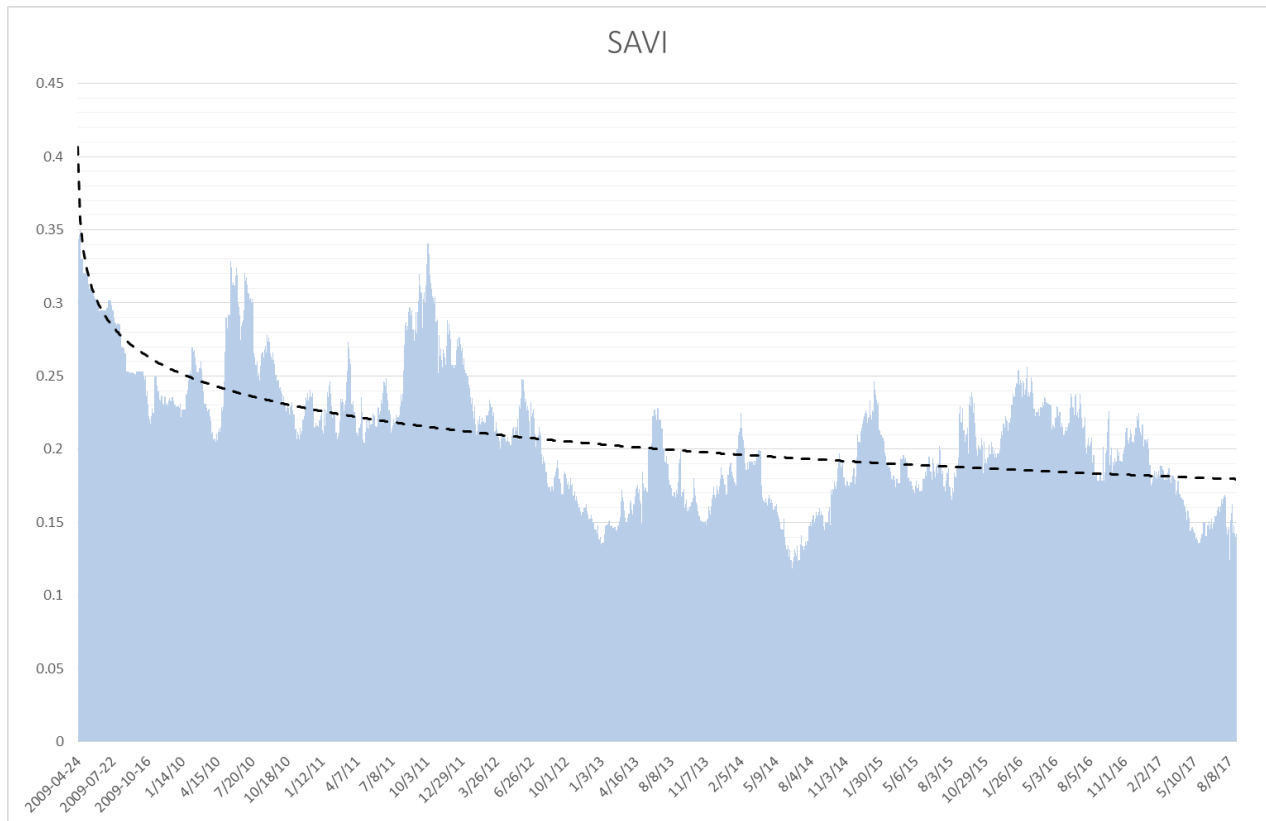
SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.166082
R Square	0.0275832
Adjusted R Square	0.0175583
Standard Error	0.1052818
Observations	99

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.030498	0.030498	2.751468	0.1003954
Residual	97	1.0751731	0.0110843		
Total	98	1.1056711			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>	
Intercept	-0.0114491	0.0109596	-1.0446641	0.2987746	-0.0332009	0.0103027	-0.0332009	0.0103027	
	0.095520433	0.5277158	0.3181397	1.658755	0.1003954	-0.1037034	1.159135	-0.1037034	1.159135

SAVI



Regression: SAVI and portfolios with 3 month holding periods

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.4411049
R Square	0.1945735
Adjusted R Square	0.0396838
Standard Error	0.1082224
Observations	32

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	0.073564	0.0147128	1.256207	0.312317822
Residual	26	0.3045142	0.0117121		
Total	31	0.3780782			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0479132	0.0267641	1.7902058	0.0850742	-0.007101141	0.1029275	-0.0071011	0.1029275
Mean Reversion 1	0.569457	0.3474679	1.6388764	0.1132853	-0.14477355	1.2836875	-0.1447735	1.2836875
Mean Reversion 2	-0.9566761	0.8604304	-1.1118576	0.2763751	-2.725316109	0.8119639	-2.7253161	0.8119639
Momentum 1	0.5355806	0.4323214	1.238848	0.2264698	-0.353068884	1.42423	-0.3530689	1.42423
Momentum 2	0.4495915	0.7400048	0.6075521	0.5487548	-1.071510143	1.9706931	-1.0715101	1.9706931
Neutral	-0.7122583	0.93593	-0.7610166	0.4534945	-2.636089978	1.2115735	-2.63609	1.2115735

Regression: SAVI and portfolios with 6 month holding periods

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.5416673
R Square	0.2934034
Adjusted R Square	0.1575195
Standard Error	0.1013654
Observations	32

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	0.1109294	0.0221859	2.1592207	0.0898848
Residual	26	0.2671487	0.010275		
Total	31	0.3780782			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0496084	0.0286028	1.7343865	0.0946925	-0.0091856	0.1084023	-0.0091856	0.1084023
Mean Reversion 1	0.6448986	0.2187711	2.9478243	0.0066777	0.1952083	1.094589	0.1952083	1.094589
Mean Reversion 2	-0.8669434	0.5313185	-1.6316831	0.1148013	-1.9590841	0.2251974	-1.9590841	0.2251974
Momentum 1	0.328727	0.2779633	1.182627	0.2476593	-0.2426349	0.9000888	-0.2426349	0.9000888
Momentum 2	0.3340063	0.6019866	0.5548402	0.5837462	-0.9033948	1.5714075	-0.9033948	1.5714075
Neutral	-0.2914321	0.5918624	-0.4923984	0.6265701	-1.5080227	0.9251585	-1.5080227	0.9251585

Regression: SAVI and portfolios with 9 month holding periods

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.5036162
R Square	0.2536293
Adjusted R Square	0.1100964
Standard Error	0.1041793
Observations	32

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	0.0958917	0.0191783	1.767047	0.154881849
Residual	26	0.2821865	0.0108533		
Total	31	0.3780782			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0735427	0.033243	2.2122774	0.035937	0.005210768	0.1418746	0.0052108	0.1418746
Mean Reversion 1	0.6040168	0.2292757	2.6344558	0.0140103	0.132733776	1.0752998	0.1327338	1.0752998
Mean Reversion 2	-0.4638299	0.3985866	-1.1636868	0.2551193	-1.283136401	0.3554765	-1.2831364	0.3554765
Momentum 1	0.1218844	0.2212985	0.5507691	0.5864938	-0.333001185	0.5767699	-0.3330012	0.5767699
Momentum 2	0.4008164	0.490164	0.817719	0.4209486	-0.606730084	1.4083629	-0.6067301	1.4083629
Neutral	-0.6955705	0.5041823	-1.3796011	0.1794603	-1.731932029	0.3407911	-1.731932	0.3407911

Regression: SAVI and portfolios with 12 month holding periods

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.3612225
R Square	0.1304817
Adjusted R Square	-0.0305402
Standard Error	0.1105189
Observations	33

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	5	0.0494889	0.0098978	0.8103351	0.5525856
Residual	27	0.3297895	0.0122144		
Total	32	0.3792784			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0521985	0.0343647	1.518956	0.1403977	-0.0183121	0.1227091	-0.0183121	0.1227091
Mean Reversion 1	0.3483605	0.2926411	1.1904019	0.24425	-0.2520894	0.9488105	-0.2520894	0.9488105
Mean Reversion 2	0.1381124	0.3792112	0.3642098	0.7185382	-0.6399646	0.9161894	-0.6399646	0.9161894
Momentum 1	0.247377	0.2554535	0.968384	0.3414478	-0.2767702	0.7715242	-0.2767702	0.7715242
Momentum 2	0.0356796	0.4833905	0.0738111	0.9417048	-0.9561557	1.0275149	-0.9561557	1.0275149
Neutral	-0.727974	0.441322	-1.6495304	0.1106269	-1.633492	0.1775439	-1.633492	0.1775439

