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**Technical analysis and trading strategy in Chinese stock market**

In Partial Fulfillment of the Requirements  
for the Bachelor of Science in Finance

by

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## **ABSTRACT**

Technical analysis and trading strategy have been widely used in stock markets since the market is not efficient all the time. This paper uses rule-based method to identify yearly based bull and bear markets in Chinese stock market for stocks traded on Shanghai Stock Exchange. Specific trading strategy is being designed to do simulation trading in bull and bear market respectively. Findings suggest that there is a significant difference of simulation returns between bull and bear market situation. Conservative bear strategy for bear markets performs better than aggressive bull strategy.

## 1. INTRODUCTION

Having a glimpse of the financial market, there are all kinds financial instrument for investors to choose. Some of them offer low risk and stable return like bond, other derivatives like options require advanced knowledge and not so many investors have experience in investing them. Besides, these derivatives start to gain popularity only in recent years. For several decades, lots of investors invest in stocks as they provide higher returns and many investors have relatively easy access to the stock market.

The price of a stock can be explained in many ways, such as the discounted cash flow theory or the market rule of supply and demand. Several studies have revealed some information about the stock market. Burton (2011) talked about the efficient market hypothesis, which illustrate three kinds of forms of stock market. The weak form is that the future stock prices can be predicted by relying on the historical data. The semi-strong form says that the current stock price is the reflection of historical price plus the available public information about the company. The strong form indicates that the market price of stock is the representation of all information known to any market participants. However, the market is always not efficient. In addition, Fakultät (2010) also pointed out the price sequence of stock is not a stationary process. The stationarity of time-series data can be little applied. These are reasons why lots of speculators could earn positive profit in the stock market.

Based on these market investigations, researchers give the name “technical analysis” to the method that investors use to earn profit in the stock market. As Day Trading Encyclopedia explains, investors try to use technical analysis to interpret potential

patterns and price relevance instead of focusing on the operation of the listed company. James (2019) stated two categories of technical analysis which consists of chart patterns and technical indicators.

Paul also provide validity for technical analysis by saying that though the stock price movement is random, but price trends is similar to business cycles and they tend to repeat themselves in various time periods.

## **2. LITERATURE REVIEW**

Technical analysis can be divided into chart patterns and technical indicators, each of them contains lots of subcategories and are useful whether in recognizing or trade in bull and bear market.

### **2.1 Bull and Bear Markets**

Through empirical results, the stock market will appear as bull or bear market alternatively. At other times, the market keeps adjusting itself. When it's the time for bull market, investors hold great optimism and high demand push stock price goes high. During this period, it's profitable to follow the uptrend to buy. While it's time for bear markets, the market is full of pessimism and most investors do not want to hold stocks.

As Philip (2016) investigated, the idea of bull and bear markets is similar to business cycles, where there is expansion, there is recession. Some empirical results has been revealed. Firstly, the greatest return comes at the initial stage of the bull market and the return get increasingly smaller as the bull market persists, which is the same as

diminishing marginal return. This result inspires investors that they are supposed to use indicators to catch the start point of the bull market to maximize their profits. For example, Mark (2019) uses the example of iShares Global Clean Energy to illustrate the huge profit investors are able to achieve if they catch the initial surge of the bull market. Secondly, when the market starts to enter into a bear market, the losses will get increasingly large as time goes by. Last but not least, the average surge of stock price in bull market is 64% and the average collapse of stock price in bear market is 20%. In terms of duration, the bull market outlives the bear market by a ratio of 2:1.

