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TESIS DOCTORAL

Behavioral finance strategic application in risk investment based on the Chinese and European Financial Market

Aplicación estratégica de las finanzas del comportamiento en las inversiones con riesgo basada en el Mercado Financiero Chino y Europeo

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

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Doctorial Thesis

Behavioral Finance Strategic Application in Risk Investment

- **Based on the Chinese and European Financial Market**

Aplicación Estratégica de Las Finanzas del Comportamiento en Las Inversiones con Riesgo - Basada en el Mercado Financiero Chino y Europeo

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Summary

The dissertation *Behavioral Finance Strategic Application in Risk Investment - Based on the Chinese and European Financial Market* mainly discusses the two concepts of behavioral finance - momentum strategy and mental accounting. We tried to explain the investors psychology by the perspective of behavior finance, analyzed the characters of the Chinese stock market and the European stock market, then designed optimized investment portfolios between profits and investment risks. By testing the investors risk appetite, we tried to find momentum strategy that was appropriated to the profile of investors risk tolerance and profit expectation.

We used the data of all 300 listed companies of HUSHEN 300 Index and all listed companies of EUROSTAXX 600 Index during a 10 year period (2005-2015). We analyzed the difference of market efficiency of these two markets, designed differenced momentum investment portfolios for each of them. By using a 10 year period (2005-2015) data set of these two stock markets, we proved that the Chinese stock market was an inefficient market and the European stock market is a efficient market. Comparing with the European investors, the Chinese investors are less rational. After separating the 10 year period to bull market period, bear market period and normal market period, we designed multivariate momentum model with different investment periods and discovered that short term investment period is more suitable to the Chinese stock market and the middle investment period is more suitable to the European stock market. It also meant that the price volatility of the Chinese stock market is higher than the European stock market in a short period, which provided an arbitrage opportunity to investors of the Chinese stock market.

By introducing the impact of the book value and implicit factor - interest rate in our multivariate momentum model, our experiment demonstrated that the momentum model was not depend on single factor, it could be affected by a variety of factors, such as investment market, economic circle, company basic value or many implicit factors. We also introduced the concept of mental accounting in the dissertation and tried to add the investors psychological factors into investment portfolio. We found that understanding the investors risk appetite was the key to design a suitable investment portfolio. We classified three investment standard investment indicator, the risk factor BETA, the historical yield RE and the net profitability TROA of the listed company and designed momentum investment portfolios for each of these three indicators, then we observed the price

volatility and return rate of these momentum models in the next year (2015). Finally, we designed a momentum model that had more future profits, and got a more appropriate portfolio which was based on investor risk appetite and profits profile.

In this dissertation, we demonstrated the impact of behavior finance in risk investments and provided a new perspective that could optimized the investment portfolio designing. We proved that the investor psychological factors decided their decision making system, and their investment profit or losses. Our objective is to boldly apply the concept of behavioral finance and to integrate it into investment portfolio design and to improve the traditional momentum model into multivariable momentum model to pursuit maximum profits.

Resumen

La tesis APLICACIÓN ESTRATÉGICA DE LAS FINANZAS DEL COMPORTAMIENTO EN LAS INVERSIONES CON RIESGO -BASADA EN EL MERCADO FINANCIERO CHINO Y EUROPEO discute principalmente dos conceptos de finanzas del comportamiento: la estrategia de impulso y la cuenta mental. Trata de explicar la psicología de los inversores desde la perspectiva de los comportamientos financieros, analizando las características del mercado financiero chino y del mercado financiero europeo, posteriormente busca las carteras de inversión optimizadas que se encuentran en equilibrio entre los beneficios y los riesgos de la inversión. Al probar el apetito por el riesgo de los inversores, trata de encontrar una estrategia de impulso que se adapte al perfil de la tolerancia al riesgo de los inversores y a su expectativa de ganancias.