Regression: SAVI and portfolios with 18 month holding periods

SUMMARY OUTPUT

<i>Regression Statistics</i>								
Multiple R		0.4464145						
R Square		0.1992859						
Adjusted R Square		0.0453024						
Standard Error		0.1079053						
Observations		32						

<i>ANOVA</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	5	0.0753456	0.0150691	1.294203	0.2967363	
Residual	26	0.3027325	0.0116436			
Total	31	0.3780782				

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0482301	0.039758	1.2130925	0.2360011	-0.0334936	0.1299538	-0.0334936	0.1299538
Mean Reversion 1	0.4912356	0.2812424	1.7466625	0.0925014	-0.0868665	1.0693377	-0.0868665	1.0693377
Mean Reversion 2	-0.2785068	0.3705357	-0.7516329	0.4590222	-1.040154	0.4831403	-1.040154	0.4831403
Momentum 1	0.4080518	0.277376	1.4711143	0.1532607	-0.1621027	0.9782064	-0.1621027	0.9782064
Momentum 2	0.105984	0.3138891	0.3376481	0.7383394	-0.5392242	0.7511923	-0.5392242	0.7511923
Neutral	-0.6437752	0.3200727	-2.0113407	0.054763	-1.301694	0.0141436	-1.301694	0.0141436

Regression: SAVI and portfolios with 24 month holding periods

SUMMARY OUTPUT

<i>Regression Statistics</i>								
Multiple R		0.4543639						
R Square		0.2064465						
Adjusted R Square		0.0538401						
Standard Error		0.1074218						
Observations		32						

<i>ANOVA</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	5	0.0780529	0.0156106	1.3528036	0.2740895	
Residual	26	0.3000252	0.0115394			
Total	31	0.3780782				

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0240765	0.0453462	0.530948	0.5999614	-0.0691339	0.1172868	-0.0691339	0.1172868
Mean Reversion 1	0.1055823	0.2543855	0.4150484	0.6815116	-0.4173147	0.6284793	-0.4173147	0.6284793
Mean Reversion 2	0.0655044	0.3582848	0.1828277	0.8563514	-0.6709607	0.8019694	-0.6709607	0.8019694
Momentum 1	-0.0441558	0.2136843	-0.2066403	0.8379005	-0.4833901	0.3950786	-0.4833901	0.3950786
Momentum 2	0.5295242	0.3182984	1.663609	0.1081995	-0.1247477	1.183796	-0.1247477	1.183796
Neutral	-0.6156728	0.3334279	-1.8464944	0.0762342	-1.3010438	0.0696981	-1.3010438	0.0696981

Date	SAVI	5/9/11	0.219779	7/4/13	0.227719	7/28/15	0.186888
2009-04-24	0.343439884	5/10/11	0.213968	7/5/13	0.220725	7/29/15	0.180705
2009-04-28	0.340340965	5/11/11	0.214256	7/8/13	0.220374	7/30/15	0.17456
2009-04-29	0.346398883	5/12/11	0.219463	7/9/13	0.220208	7/31/15	0.171816
2009-04-30	0.349582729	5/13/11	0.216937	7/11/13	0.219754	8/3/15	0.174042
2009-05-04	0.34223982	5/16/11	0.214295	7/12/13	0.214629	8/4/15	0.168125
2009-05-05	0.32978151	5/17/11	0.217148	7/15/13	0.214186	8/5/15	0.165424
2009-05-06	0.329790074	5/19/11	0.217118	7/16/13	0.214186	8/6/15	0.168478
2009-05-07	0.329779618	5/20/11	0.217334	7/17/13	0.214106	8/7/15	0.173571
2009-05-08	0.326622964	5/23/11	0.224803	7/19/13	0.200703	8/11/15	0.170528
2009-05-11	0.320136562	5/24/11	0.22314	7/22/13	0.199171	8/12/15	0.184196
2009-05-12	0.320055872	5/25/11	0.223026	7/23/13	0.19908	8/13/15	0.175904
2009-05-13	0.320017554	5/26/11	0.218104	7/24/13	0.191215	8/14/15	0.181296
2009-05-14	0.319971887	5/27/11	0.215636	7/25/13	0.191138	8/17/15	0.180935
2009-05-15	0.323132021	5/30/11	0.215479	7/26/13	0.195374	8/18/15	0.17823
2009-05-18	0.322963076	5/31/11	0.212903	7/29/13	0.193363	8/19/15	0.186119
2009-05-19	0.319728296	6/1/11	0.215548	7/30/13	0.189907	8/20/15	0.18906
2009-05-20	0.319668812	6/2/11	0.223472	7/31/13	0.189856	8/21/15	0.194392
2009-05-21	0.313128141	6/3/11	0.228594	8/1/13	0.189888	8/24/15	0.193951
2009-05-22	0.313036904	6/6/11	0.228415	8/2/13	0.178817	8/25/15	0.224053
2009-05-25	0.309570431	6/7/11	0.223427	8/5/13	0.175435	8/26/15	0.229286
2009-05-26	0.309489495	6/8/11	0.226015	8/6/13	0.175445	8/27/15	0.229127
2009-05-27	0.309393904	6/9/11	0.226147	8/7/13	0.175455	8/28/15	0.218343
2009-05-28	0.309333515	6/10/11	0.233824	8/8/13	0.173516	8/31/15	0.218083
2009-05-29	0.309243986	6/13/11	0.231138	8/12/13	0.168044	9/1/15	0.228369
2009-06-01	0.310488523	6/14/11	0.231142	8/13/13	0.168031	9/2/15	0.223071
2009-06-02	0.310352175	6/15/11	0.238564	8/14/13	0.167626	9/3/15	0.212663
2009-06-03	0.310156228	6/17/11	0.246151	8/15/13	0.167637	9/4/15	0.212721
2009-06-04	0.304440287	6/20/11	0.245939	8/16/13	0.17074	9/7/15	0.21253
2009-06-05	0.303266943	6/21/11	0.241092	8/19/13	0.170565	9/8/15	0.204785
2009-06-08	0.302763291	6/22/11	0.243296	8/20/13	0.167411	9/9/15	0.204753
2009-06-09	0.30260212	6/23/11	0.248367	8/21/13	0.172155	9/10/15	0.209862
2009-06-10	0.302443843	6/24/11	0.243294	8/22/13	0.172212	9/11/15	0.209938
2009-06-11	0.302253681	6/27/11	0.238597	8/23/13	0.169709	9/14/15	0.214898
2009-06-12	0.30206999	6/28/11	0.233485	8/26/13	0.172102	9/16/15	0.197108
2009-06-15	0.301528781	6/29/11	0.228354	8/27/13	0.177227	9/17/15	0.19211
2009-06-17	0.301128727	6/30/11	0.226542	8/28/13	0.190127	9/18/15	0.230199
2009-06-18	0.294508884	7/1/11	0.226793	8/29/13	0.192452	9/21/15	0.229424
2009-06-19	0.294572191	7/4/11	0.224107	8/30/13	0.193139	9/22/15	0.236249
2009-06-22	0.294643394	7/5/11	0.221569	9/2/13	0.197977	9/23/15	0.229548
2009-06-23	0.294637666	7/6/11	0.211287	9/3/13	0.167765	9/25/15	0.230881
2009-06-24	0.294721041	7/7/11	0.208736	9/4/13	0.17037	9/28/15	0.238966
2009-06-25	0.2947352	7/8/11	0.214156	9/5/13	0.170318	9/29/15	0.235813
2009-06-26	0.294745889	7/11/11	0.216596	9/6/13	0.170497	9/30/15	0.224543
2009-06-29	0.294788496	7/12/11	0.22088	9/9/13	0.172984	10/1/15	0.231751
2009-06-30	0.294804703	7/13/11	0.218219	9/10/13	0.16254	10/2/15	0.227884
2009-07-01	0.294827807	7/14/11	0.218126	9/12/13	0.159944	10/5/15	0.217878
2009-07-02	0.294837122	7/15/11	0.218867	9/13/13	0.16281	10/6/15	0.208491
2009-07-03	0.294863424	7/18/11	0.22393	9/17/13	0.16267	10/7/15	0.203237
2009-07-06	0.295144557	7/19/11	0.221416	9/18/13	0.165275	10/8/15	0.199246
2009-07-07	0.296815357	7/20/11	0.22148	9/19/13	0.157609	10/9/15	0.195384
2009-07-08	0.296818828	7/21/11	0.218967	9/20/13	0.157143	10/12/15	0.202786
2009-07-09	0.296781492	7/22/11	0.221877	9/23/13	0.16007	10/13/15	0.200064
2009-07-10	0.301527213	7/25/11	0.221794	9/26/13	0.157959	10/14/15	0.199746
2009-07-13	0.301521633	7/26/11	0.223147	9/27/13	0.158215	10/15/15	0.20069
2009-07-14	0.301508466	7/27/11	0.228353	9/30/13	0.160802	10/16/15	0.201575
2009-07-15	0.301471824	7/28/11	0.229145	10/1/13	0.161193	10/19/15	0.199641