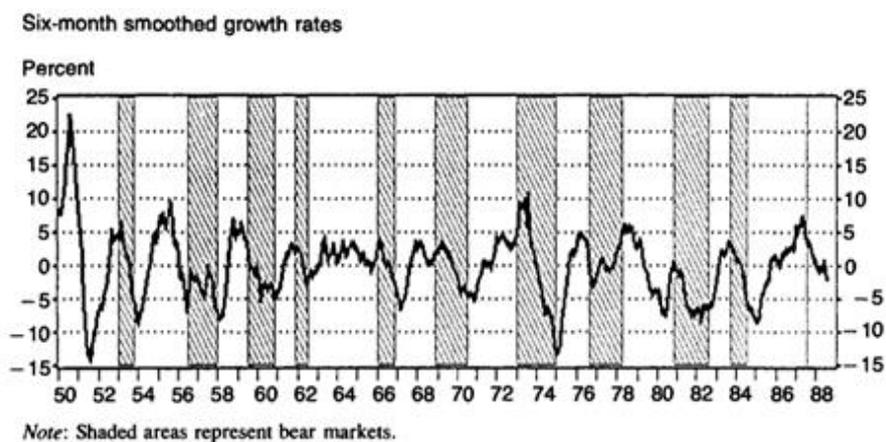


Figure 1. Bull and Bear Market Periods in History

Since in bull market lots of investors could make profit, there are also methods to trade in the bear market. As Phil suggested, the true investors are those who like to stand in the opposite of the bear market. When there is fear, it's a good chance to buy the stock at low price since it is oversold and undervalued. The price of the stock is likely to bounce back to a certain level. The famous Wave Theory also stands for this point of view. The uptrend of the bull market is likely to be broken down into three uptrends and two small downtrends. While the bear market is likely to be broken down into two downtrends and one small uptrend.

## 2.2 Candle Charts

Most software show candle charts to investors, which include open price, close price, the highest price and the lowest price in a single candle so that investors could have a straightforward impression on the price performance of a single day. By analyzing candle charts with various days, investors could gain very useful information.

### 2.2.1 Distinguish Bull and Bear Markets Using Candle Charts

Marshall (2007) listed four patterns of candle charts respectively to recognize bull and bear markets. For bull markets, firstly, Three White Soldiers (TWS): after a down trend, there is an uptrend for three consecutive days with close price get progressively higher. Secondly, Three Inside Up (TIU): a downtrend followed by a small increase the next day and the third day makes the price to a new high. Thirdly, Three Outside Up (TOU): a downtrend followed by an increase the next day which engulfs the initial day and the third day makes the price to a new high. Fourthly, Morning Star (MS): a downtrend continues and is followed by a downward gap and a small decrease the next day, while the third day makes a new high and the close price is in the mid of the body of the first day.

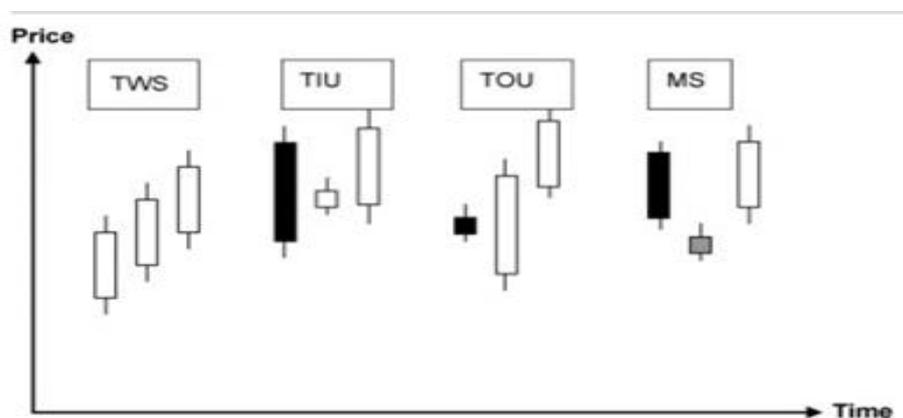


Figure 2. Bull Market Candle Charts

For bear markets, the situation is the opposite of the bull markets. The names of these four candle charts patterns also change to Three Black Crows (TBC), Three Inside Down (TID), Three Outside Down (TOD) and Evening Star (ES).