2009-07-16	0.30146616	7/29/11	0.237064	10/2/13	0.163817	10/20/15	0.207031
2009-07-17	0.298024422	8/1/11	0.231913	10/3/13	0.163898	10/21/15	0.205593
2009-07-20	0.297945719	8/2/11	0.232525	10/4/13	0.16398	10/22/15	0.202842
2009-07-21	0.294781811	8/3/11	0.237641	10/7/13	0.166544	10/23/15	0.183494
2009-07-22	0.294751824	8/4/11	0.24833	10/8/13	0.176169	10/26/15	0.204792
2009-07-23	0.289843347	8/5/11	0.253475	10/9/13	0.180176	10/27/15	0.19001
2009-07-24	0.289796792	8/8/11	0.270939	10/10/13	0.173614	10/28/15	0.190604
2009-07-27	0.286470239	8/10/11	0.284903	10/11/13	0.165786	10/29/15	0.193341
2009-07-28	0.286400386	8/11/11	0.286908	10/14/13	0.168478	10/30/15	0.190394
2009-07-29	0.283160668	8/12/11	0.286849	10/15/13	0.163679	11/2/15	0.190564
2009-07-30	0.284563002	8/15/11	0.281432	10/16/13	0.16224	11/3/15	0.194148
2009-07-31	0.284497453	8/16/11	0.284032	10/17/13	0.157619	11/4/15	0.191424
2009-08-03	0.285666356	8/17/11	0.281206	10/18/13	0.157579	11/5/15	0.194551
2009-08-04	0.285595106	8/18/11	0.293966	10/21/13	0.154759	11/6/15	0.203257
2009-08-05	0.285546194	8/19/11	0.297022	10/22/13	0.150398	11/9/15	0.190431
2009-08-06	0.285447848	8/22/11	0.294136	10/23/13	0.153987	11/10/15	0.196404
2009-08-07	0.277105124	8/23/11	0.296632	10/24/13	0.151459	11/11/15	0.196471
2009-08-11	0.276717089	8/24/11	0.291426	10/25/13	0.150784	11/12/15	0.199341
2009-08-12	0.269919284	8/25/11	0.294927	10/28/13	0.150814	11/13/15	0.205064
2009-08-13	0.269827474	8/26/11	0.294656	10/29/13	0.150603	11/16/15	0.20185
2009-08-14	0.269703633	8/29/11	0.281926	10/30/13	0.150134	11/17/15	0.196562
2009-08-17	0.269364728	8/30/11	0.281828	10/31/13	0.150293	11/18/15	0.199389
2009-08-18	0.269264552	8/31/11	0.274241	11/1/13	0.149903	11/19/15	0.194739
2009-08-19	0.269159854	9/1/11	0.274108	11/4/13	0.150032	11/20/15	0.194532
2009-08-20	0.26562046	9/2/11	0.281556	11/5/13	0.151037	11/23/15	0.194355
2009-08-21	0.265498328	9/5/11	0.28883	11/6/13	0.148133	11/24/15	0.197054
2009-08-24	0.243934725	9/6/11	0.293729	11/7/13	0.148289	11/25/15	0.194574
2009-08-25	0.253211057	9/7/11	0.278859	11/8/13	0.151832	11/26/15	0.191975
2009-08-26	0.253073322	9/8/11	0.273833	11/11/13	0.151864	11/27/15	0.197103
2009-08-27	0.252957767	9/9/11	0.293608	11/12/13	0.152239	11/30/15	0.196993
2009-08-28	0.252816882	9/12/11	0.300884	11/13/13	0.160768	12/1/15	0.196966
2009-08-31	0.252404793	9/13/11	0.315065	11/14/13	0.157928	12/2/15	0.199628
2009-09-01	0.252277699	9/14/11	0.319583	11/15/13	0.155126	12/3/15	0.199643
2009-09-02	0.252140062	9/15/11	0.311814	11/18/13	0.155133	12/4/15	0.207434
2009-09-03	0.251997022	9/16/11	0.307145	11/19/13	0.16067	12/7/15	0.207212
2009-09-04	0.251864742	9/19/11	0.30651	11/20/13	0.160744	12/8/15	0.212342
2009-09-07	0.252418661	9/20/11	0.298914	11/21/13	0.166026	12/9/15	0.20981
2009-09-08	0.252262228	9/21/11	0.282876	11/22/13	0.168697	12/10/15	0.212337
2009-09-09	0.252103462	9/22/11	0.299441	11/25/13	0.168671	12/11/15	0.217411
2009-09-10	0.251932033	9/23/11	0.302639	11/26/13	0.174247	12/14/15	0.217259
2009-09-11	0.251766613	9/26/11	0.30708	11/27/13	0.169091	12/15/15	0.214693
2009-09-14	0.251252287	9/27/11	0.293815	11/28/13	0.166442	12/17/15	0.204622
2009-09-15	0.25106705	9/28/11	0.30017	11/29/13	0.166491	12/18/15	0.222634
2009-09-16	0.250858025	9/29/11	0.311857	12/2/13	0.169038	12/21/15	0.220187
2009-09-17	0.253326589	9/30/11	0.326512	12/3/13	0.1745	12/22/15	0.21938
2009-09-18	0.253318736	10/3/11	0.322113	12/4/13	0.174803	12/23/15	0.211978
2009-09-21	0.253280428	10/4/11	0.340749	12/5/13	0.172183	12/24/15	0.212246
2009-09-22	0.253246868	10/5/11	0.340621	12/6/13	0.169564	12/28/15	0.214835
2009-09-23	0.253220354	10/6/11	0.333153	12/9/13	0.174566	12/29/15	0.218311
2009-09-25	0.253179449	10/7/11	0.329187	12/10/13	0.174693	12/30/15	0.218311
2009-09-28	0.253121673	10/10/11	0.319215	12/11/13	0.179872	12/31/15	0.221352
2009-09-29	0.253085672	10/11/11	0.313652	12/12/13	0.187646	1/4/16	0.230502
2009-09-30	0.253078376	10/12/11	0.304856	12/13/13	0.187637	1/5/16	0.229281
2009-10-01	0.25303823	10/13/11	0.309538	12/17/13	0.182463	1/6/16	0.229754
2009-10-02	0.253013683	10/14/11	0.304612	12/18/13	0.182463	1/7/16	0.237617
2009-10-05	0.249683535	10/17/11	0.302494	12/19/13	0.179866	1/8/16	0.237933
2009-10-06	0.25293464	10/18/11	0.303218	12/20/13	0.176354	1/11/16	0.235728

2009-10-07	0.249648586	10/19/11	0.299335	12/23/13	0.176354	1/12/16	0.236035
2009-10-08	0.247178246	10/20/11	0.304776	12/24/13	0.175708	1/13/16	0.236927
2009-10-09	0.249615881	10/21/11	0.289193	12/27/13	0.170905	1/14/16	0.242221
2009-10-12	0.2388562	10/24/11	0.287232	12/30/13	0.168704	1/15/16	0.245002
2009-10-13	0.236348127	10/25/11	0.287755	12/31/13	0.169172	1/18/16	0.24439
2009-10-14	0.228822601	10/26/11	0.288873	1/2/14	0.169172	1/19/16	0.239679
2009-10-15	0.239558615	10/27/11	0.268886	1/3/14	0.182427	1/20/16	0.253824
2009-10-16	0.230448972	10/28/11	0.251759	1/6/14	0.182427	1/21/16	0.254066
2009-10-19	0.222826366	10/31/11	0.260062	1/7/14	0.183562	1/22/16	0.243835
2009-10-20	0.222780582	11/1/11	0.278069	1/8/14	0.187817	1/25/16	0.24409
2009-10-21	0.220226139	11/2/11	0.263945	1/9/14	0.190511	1/26/16	0.247566
2009-10-23	0.217614748	11/3/11	0.263884	1/10/14	0.190916	1/27/16	0.245296
2009-10-26	0.217459214	11/4/11	0.268789	1/13/14	0.184425	1/28/16	0.237994
2009-10-27	0.222450585	11/7/11	0.260699	1/14/14	0.184658	1/29/16	0.235702
2009-10-28	0.227435304	11/8/11	0.256029	1/15/14	0.182101	2/1/16	0.239283
2009-10-29	0.221584271	11/9/11	0.26843	1/16/14	0.181862	2/2/16	0.246985
2009-10-30	0.224833419	11/10/11	0.265564	1/17/14	0.180439	2/3/16	0.245322
2009-11-02	0.224685969	11/11/11	0.265518	1/20/14	0.177879	2/4/16	0.237465
2009-11-03	0.244678198	11/14/11	0.262829	1/21/14	0.17614	2/5/16	0.237216
2009-11-04	0.249524509	11/15/11	0.257769	1/22/14	0.176927	2/8/16	0.240459
2009-11-05	0.249482529	11/16/11	0.257791	1/23/14	0.175282	2/9/16	0.248708
2009-11-06	0.249433218	11/17/11	0.26277	1/24/14	0.185941	2/10/16	0.246261
2009-11-09	0.243480647	11/18/11	0.270549	1/27/14	0.199875	2/11/16	0.256367
2009-11-10	0.243742819	11/21/11	0.287828	1/28/14	0.199964	2/15/16	0.236081
2009-11-11	0.239450643	11/22/11	0.278282	1/29/14	0.204455	2/16/16	0.238874
2009-11-12	0.239386183	11/23/11	0.285568	1/30/14	0.209604	2/17/16	0.236353
2009-11-13	0.239332822	11/24/11	0.280582	1/31/14	0.211618	2/18/16	0.236275
2009-11-16	0.234100497	11/25/11	0.280532	2/3/14	0.214769	2/22/16	0.23866
2009-11-17	0.233254416	11/28/11	0.270397	2/4/14	0.22339	2/23/16	0.243764
2009-11-18	0.23319076	11/29/11	0.275327	2/5/14	0.225016	2/24/16	0.24884
2009-11-19	0.23645639	11/30/11	0.257809	2/6/14	0.214371	2/25/16	0.246227
2009-11-20	0.236391329	12/1/11	0.257791	2/7/14	0.208484	2/29/16	0.238228
2009-11-23	0.23035611	12/2/11	0.257778	2/10/14	0.20612	3/1/16	0.233015
2009-11-24	0.231071766	12/5/11	0.255111	2/11/14	0.206182	3/2/16	0.227878
2009-11-25	0.230220311	12/6/11	0.255132	2/12/14	0.201098	3/3/16	0.227855
2009-11-26	0.233481711	12/7/11	0.2552	2/13/14	0.190578	3/4/16	0.227828
2009-11-27	0.235957459	12/8/11	0.25771	2/14/14	0.188325	3/8/16	0.222637
2009-11-30	0.235750677	12/9/11	0.257692	2/17/14	0.185905	3/9/16	0.225192
2009-12-01	0.230607486	12/12/11	0.265086	2/18/14	0.185957	3/10/16	0.225245
2009-12-02	0.229762555	12/13/11	0.267703	2/19/14	0.18583	3/11/16	0.225357
2009-12-03	0.231459005	12/14/11	0.274945	2/20/14	0.190899	3/14/16	0.225239
2009-12-04	0.229626289	12/15/11	0.26989	2/21/14	0.185952	3/15/16	0.227796
2009-12-07	0.231962143	12/19/11	0.276719	2/24/14	0.186115	3/16/16	0.225253
2009-12-08	0.233469	12/20/11	0.274494	2/25/14	0.191227	3/17/16	0.222694
2009-12-09	0.235165301	12/21/11	0.276279	2/26/14	0.191196	3/18/16	0.226258
2009-12-10	0.233347467	12/22/11	0.271756	2/27/14	0.191258	3/22/16	0.228832
2009-12-011	0.230748637	12/23/11	0.267326	2/28/14	0.188738	3/23/16	0.228613
12/14/09	0.232927062	12/28/11	0.267107	3/3/14	0.191477	3/24/16	0.228392
12/15/09	0.235471156	12/29/11	0.269605	3/4/14	0.188867	3/29/16	0.232048
12/17/09	0.235561024	12/30/11	0.269559	3/5/14	0.191598	3/30/16	0.231532
12/18/09	0.233010141	1/3/12	0.257803	3/6/14	0.189023	3/31/16	0.229665
12/21/09	0.232901644	1/4/12	0.26184	3/7/14	0.189058	4/1/16	0.234603
12/22/09	0.230347779	1/5/12	0.254228	3/10/14	0.191802	4/5/16	0.235447
12/23/09	0.230440604	1/6/12	0.251768	3/11/14	0.189236	4/6/16	0.234993
12/24/09	0.230445976	1/9/12	0.251699	3/12/14	0.191831	4/7/16	0.231983
12/28/09	0.228401757	1/10/12	0.248019	3/13/14	0.191831	4/8/16	0.231803
12/29/09	0.228829844	1/11/12	0.251984	3/14/14	0.197117	4/11/16	0.231436