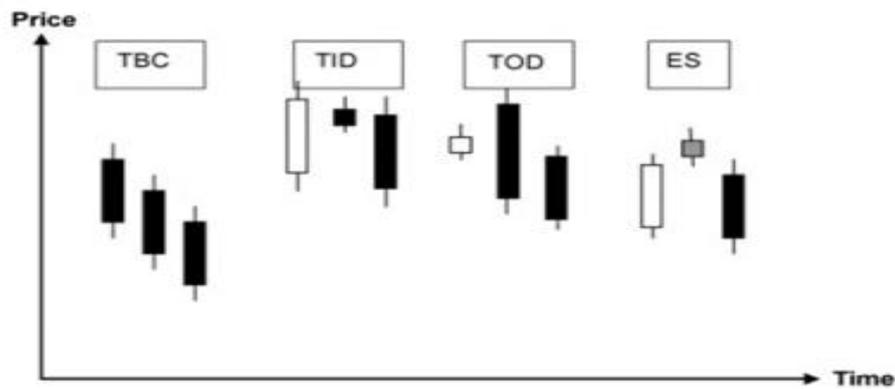


Figure 3. Bear Market Candle Charts

### 2.2.2 Trade Using Candle Charts

Lin (2011) provided other patterns for trade since he holds the view that market turns are suggested by candle charts. Hammers & Hanging Man: the price of the second day goes up after the drop in the first day and the gap between the lowest price and the close price is large for two consecutive days. Dark Cloud Cover: the open price next day is higher but the price goes down and the low wick is in the body of the first day. Piercing Line: the open price of the next day is lower but price goes up and the upper wick is in the body of the first day. Engulfing Pattern: following a drop or surge of the first day, the second day's body engulfs the first day's body.

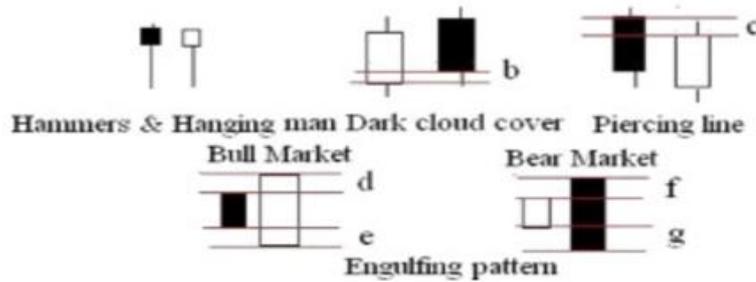


Figure 4. Trading Patterns of Candle Charts

These are candle charts for short days, when candle charts are combined together, they are likely to form a trend. Robert (2018) pointed out that in most cases, when the price is in a reversal trend whether it reaches top or bottom, a recognizable pattern will show as Reversal Formation. Represented by candle charts for months, the trend could act like “V” form or “W”, “M” form which resembles shoulder, head and shoulder as human body. Furthermore, if activity attending the right shoulder is abnormally dull, that shoulder is apt to be low but protracted in time.

### 2.3 Stock Indices

Motley Fool Platform explains that a stock Index is used to describe the performance of the stock market or a specific part in the whole market. Famous indices include NASDAQ, S&P 500, and Dow Jones Industrial Average. Dow Jones Industrial Average assigns more weight to companies with higher stock prices since it is a price-weight index. S&P 500 assigns more weight to companies with larger market capitalization since it is a size-weight index. ETX Capital indicates that different indices have different sensitivity to price, investors could choose which indices to follow in accordance to their risk preferences.

The stock market is a big ocean, investors have to choose which part of it they want

to explore. Randy (2019) stated that long-term investors often use fundamental analysis which uses information like P/E ratio and EPS ratio on the financial report to pick ideal companies. Besides these ratios, one of the methods to predict the price of a stock is called Dividend Discount Model (DDM). LESLIE KRAMER (2019) says the value of a security is the present value of its future cash flows adjusted for the time value of money and risk. Investors are able to use this concept to pick stocks to trade. If the general situation is bull market, investors could also follow the indices.