12/30/09	0.229288853	1/12/12	0.249497	3/17/14	0.194429	4/12/16	0.231267
12/31/09	0.229337527	1/13/12	0.249539	3/18/14	0.191846	4/13/16	0.230997
1/4/10	0.229260146	1/16/12	0.246953	3/19/14	0.199568	4/14/16	0.230843
1/5/10	0.228238302	1/17/12	0.244029	3/20/14	0.199563	4/15/16	0.230688
1/6/10	0.22837241	1/18/12	0.241928	3/24/14	0.198874	4/18/16	0.230335
1/7/10	0.230822478	1/19/12	0.235373	3/25/14	0.198888	4/19/16	0.230194
1/8/10	0.230909251	1/20/12	0.234517	3/26/14	0.171889	4/20/16	0.229976
1/11/10	0.22198634	1/23/12	0.231051	3/27/14	0.175139	4/21/16	0.213291
1/12/10	0.226850295	1/24/12	0.23467	3/28/14	0.166504	4/22/16	0.216624
1/13/10	0.227043916	1/25/12	0.234769	3/31/14	0.167251	4/25/16	0.216343
1/14/10	0.227068266	1/26/12	0.225932	4/1/14	0.16489	4/26/16	0.215551
1/15/10	0.227086932	1/27/12	0.220896	4/2/14	0.164824	4/28/16	0.214754
1/18/10	0.226969125	1/30/12	0.229553	4/3/14	0.163216	4/29/16	0.210148
1/19/10	0.226993116	1/31/12	0.221958	4/4/14	0.16336	5/3/16	0.221693
1/20/10	0.227170955	2/1/12	0.216899	4/7/14	0.166388	5/4/16	0.221516
1/21/10	0.227272325	2/2/12	0.209255	4/8/14	0.163921	5/5/16	0.221347
1/22/10	0.237550726	2/3/12	0.209757	4/9/14	0.16277	5/6/16	0.229246
1/25/10	0.237452606	2/6/12	0.212501	4/10/14	0.161707	5/9/16	0.228766
1/26/10	0.240763986	2/7/12	0.219569	4/11/14	0.165714	5/10/16	0.222714
1/27/10	0.238276071	2/8/12	0.217076	4/14/14	0.166204	5/11/16	0.219673
1/28/10	0.247046567	2/9/12	0.217168	4/15/14	0.168961	5/12/16	0.225353
1/29/10	0.251467732	2/10/12	0.222377	4/16/14	0.166518	5/13/16	0.225223
2/1/10	0.253913786	2/13/12	0.216083	4/17/14	0.16569	5/17/16	0.218657
2/2/10	0.25150234	2/14/12	0.216847	4/22/14	0.163161	5/18/16	0.215425
2/3/10	0.251517175	2/15/12	0.218516	4/23/14	0.165522	5/20/16	0.215527
2/4/10	0.252382792	2/16/12	0.22133	4/24/14	0.163126	5/23/16	0.218069
2/5/10	0.269363083	2/17/12	0.21861	4/25/14	0.157848	5/24/16	0.215203
2/8/10	0.269658557	2/20/12	0.218722	4/29/14	0.158582	5/25/16	0.2097
2/9/10	0.266834878	2/21/12	0.216203	4/30/14	0.158656	5/26/16	0.209839
2/10/10	0.267943097	2/22/12	0.218918	5/2/14	0.158279	5/27/16	0.20988
2/11/10	0.262872685	2/23/12	0.218294	5/5/14	0.160899	5/31/16	0.212285
2/12/10	0.262860332	2/24/12	0.218273	5/8/14	0.161171	6/1/16	0.214951
2/15/10	0.257684643	2/27/12	0.221218	5/9/14	0.16241	6/2/16	0.212608
2/16/10	0.255188894	2/28/12	0.223062	5/12/14	0.157152	6/3/16	0.212611
2/17/10	0.252834719	2/29/12	0.223115	5/13/14	0.157186	6/6/16	0.215111
2/18/10	0.252626105	3/1/12	0.223206	5/14/14	0.15462	6/7/16	0.215125
2/19/10	0.252618757	3/2/12	0.223253	5/15/14	0.154652	6/8/16	0.217715
2/22/10	0.252630279	3/5/12	0.22591	5/16/14	0.152873	6/9/16	0.21787
2/23/10	0.255199085	3/6/12	0.23364	5/19/14	0.150147	6/10/16	0.220426
2/24/10	0.255169769	3/7/12	0.231086	5/20/14	0.145491	6/13/16	0.227954
2/25/10	0.255154037	3/8/12	0.22856	5/21/14	0.145446	6/14/16	0.238082
2/26/10	0.260093028	3/9/12	0.228564	5/22/14	0.145161	6/15/16	0.235552
3/1/10	0.255001072	3/12/12	0.228596	5/23/14	0.145211	6/17/16	0.234176
3/2/10	0.252527462	3/13/12	0.22497	5/26/14	0.145065	6/20/16	0.228653
3/4/10	0.247489168	3/14/12	0.222745	5/27/14	0.145044	6/21/16	0.228302
3/8/10	0.239605368	3/15/12	0.225655	5/28/14	0.145024	6/22/16	0.223235
3/9/10	0.230898748	3/16/12	0.213273	5/29/14	0.152279	6/23/16	0.222946
3/10/10	0.230898563	3/19/12	0.212026	5/30/14	0.139979	6/24/16	0.236338
3/11/10	0.230946477	3/20/12	0.212462	6/2/14	0.134376	6/27/16	0.237781
3/12/10	0.228388276	3/22/12	0.217622	6/3/14	0.133965	6/28/16	0.230411
3/15/10	0.230941108	3/23/12	0.218394	6/4/14	0.131483	6/29/16	0.22312
3/16/10	0.228395047	3/26/12	0.213537	6/5/14	0.131529	6/30/16	0.225157
3/17/10	0.225838072	3/27/12	0.208163	6/6/14	0.131716	7/1/16	0.224056
3/18/10	0.225617433	3/28/12	0.205357	6/9/14	0.134157	7/4/16	0.22166
3/19/10	0.227269124	3/29/12	0.208166	6/10/14	0.126439	7/5/16	0.227375
3/23/10	0.227721171	3/30/12	0.20584	6/11/14	0.131647	7/6/16	0.237864
3/24/10	0.222770035	4/2/12	0.201594	6/12/14	0.123933	7/7/16	0.231823

3/25/10	0.218082932	4/3/12	0.199962	6/13/14	0.124089	7/8/16	0.231064
3/26/10	0.219001808	4/4/12	0.211144	6/17/14	0.12398	7/11/16	0.221279
3/29/10	0.208184794	4/5/12	0.207195	6/18/14	0.123987	7/12/16	0.217191
3/30/10	0.210458576	4/10/12	0.207184	6/19/14	0.118798	7/13/16	0.214529
3/31/10	0.211541786	4/11/12	0.208647	6/20/14	0.123055	7/14/16	0.214453
4/1/10	0.206609204	4/12/12	0.20672	6/23/14	0.12618	7/15/16	0.213331
4/6/10	0.204067462	4/13/12	0.209469	6/24/14	0.126366	7/18/16	0.215705
4/7/10	0.206797117	4/16/12	0.209506	6/25/14	0.131599	7/20/16	0.221785
4/8/10	0.207374437	4/17/12	0.207087	6/26/14	0.129112	7/21/16	0.201034
4/9/10	0.204973922	4/18/12	0.204667	6/27/14	0.129574	7/25/16	0.200811
4/12/10	0.205058954	4/19/12	0.205256	6/30/14	0.12698	7/26/16	0.197377
4/13/10	0.210785653	4/20/12	0.205403	7/1/14	0.133748	7/27/16	0.197356
4/14/10	0.205743534	4/23/12	0.205432	7/2/14	0.123546	7/28/16	0.202525
4/15/10	0.206312044	4/24/12	0.207728	7/3/14	0.123758	7/29/16	0.207803
4/16/10	0.211672256	4/25/12	0.205303	7/4/14	0.124444	8/2/16	0.201613
4/19/10	0.214341148	4/26/12	0.20499	7/7/14	0.124201	8/4/16	0.201974
4/20/10	0.211897276	4/30/12	0.202443	7/8/14	0.124443	8/5/16	0.202817
4/21/10	0.212044529	5/2/12	0.202561	7/9/14	0.135106	8/8/16	0.204556
4/22/10	0.215144203	5/3/12	0.202714	7/10/14	0.137946	8/10/16	0.207747
4/23/10	0.212683766	5/4/12	0.208007	7/11/14	0.141365	8/11/16	0.193009
4/28/10	0.228991753	5/7/12	0.209045	7/14/14	0.133602	8/12/16	0.190839
4/29/10	0.226490971	5/8/12	0.214282	7/15/14	0.133737	8/15/16	0.196169
4/30/10	0.229445005	5/9/12	0.214938	7/16/14	0.130819	8/16/16	0.195948
5/3/10	0.229441396	5/10/12	0.209533	7/17/14	0.130926	8/17/16	0.196012
5/4/10	0.246165778	5/11/12	0.207372	7/18/14	0.133908	8/18/16	0.181247
5/5/10	0.266666483	5/14/12	0.215053	7/21/14	0.136544	8/19/16	0.184076
5/6/10	0.27683185	5/15/12	0.215145	7/22/14	0.134035	8/22/16	0.184063
5/10/10	0.289544826	5/16/12	0.212312	7/23/14	0.13413	8/23/16	0.183898
5/11/10	0.289546363	5/17/12	0.215323	7/24/14	0.136828	8/24/16	0.178436
5/12/10	0.282040927	5/18/12	0.220761	7/25/14	0.137163	8/25/16	0.178473
5/13/10	0.282339356	5/21/12	0.221014	7/28/14	0.137183	8/26/16	0.17839
5/14/10	0.291614585	5/22/12	0.205905	7/29/14	0.147282	8/29/16	0.178434
5/17/10	0.291818006	5/23/12	0.229989	7/30/14	0.144424	8/30/16	0.178481
5/18/10	0.286836804	5/24/12	0.227496	7/31/14	0.147135	8/31/16	0.183704
5/19/10	0.291770732	5/25/12	0.227438	8/1/14	0.15011	9/1/16	0.183689
5/20/10	0.328449725	5/28/12	0.224957	8/4/14	0.14755	9/2/16	0.178465
5/21/10	0.324342803	5/29/12	0.235114	8/5/14	0.147648	9/5/16	0.178569
5/25/10	0.321727574	5/30/12	0.247722	8/6/14	0.151979	9/6/16	0.178623
5/26/10	0.312242059	5/31/12	0.247639	8/7/14	0.154594	9/7/16	0.191543
5/28/10	0.311958559	6/1/12	0.247599	8/8/14	0.154741	9/8/16	0.201833
5/31/10	0.314203531	6/4/12	0.247367	8/11/14	0.149892	9/9/16	0.178696
6/1/10	0.311760617	6/6/12	0.239578	8/12/14	0.149884	9/12/16	0.183988
6/2/10	0.311785525	6/7/12	0.229286	8/13/14	0.152474	9/13/16	0.184008
6/3/10	0.311658943	6/8/12	0.231954	8/14/14	0.152465	9/14/16	0.196925
6/4/10	0.31876338	6/11/12	0.234268	8/15/14	0.157115	9/15/16	0.199506
6/8/10	0.324112929	6/12/12	0.226715	8/18/14	0.154179	9/16/16	0.202242
6/9/10	0.319260562	6/13/12	0.226668	8/19/14	0.154489	9/19/16	0.211768
6/10/10	0.314339188	6/14/12	0.229193	8/20/14	0.154765	9/20/16	0.221124
6/14/10	0.299707217	6/15/12	0.22673	8/21/14	0.15714	9/21/16	0.22572
6/15/10	0.297270233	6/18/12	0.218946	8/22/14	0.157308	9/22/16	0.191671
6/17/10	0.29697946	6/19/12	0.216388	8/25/14	0.159669	9/23/16	0.18943
6/18/10	0.291555676	6/21/12	0.206138	8/26/14	0.154822	9/26/16	0.195752
6/21/10	0.274462439	6/22/12	0.230216	8/27/14	0.154831	9/27/16	0.200938
6/22/10	0.276835356	6/25/12	0.232278	8/28/14	0.157433	9/28/16	0.191205
6/23/10	0.284263914	6/26/12	0.222271	8/29/14	0.155065	9/29/16	0.184487
6/24/10	0.286251838	6/27/12	0.224931	9/1/14	0.15495	9/30/16	0.191439
6/25/10	0.288002158	6/28/12	0.227316	9/2/14	0.152279	10/3/16	0.191239

6/28/10	0.288328049	6/29/12	0.219628	9/3/14	0.147161	10/4/16	0.189307
6/29/10	0.294868679	7/2/12	0.221346	9/4/14	0.144452	10/5/16	0.193514
6/30/10	0.304476917	7/3/12	0.209849	9/5/14	0.149771	10/6/16	0.193892
7/1/10	0.320084472	7/4/12	0.209931	9/8/14	0.147066	10/7/16	0.191375
7/2/10	0.315068165	7/5/12	0.201803	9/9/14	0.149632	10/10/16	0.191322
7/5/10	0.317222687	7/6/12	0.203582	9/10/14	0.149738	10/12/16	0.191477
7/6/10	0.312169873	7/9/12	0.207154	9/11/14	0.149736	10/13/16	0.200685
7/7/10	0.309528948	7/10/12	0.207313	9/12/14	0.149836	10/14/16	0.195546
7/8/10	0.306579444	7/11/12	0.20964	9/16/14	0.152377	10/17/16	0.198033
7/9/10	0.306359367	7/12/12	0.215138	9/17/14	0.157564	10/18/16	0.19548
7/12/10	0.306073296	7/13/12	0.210183	9/18/14	0.160263	10/19/16	0.191983
7/13/10	0.3022425	7/16/12	0.211134	9/19/14	0.148173	10/20/16	0.192296
7/14/10	0.303249714	7/17/12	0.209693	9/22/14	0.155897	10/21/16	0.191543
7/15/10	0.300669006	7/18/12	0.204371	9/25/14	0.172303	10/24/16	0.191538
7/16/10	0.300532979	7/19/12	0.196515	9/26/14	0.169033	10/25/16	0.19163
7/19/10	0.302701578	7/20/12	0.189866	9/29/14	0.173094	10/26/16	0.189845
7/20/10	0.300148147	7/23/12	0.195026	9/30/14	0.169889	10/27/16	0.196592
7/21/10	0.281417039	7/25/12	0.194994	10/1/14	0.172524	10/28/16	0.19917
7/22/10	0.265367584	7/26/12	0.191881	10/2/14	0.177767	10/31/16	0.201616
7/23/10	0.262819689	7/27/12	0.185901	10/3/14	0.175177	11/1/16	0.198482
7/26/10	0.255136158	7/31/12	0.190071	10/6/14	0.169857	11/2/16	0.211898
7/27/10	0.257401469	8/1/12	0.184149	10/7/14	0.172648	11/3/16	0.21458
7/28/10	0.257403321	8/2/12	0.184572	10/8/14	0.177882	11/4/16	0.214575
7/29/10	0.255027851	8/3/12	0.179388	10/9/14	0.1779	11/7/16	0.208916
7/30/10	0.259983524	8/6/12	0.17664	10/10/14	0.18701	11/8/16	0.206366
8/2/10	0.249878126	8/8/12	0.174149	10/13/14	0.184255	11/9/16	0.203816
8/3/10	0.252378574	8/10/12	0.173997	10/14/14	0.190657	11/10/16	0.199163
8/4/10	0.246847008	8/13/12	0.17392	10/16/14	0.197256	11/11/16	0.207786
8/5/10	0.247016383	8/14/12	0.174402	10/20/14	0.191278	11/14/16	0.210707
8/6/10	0.252046764	8/15/12	0.171307	10/21/14	0.184182	11/15/16	0.213446
8/10/10	0.257266284	8/16/12	0.170655	10/22/14	0.187623	11/16/16	0.210527
8/11/10	0.265086004	8/17/12	0.174616	10/23/14	0.189256	11/17/16	0.205111
8/12/10	0.266380106	8/20/12	0.174466	10/24/14	0.189145	11/21/16	0.204832
8/13/10	0.26631752	8/22/12	0.174518	10/27/14	0.19146	11/22/16	0.199192
8/16/10	0.265764763	8/23/12	0.171914	10/28/14	0.180791	11/24/16	0.204403
8/17/10	0.262941876	8/24/12	0.180037	10/29/14	0.17626	11/25/16	0.204297
8/18/10	0.268179969	8/27/12	0.179717	10/30/14	0.180817	11/28/16	0.209391
8/19/10	0.267883868	8/29/12	0.181871	10/31/14	0.175526	11/29/16	0.2145
8/20/10	0.270426896	8/30/12	0.184632	11/3/14	0.174771	11/30/16	0.214551
8/23/10	0.265090818	8/31/12	0.187536	11/4/14	0.178408	12/1/16	0.21722
8/24/10	0.266260701	9/3/12	0.187338	11/5/14	0.177798	12/2/16	0.222373
8/25/10	0.278671739	9/4/12	0.192551	11/6/14	0.178168	12/5/16	0.21964
8/26/10	0.273430121	9/6/12	0.187206	11/7/14	0.174549	12/6/16	0.224761
8/27/10	0.276056267	9/7/12	0.179676	11/10/14	0.175088	12/7/16	0.222167
8/30/10	0.273297029	9/10/12	0.179479	11/11/14	0.175	12/8/16	0.214512
8/31/10	0.273316087	9/11/12	0.179463	11/12/14	0.177186	12/9/16	0.211962
9/1/10	0.263268153	9/12/12	0.176825	11/13/14	0.17711	12/13/16	0.211874
9/2/10	0.265780987	9/13/12	0.176804	11/14/14	0.177034	12/14/16	0.209313
9/3/10	0.26339105	9/14/12	0.169218	11/17/14	0.177286	12/15/16	0.21709
9/6/10	0.260786403	9/18/12	0.169049	11/18/14	0.177207	12/19/16	0.216898
9/7/10	0.265788391	9/19/12	0.169049	11/19/14	0.181723	12/20/16	0.216881
9/8/10	0.260802261	9/20/12	0.169219	11/20/14	0.187081	12/21/16	0.201601
9/9/10	0.260796304	9/21/12	0.182902	11/21/14	0.187081	12/22/16	0.201615
9/10/10	0.258417429	9/25/12	0.17706	11/24/14	0.176407	12/23/16	0.206753
9/13/10	0.253260724	9/26/12	0.184747	11/25/14	0.176178	12/28/16	0.206131
9/14/10	0.250656819	9/27/12	0.182944	11/26/14	0.181477	12/29/16	0.203752
9/15/10	0.250862182	9/28/12	0.180389	11/27/14	0.18653	12/30/16	0.206495