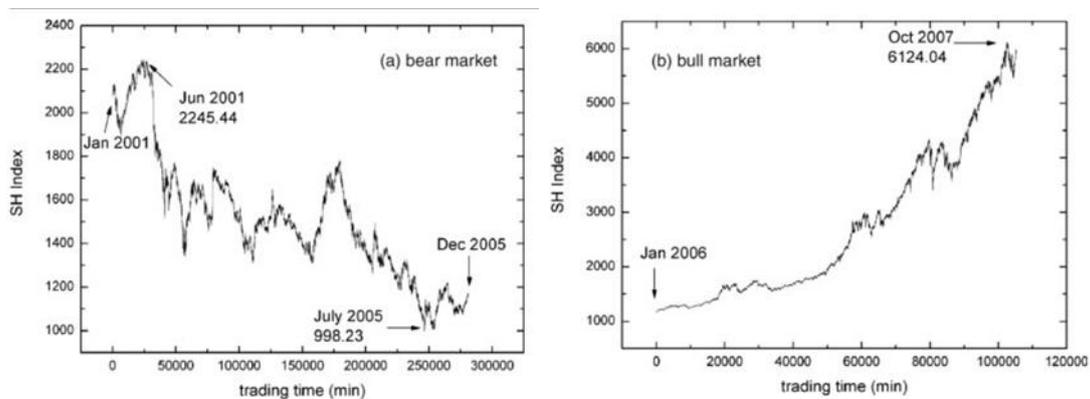


Figure 5. Bull and bear markets by using SH Index in history

## 2.4 Simple Moving Average

Abeyant (2001) illustrated Simple Moving Average (SMA), which is composed by getting the average price of a particular stock during a specified number of periods. Its fluctuations are less volatile than the actual stock price. For example, after calculating out the moving average of close prices of 10 days and 20 days, when the 10 days moving average up cross the 20 days moving average, it's called a "golden cross" and it's time to buy since it denotes an incoming uptrend. When 10 days of moving average down cross the 20 days moving average, it's a "death cross" and it's time to sell.

$$SMA(t) = \frac{1}{n} \sum_{i=t-n}^t x(i)$$

Figure 6. Formula for Simple Moving Average

## 2.5 Relative Strength Index

Lamartine etc. (2010) recognized Relative Strength Index (RSI) as one of the most popular momentum oscillators. It depicts the recent situation in gains and losses of the stock and then produces a number which ranges from 0 to 100. Gains and losses are calculated as returns between two consecutive days. If RSI up crosses 30 it is considered a bullish signal, in other words, it is time to buy and expect the price to rise. On the contrary, when the index falls below 70 it is regarded as a bearish signal and investors are supposed to sell the stock.

$$RSI = 100 - \frac{100}{1+RS}, \quad \text{where } RS = \frac{avgGain}{avgLost}$$

$$avgGain = (\text{total of gains during past } n \text{ periods})/n$$

$$avgLost = (\text{total of losses during past } n \text{ periods})/n$$

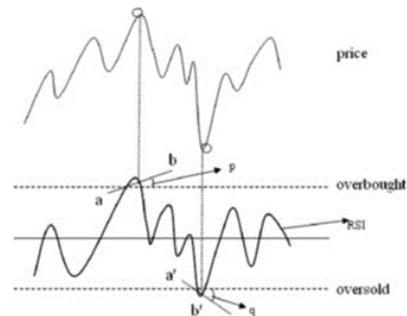


Figure 7. Formula and Trading Points for Relative Strength Index

## 2.6 Rate of Change

Lin (2011) described that ROC is the measure of the change between price today and several days ago, which means how rapid does the price change. This trading strategy

requires to calculate a short-term ROC and long-term ROC. In general, when long-term ROC makes a new high price while short-term ROC is fluctuating around the equilibrium line (often of the value of 100), the price has a high possibility to fall down. On the contrary, when long-term ROC makes a new low when short-term ROC is fluctuation the equilibrium line, the price will probably rise up.

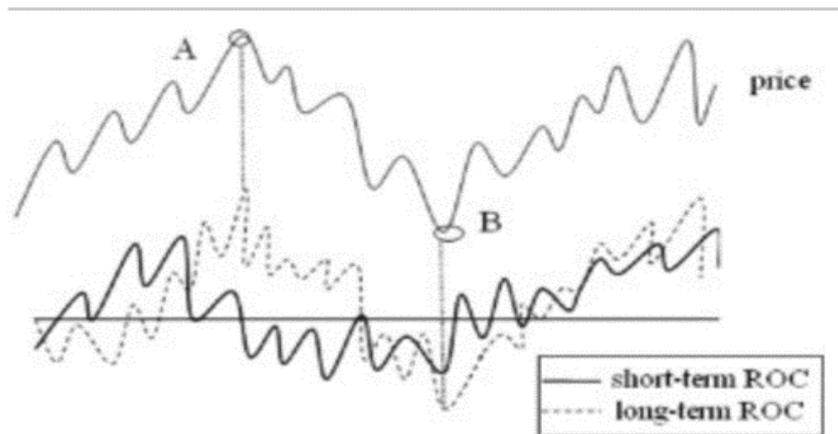


Figure 8. Trading Points for Rate of Change

### 3. METHODOLOGY AND DATA

#### 3.1 Data

In order to test the validity of various trading strategies to see its return over a specific period of time, historical trading data of stocks in Chinese stock market are needed. Stock trading data is of daily basis. The dataset consists of 3792 stocks in the whole Chinese stock market includes A-share board, growth enterprise board, small and medium enterprise board. This paper uses stocks trading in the Shanghai Stock Exchange as samples. Of each individual stock, it includes open, close, high and low price of the day. Price change, trading volume and money. Along with the adjust price

for close price due to the stock split. It is a time-series data on trading days from its IPO till 20<sup>th</sup> September, 2019 if the stock is still traded on the exchange.

### 3.2 Methodology

The moving trend of stock price is random and most investors, including many experts believe the idea for bull and bear market respectively. Different trading strategies are designed for those two market situations in accordance with bull and bear characteristics.

#### 3.2.1 Bull and Bear Market Recognition

One rule-based method to judge bull and bear market by identifying peaks and troughs Pagan and Sossounov (2003) is used with the help of Shanghai Composite Index. The following figure shows the identification result.

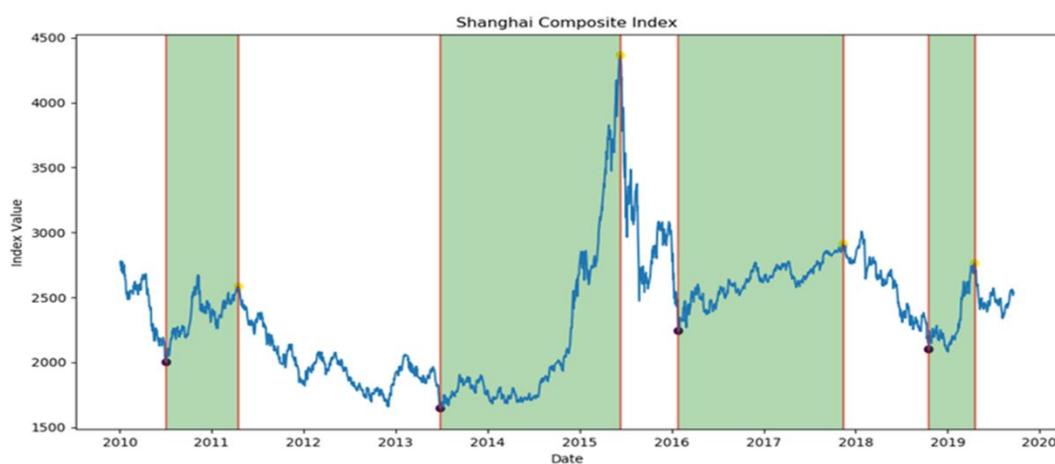


Figure 9. Shanghai Composite Index for Bull and Bear Markets

There is an alternating sequence of bull and bear market while the green area stands for the bull. Hypothesis testing is used to test in two bull year 2014, 2016 and in two

bear year 2012, 2018.