9/20/10	0.238625946	10/1/12	0.175027	11/28/14	0.194314	1/3/17	0.204631
9/21/10	0.24704541	10/2/12	0.175401	12/1/14	0.209947	1/4/17	0.207359
9/22/10	0.247049196	10/3/12	0.178091	12/2/14	0.204753	1/5/17	0.19984
9/23/10	0.247358814	10/4/12	0.176555	12/3/14	0.20217	1/6/17	0.185727
9/27/10	0.242756865	10/5/12	0.172966	12/4/14	0.204751	1/9/17	0.188971
9/28/10	0.242034725	10/8/12	0.17549	12/5/14	0.204676	1/10/17	0.189087
9/29/10	0.242058556	10/9/12	0.180183	12/8/14	0.204476	1/11/17	0.175094
9/30/10	0.235579209	10/10/12	0.178941	12/9/14	0.212321	1/12/17	0.175248
10/1/10	0.239746758	10/11/12	0.174992	12/10/14	0.214899	1/13/17	0.172823
10/4/10	0.238073117	10/12/12	0.176295	12/11/14	0.217446	1/16/17	0.17688
10/5/10	0.233007634	10/15/12	0.174851	12/12/14	0.215148	1/17/17	0.179733
10/6/10	0.230495965	10/16/12	0.168379	12/15/14	0.22009	1/18/17	0.181648
10/7/10	0.235958798	10/17/12	0.164654	12/17/14	0.222663	1/19/17	0.181679
10/8/10	0.230903915	10/18/12	0.168365	12/18/14	0.207475	1/20/17	0.185009
10/11/10	0.229539378	10/19/12	0.17099	12/19/14	0.225049	1/23/17	0.180972
10/12/10	0.231669876	10/22/12	0.164854	12/22/14	0.226522	1/24/17	0.178697
10/13/10	0.225361795	10/23/12	0.16768	12/23/14	0.223476	1/25/17	0.18461
10/14/10	0.225761136	10/24/12	0.164992	12/24/14	0.224423	1/26/17	0.179497
10/15/10	0.228406111	10/25/12	0.164949	12/29/14	0.218145	1/27/17	0.182196
10/18/10	0.226679646	10/26/12	0.162537	12/30/14	0.22023	1/30/17	0.185071
10/19/10	0.230935888	10/29/12	0.162417	12/31/14	0.221644	1/31/17	0.184006
10/20/10	0.228412275	10/30/12	0.160095	1/2/15	0.222172	2/1/17	0.181546
10/21/10	0.223617672	10/31/12	0.160143	1/5/15	0.233196	2/2/17	0.186937
10/22/10	0.228839906	11/1/12	0.157546	1/6/15	0.22758	2/3/17	0.188508
10/25/10	0.226119428	11/2/12	0.154374	1/7/15	0.222965	2/6/17	0.188665
10/26/10	0.229826561	11/5/12	0.15483	1/8/15	0.220509	2/7/17	0.188713
10/27/10	0.232431657	11/6/12	0.156546	1/9/15	0.226604	2/8/17	0.188374
10/28/10	0.229472188	11/7/12	0.157056	1/12/15	0.225844	2/9/17	0.186219
10/29/10	0.226349742	11/8/12	0.157095	1/13/15	0.225411	2/13/17	0.185268
11/1/10	0.223647477	11/9/12	0.159765	1/14/15	0.246536	2/14/17	0.178933
11/2/10	0.22371919	11/12/12	0.157394	1/15/15	0.245512	2/15/17	0.178957
11/3/10	0.221203118	11/13/12	0.159912	1/16/15	0.240366	2/16/17	0.178979
11/4/10	0.213772847	11/14/12	0.160249	1/19/15	0.237216	2/17/17	0.181595
11/5/10	0.214260959	11/15/12	0.162889	1/20/15	0.236869	2/20/17	0.178889
11/8/10	0.214099077	11/16/12	0.160821	1/21/15	0.23401	2/21/17	0.178921
11/9/10	0.206838501	11/19/12	0.157751	1/22/15	0.23062	2/22/17	0.181691
11/10/10	0.212038532	11/20/12	0.155137	1/23/15	0.23202	2/23/17	0.184033
11/11/10	0.209717671	11/21/12	0.154948	1/26/15	0.221314	2/24/17	0.186779
11/12/10	0.209456149	11/22/12	0.15216	1/27/15	0.213559	2/27/17	0.187029
11/15/10	0.207009257	11/23/12	0.152187	1/28/15	0.208285	2/28/17	0.179593
11/16/10	0.212189397	11/26/12	0.152204	1/29/15	0.212636	3/1/17	0.176895
11/17/10	0.21479002	11/27/12	0.152285	1/30/15	0.209958	3/2/17	0.176808
11/18/10	0.209877566	11/28/12	0.15503	2/2/15	0.209634	3/3/17	0.179384
11/19/10	0.212476358	11/29/12	0.152329	2/3/15	0.206961	3/6/17	0.181936
11/22/10	0.21247	11/30/12	0.149718	2/4/15	0.208039	3/7/17	0.181925
11/23/10	0.220324074	12/3/12	0.149595	2/5/15	0.208008	3/8/17	0.181917
11/24/10	0.219962429	12/4/12	0.149786	2/6/15	0.205422	3/9/17	0.17937
11/25/10	0.220129882	12/5/12	0.150433	2/9/15	0.205239	3/10/17	0.176761
11/26/10	0.222723677	12/6/12	0.145157	2/10/15	0.197964	3/13/17	0.179308
11/29/10	0.23023858	12/7/12	0.14517	2/11/15	0.195672	3/14/17	0.168949
11/30/10	0.235404363	12/10/12	0.145013	2/12/15	0.192754	3/15/17	0.168939
12/1/10	0.227759747	12/12/12	0.142568	2/13/15	0.189873	3/17/17	0.171569
12/2/10	0.233062746	12/13/12	0.142576	2/16/15	0.189711	3/20/17	0.174653
12/3/10	0.238153132	12/14/12	0.142666	2/17/15	0.189818	3/22/17	0.178082
12/6/10	0.238020928	12/18/12	0.147877	2/18/15	0.189994	3/23/17	0.17835
12/7/10	0.233158318	12/19/12	0.138289	2/19/15	0.1874	3/24/17	0.169302
12/8/10	0.235700286	12/21/12	0.138456	2/20/15	0.187375	3/27/17	0.169426