### **3.2.2 Trading Strategy in Bull Market**

In the bull market, the probability of price surging is high, so the strategy of “buy the winners” is applied. By using moving maximum of a window of T days, when the price makes a break through and reach a new high, it’s a strong buy signal. On the contrary, if price starts to go down and when the price is lower than the last buying price, it is a sell signal. In short, the bull strategy aims to be aggressive and catch the increasing high points.

Bull Market (buy the winners):

T days Moving Maximum:  $T(\max) = \max (P_t, P_{t-1}, \dots, P_{t-(T-1)})$

Buy signal:  $P(T) = T(\max)$

Sell signal:  $P(T+n) < P(T-1)$

### **3.2.3 Trading Strategy in Bear Market**

The fluctuation of stock price is random. However, it has a main trend around the moving average. When the price is significantly deviate from the moving average, it is considered to be oversold and undervalued. When the price is significantly higher than the moving average, it is considered to be overbought and overvalued. For each day, there is a difference between the actual price and the n days’ moving average. After calculating moving average, a moving standard deviation of the difference of previous n days will be calculated. When the difference is larger than k standard deviations, it is a buy signal. When the price reaches the moving average after a buy signal, it is

considered as a sell signal. There are two parameters to be tested in the model, one is the number  $n$  days of moving average, another is the number of  $k$  standard deviations. From empirical results,  $n$  will be set as 20 and  $k$  is 2.

Bear Market (mean reversion):

$$T \text{ days moving average: } T(\text{average}) = (P_t, P_{t-1}, \dots, P_{t-(T-1)})/T$$

$$T \text{ day difference: } T(\text{diff}) = T(\text{average}) - T(\text{diff})$$

$$T \text{ days standard deviation: } T(\text{sd}) = \text{standard deviation of } (T(\text{diff})_t, T(\text{diff})_{t-1}, \dots, T(\text{diff})_{t-(T-1)})$$

$$\text{Buy signal: } T(\text{diff}) \geq T(\text{sd}) * 2$$

$$\text{Sell signal: } T(\text{diff}) < 0 \text{ (first point after the buy signal)}$$

### 3.3 Simulation and Hypothesis

Two models will be applied to their respective sample for simulation. For bull and bear market, the simulation assumes that an individual investor has 1 million to invest and 0.1 million will be spent whenever there is a buy signal and sell all the existing positions when encounter a sell signal. If there is no more cash, the buy signal will be ignored. If there is no sell signal until the end of the year, all the open positions will be liquidated to sell at the last day of the year so to calculate yearly returns.

The first hypothesis states that  $H_0$ : there is no difference between the returns of trading strategies that designed for its target market situation. The second states that  $H_0$ : In the bull market, bull strategy performs better than bear strategy. The third states that  $H_0$ : In the bear market, bear strategy performs better than bull strategy.

#### **4. ANALYSIS AND FINDINGS**

From the results in appendix A, it is clear to see that for the four years selected to be tested, results in three of the years of 2012, 2016 and 2018 are significant in terms of 0.05 significance level. Different trading strategies indeed make differences in catching critical points under different market situations. Amazingly, the test during bull year of China's stock market in 2014 is not significant. This phenomenon can be reasonably explained. Under a bull market, the price does not go up all the time, there are small periods of adjusting and down trend. The mean-reversion strategy will effectively catch these points while market sentiment is positive, so the probability of price falling down is very low. That's the reason why the strategy designed for bear market can also make money in the bull market.

Having a look into the detail of percentile of return of different years in appendix A, there are more detailed information. In the two bear years in 2012 and 2018. The bear strategy performs better than the bull strategy in terms of positive returns' percentiles. Especially in 2012, 90% of the stocks that use bear strategy are able to make positive returns. During the two bull years in 2014 and 2016, the bull strategy is able to make abnormal return in 2014 while it does not perform well in 2016 when there are a lot more fluctuations and adjusting periods. To conclude, it's not reasonable to use single trading strategy to trade since each one of a specific trading strategy is only capable of catching one characteristic of the stock. It's wise to use multiple technical indicators and blend in public information to make better investing decisions.