12/9/10	0.235858411	12/27/12	0.138403	2/23/15	0.187206	3/28/17	0.167087
12/10/10	0.240888623	12/31/12	0.140048	2/24/15	0.184609	3/29/17	0.166664
12/13/10	0.235726334	1/2/13	0.13509	2/25/15	0.179359	3/30/17	0.166914
12/14/10	0.235742803	1/3/13	0.135469	2/26/15	0.179277	3/31/17	0.167161
12/15/10	0.235985504	1/4/13	0.135842	2/27/15	0.179291	4/3/17	0.165243
12/17/10	0.238247804	1/7/13	0.136154	3/2/15	0.181822	4/4/17	0.165479
12/20/10	0.228306162	1/8/13	0.136085	3/3/15	0.179297	4/5/17	0.163071
12/21/10	0.209893792	1/9/13	0.136085	3/4/15	0.181884	4/6/17	0.161771
12/22/10	0.21446445	1/10/13	0.141653	3/5/15	0.1793	4/7/17	0.160889
12/23/10	0.215321319	1/11/13	0.14186	3/6/15	0.171677	4/10/17	0.157646
12/24/10	0.215521808	1/15/13	0.147436	3/9/15	0.174153	4/11/17	0.155185
12/28/10	0.218014198	1/16/13	0.148091	3/11/15	0.179476	4/13/17	0.151087
12/29/10	0.21562183	1/17/13	0.148277	3/12/15	0.179467	4/18/17	0.15822
12/30/10	0.214039041	1/18/13	0.145835	3/13/15	0.17946	4/20/17	0.154643
12/31/10	0.216602956	1/21/13	0.148565	3/16/15	0.176883	4/21/17	0.157569
1/3/11	0.215020732	1/22/13	0.150927	3/17/15	0.176886	4/24/17	0.153248
1/4/11	0.212658397	1/23/13	0.148827	3/18/15	0.176892	4/25/17	0.146482
1/5/11	0.219561751	1/24/13	0.151601	3/19/15	0.174327	4/26/17	0.144123
1/6/11	0.219740646	1/25/13	0.14711	3/20/15	0.193647	4/28/17	0.144619
1/7/11	0.223014182	1/28/13	0.147246	3/23/15	0.193447	5/2/17	0.14555
1/10/11	0.226870846	1/29/13	0.147339	3/24/15	0.19075	5/3/17	0.146334
1/11/11	0.218028271	1/30/13	0.148127	3/25/15	0.193323	5/4/17	0.147073
1/12/11	0.213011091	1/31/13	0.146232	3/26/15	0.195878	5/5/17	0.144621
1/13/11	0.210583009	2/1/13	0.146392	3/27/15	0.195816	5/8/17	0.145081
1/14/11	0.210174123	2/4/13	0.146466	3/30/15	0.193047	5/9/17	0.142615
1/17/11	0.227726686	2/5/13	0.146734	3/31/15	0.193002	5/10/17	0.142758
1/18/11	0.215931512	2/6/13	0.146874	4/1/15	0.194563	5/11/17	0.138781
1/19/11	0.218586575	2/7/13	0.146621	4/7/15	0.191224	5/12/17	0.138996
1/20/11	0.227021736	2/8/13	0.144518	4/8/15	0.191275	5/15/17	0.139605
1/21/11	0.224669621	2/11/13	0.144569	4/9/15	0.191275	5/16/17	0.137741
1/24/11	0.234402728	2/12/13	0.147638	4/10/15	0.187213	5/17/17	0.137893
1/25/11	0.238805414	2/13/13	0.145131	4/13/15	0.18045	5/18/17	0.13568
1/26/11	0.235641129	2/14/13	0.147863	4/14/15	0.180473	5/19/17	0.135574
1/27/11	0.233087343	2/15/13	0.147971	4/15/15	0.17815	5/22/17	0.135972
1/28/11	0.243195253	2/19/13	0.150815	4/16/15	0.174488	5/23/17	0.136096
1/31/11	0.246167329	2/20/13	0.153678	4/17/15	0.178197	5/24/17	0.138822
2/1/11	0.237643332	2/25/13	0.161769	4/20/15	0.17801	5/25/17	0.141544
2/2/11	0.229194334	2/26/13	0.164594	4/21/15	0.175422	5/26/17	0.141653
2/3/11	0.224139273	2/27/13	0.172437	4/22/15	0.174859	5/30/17	0.142044
2/4/11	0.221627318	2/28/13	0.167225	4/23/15	0.172306	5/31/17	0.144737
2/7/11	0.224338032	3/1/13	0.164472	4/28/15	0.169557	6/1/17	0.149957
2/8/11	0.221213032	3/4/13	0.164397	4/29/15	0.172238	6/2/17	0.150042
2/9/11	0.223838828	3/6/13	0.158146	5/4/15	0.16981	6/5/17	0.150268
2/10/11	0.226452098	3/8/13	0.152951	5/5/15	0.169874	6/6/17	0.140564
2/11/11	0.218828153	3/11/13	0.15018	5/6/15	0.175144	6/7/17	0.140364
2/14/11	0.211275245	3/12/13	0.150436	5/7/15	0.178309	6/8/17	0.140346
2/15/11	0.211329898	3/13/13	0.150441	5/8/15	0.173474	6/9/17	0.142891
2/16/11	0.206563827	3/14/13	0.150443	5/11/15	0.170761	6/12/17	0.148102
2/17/11	0.206587617	3/15/13	0.153072	5/12/15	0.17339	6/13/17	0.148096
2/18/11	0.209178383	3/18/13	0.155697	5/13/15	0.173422	6/14/17	0.148094
2/21/11	0.206656731	3/19/13	0.155695	5/14/15	0.176238	6/15/17	0.150693
2/22/11	0.211205805	3/20/13	0.155694	5/18/15	0.170984	6/19/17	0.145181
2/23/11	0.219127205	3/25/13	0.163481	5/19/15	0.171256	6/20/17	0.148446
2/24/11	0.229434094	3/26/13	0.161208	5/20/15	0.171498	6/21/17	0.149253
2/25/11	0.234658519	3/27/13	0.16466	5/21/15	0.171629	6/22/17	0.152699
2/28/11	0.231907006	3/28/13	0.158594	5/22/15	0.171624	6/23/17	0.145595
3/1/11	0.234477746	4/3/13	0.155379	5/25/15	0.171477	6/26/17	0.148073

3/2/11	0.231898183	4/4/13	0.156988	5/26/15	0.179357	6/27/17	0.148871
3/3/11	0.226773814	4/5/13	0.162402	5/27/15	0.179339	6/28/17	0.150058
3/4/11	0.226778302	4/10/13	0.161976	5/28/15	0.179434	6/29/17	0.153524
3/7/11	0.226779412	4/11/13	0.162196	5/29/15	0.182085	6/30/17	0.154338
3/8/11	0.230565321	4/12/13	0.167457	6/1/15	0.184485	7/3/17	0.154071
3/9/11	0.23308668	4/15/13	0.172544	6/2/15	0.181893	7/4/17	0.154831
3/10/11	0.245716823	4/16/13	0.167329	6/3/15	0.184501	7/5/17	0.152956
3/11/11	0.240791553	4/17/13	0.173802	6/4/15	0.18978	7/7/17	0.157953
3/14/11	0.253880051	4/18/13	0.175393	6/5/15	0.189744	7/10/17	0.160184
3/15/11	0.273346064	4/19/13	0.170184	6/8/15	0.18959	7/11/17	0.1609
3/16/11	0.26881348	4/22/13	0.172652	6/9/15	0.194737	7/12/17	0.158993
3/17/11	0.258967971	4/23/13	0.167441	6/10/15	0.194693	7/13/17	0.157076
3/18/11	0.261690263	4/24/13	0.164842	6/11/15	0.184439	7/14/17	0.157754
3/22/11	0.258029736	4/25/13	0.162427	6/12/15	0.18443	7/17/17	0.161109
3/23/11	0.233073803	5/16/13	0.149284	6/15/15	0.184307	7/18/17	0.165818
3/24/11	0.230956627	5/17/13	0.149314	6/17/15	0.17911	7/19/17	0.162808
3/25/11	0.230442479	5/22/13	0.158582	6/18/15	0.17654	7/20/17	0.165063
3/28/11	0.232855354	5/23/13	0.184772	6/19/15	0.193785	7/21/17	0.165806
3/29/11	0.230309646	5/24/13	0.176707	6/22/15	0.190162	7/24/17	0.167942
3/30/11	0.225221126	5/27/13	0.171414	6/23/15	0.184577	7/25/17	0.168624
3/31/11	0.225220655	5/28/13	0.168733	6/24/15	0.181461	7/26/17	0.166703
4/1/11	0.222797448	5/29/13	0.173856	6/25/15	0.181011	7/27/17	0.167356
4/4/11	0.222668981	5/30/13	0.173621	6/29/15	0.187798	7/28/17	0.146644
4/5/11	0.211164245	5/31/13	0.170981	6/30/15	0.190044	8/1/17	0.140206
4/6/11	0.209972599	6/5/13	0.170981	7/1/15	0.187025	8/2/17	0.141845
4/7/11	0.211236376	6/7/13	0.170783	7/2/15	0.183642	8/3/17	0.144928
4/8/11	0.208906	6/10/13	0.188812	7/3/15	0.185923	8/4/17	0.145057
4/11/11	0.208809853	6/11/13	0.199107	7/6/15	0.19048	8/7/17	0.146854
4/12/11	0.214411028	6/12/13	0.201791	7/7/15	0.202186	8/8/17	0.124054
4/13/11	0.214437296	6/13/13	0.20177	7/8/15	0.199197	8/10/17	0.136403
4/14/11	0.214467807	6/14/13	0.20177	7/9/15	0.189155	8/11/17	0.151312
4/15/11	0.217245252	6/18/13	0.201441	7/10/15	0.186217	8/14/17	0.156398
4/18/11	0.235800825	6/19/13	0.204003	7/13/15	0.182951	8/15/17	0.1626
4/19/11	0.225631716	6/20/13	0.214259	7/14/15	0.185276	8/16/17	0.140051
4/20/11	0.206942204	6/21/13	0.222805	7/15/15	0.184981	8/17/17	0.142818
4/21/11	0.204389497	6/24/13	0.222805	7/16/15	0.174616	8/18/17	0.148188
4/26/11	0.204331876	6/25/13	0.22681	7/17/15	0.174497	8/22/17	0.142505
4/28/11	0.204291279	6/26/13	0.22681	7/20/15	0.171483	8/23/17	0.14253
4/29/11	0.204317221	6/27/13	0.223898	7/21/15	0.171375	8/24/17	0.140185
5/3/11	0.211856601	6/28/13	0.223077	7/22/15	0.178479	8/25/17	0.142575
5/4/11	0.217014151	7/1/13	0.219661	7/23/15	0.17824		
5/5/11	0.219783012	7/2/13	0.21934	7/24/15	0.184164		
5/6/11	0.214763175	7/3/13	0.228199	7/27/15	0.183683		