## **5. CONCLUSION**

This paper finds that there is a significant difference of simulation returns between bull and bear market strategies. Different market situation indeed suggests investors to employ different trading strategy and incorporate various technical indicators to help them do trading. Bear strategy performs better than bull strategy in bear markets, while bull strategy does not perform better than bear strategy in bull market. The essence behind this phenomenon is the trading points. Bear strategy will always be more conservative than bull strategy to catch low points and expect the price to rise up. On the contrary, bull strategy is more aggressive to catch high points so to expose to more risk. On the other hand, bull strategy has higher possibility to make abnormal return than bear strategy. In fact, if there is fewer adjusting periods in bull market, bull strategy could have performed better.

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## Appendix A

z-Test: Two Sample for Means			z-Test: Two Sample for Means		
2012			2014		
	Variable 1	Variable 2		Variable 1	Variable 2
Mean	0.052695149	-0.00557	Mean	0.048699	0.038198
Known Variance	0.014338	0.006851	Known Variance	0.004138	0.027675
Observations	924	928	Observations	678	934
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0	
z	12.17526871		z	1.75681	
P(Z<=z) one-tail	0		P(Z<=z) one-tail	0.039475	
z Critical one-tail	1.644853627		z Critical one-tail	1.644854	
P(Z<=z) two-tail	0		P(Z<=z) two-tail	0.07895	
z Critical two-tail	1.959963985		z Critical two-tail	1.959964	

z-Test: Two Sample for Means			z-Test: Two Sample for Means		
2016			2018		
	Variable 1	Variable 2		Variable 1	Variable 2
Mean	-0.00031	-0.031	Mean	-0.01681	-0.03328
Known Variance	0.009672	0.008742	Known Variance	0.023246	0.00384
Observations	654	958	Observations	415	984
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0	
z	6.275848		z	2.126579	
P(Z<=z) one-tail	1.74E-10		P(Z<=z) one-tail	0.016728	
z Critical one-tail	1.644854		z Critical one-tail	1.644854	
P(Z<=z) two-tail	3.48E-10		P(Z<=z) two-tail	0.033455	
z Critical two-tail	1.959964		z Critical two-tail	1.959964	

Table 1. Test Results for Differences in Means

10th Percentile of returns	2012		2014		2016		2018	
Bear strategy	Bull strategy	Bear strategy	Bull strategy	Bear strategy	Bull strategy	Bear strategy	Bull strategy	
-0.513874	-0.209801	-0.518281	-0.28352	-0.378162	-0.337116	-0.816053	-0.229193	
-0.0928789	-0.0727817	0.0007431	-0.092814	-0.1332505	-0.1053425	-0.1977804	-0.0932813	
-0.0459074	-0.0501484	0.0159928	-0.0628436	-0.0894326	-0.0806698	-0.1049316	-0.0701602	
-0.0043396	-0.0372676	0.0259071	-0.0421578	-0.0484031	-0.0649881	-0.0684986	-0.0582481	
0.0258516	-0.026989	0.0350888	-0.0235124	-0.0110518	-0.0514502	-0.0360376	-0.0477008	
0.05577	-0.017714	0.0449495	-0.0005585	0.0149525	-0.039321	-0.004802	-0.0385535	
0.0810642	-0.0068924	0.0566688	0.022987	0.0308054	-0.0281916	0.0290824	-0.0291978	
0.1096364	0.0068901	0.0685604	0.0612409	0.0476666	-0.0135445	0.0550864	-0.0203472	
0.1498514	0.0296974	0.085287	0.1017132	0.077707	0.0054384	0.0936342	-0.006305	
0.1949177	0.070716	0.1109199	0.1912322	0.1103845	0.0402086	0.1380266	0.0257843	
0.473955	0.965652	0.287421	1.514931	0.460178	1.665659	0.466935	0.510437	

Table 2. 10th Percentile of Returns