Se utilizan los datos de las 300 empresas cotizadas del índice HUSHEN 300 en el mercado chino y de todas las sociedades cotizadas del índice EUROSTOXX 600 del mercado europeo durante un período de 10 años (2005-2015). Se analiza la diferencia de eficiencia de estos dos mercados diseñando diferentes carteras de inversión para cada uno. Durante un período de 10 años (2005-2015), se comprueba que el mercado financiero chino es un mercado ineficiente mientras que el mercado financiero europeo es un mercado eficiente. En comparación con los inversores europeos, los inversores chinos son menos racionales. Después de dividir este período de 10 años en tres subperíodos: un período de mercado alcista, un período de mercado bajista y un período de mercado normal, se diseña un modelo multivariante de impulso con diferentes períodos de inversión averiguando que el período de inversión a corto plazo es más adecuado para el mercado chino mientras que el período de inversión a plazo medio es el más adecuado para el mercado europeo. Este resultado significa que la volatilidad de precios del mercado chino es más alta que la de la bolsa europea en un plazo corto, lo que proporciona una oportunidad de arbitraje a los inversores del mercado chino.

Al introducir el impacto del valor contable y el factor implícito - la tasa de interés- en nuestro modelo multivariante, se demuestra que el modelo de impulso no depende de un solo factor, dado que puede verse afectado por una serie de factores diferentes, por ejemplo, el tipo de mercado, la situación económica, el valor contable de las empresas cotizadas o unos factores implícitos. También se introdujo en esta tesis doctoral el concepto de cuenta mental y se

añadieron factores psicológicos de los inversores para diseñar las carteras de inversiones. Se averigua con ello que entender el apetito por el riesgo de los inversores es la clave para diseñar una cartera de inversiones adecuada. Se clasificaron tres indicadores estándar en la valoración de la inversión, el factor de riesgo BETA, el rendimiento histórico y la rentabilidad neta para las empresas cotizadas. Se buscaron unas carteras dinámicas de inversión con cada uno de estos tres indicadores, observándose la volatilidad de precios y la tasa de retorno de estos modelos en el siguiente año (2015). Finalmente, se diseñó un modelo de impulso que tenía más ganancias futuras lo que proporcionó una cartera más apropiada que se basaba en el apetito por el riesgo de los inversores y en sus perfiles de rentabilidad.

En esta tesis, se ha demostrado el impacto del comportamiento financiero en la gestión del riesgo de inversión y se proporciona una nueva perspectiva que podría optimizar el diseño de las carteras de inversión. Se demuestra que los factores psicológicos del inversor no sólo influyen en sus decisiones de inversión sino que también en sus ganancias y pérdidas finales. El objetivo es aplicar audazmente un concepto de comportamiento financiero e integrarlo en el diseño de las carteras de inversión, y mejorar el modelo de impulso tradicional con un modelo multivariable para obtener la máxima rentabilidad.

Introduction

Behavioral finance is an emerging science that combines psychology and finance, which explains, investigates and predicts the development of financial market from the perspective of personal behavior and mental thoughts. By analyzing the market deviation and market abnormality, we can seek the different ways of business management and decision making in different markets of environments and strive to establish a descriptive model can reflect the real decision making behavior (Siegel, S. & Goldstein, D, A., 1959) and market operation correctly. It is worth to mention that the cognition of stock market volatility of human being is a challenged problem in the world. Till today, there does not exist a method or theory that can be convinced by public or can stand by time. Behavior finance is an interdisciplinary subject that mixes finance, psychology, behavior science and social science, which tries to discover the irrational behavior and decision making rules of financial market. The behavioral finance believes that the stock price is not only determined by its intrinsic value, but also depends on the investors behavior which has a significant impact on the stock market price volatility. The traditional finance theory believes that the personal decisions are based on the rational expectation, risk aversion, utility maximization and others assumptions.

A number of psychological studies (Markic, O., 2009) show that the real personal decisions are not that rational. For example, people are always overconfident with their own judgments, they make decisions by their past experience of earning or loss. Human irrational behavior cannot be completely understood by theory or model, but it has an important impact in the economic system. Behavioral finance reveals the fundamental flaw of neo-classical economy (Josan, A. & Voicu, C., 2013) - completed rational hypothesis, which is raised highly concern of academic circles.

The differences of behavioral finance and traditional finance (Muhammad, N. & Maheran, N., 2009) in that behavioral finance introduces psychological characters as human susceptibility, cognitive deficit, risk appetite, regretful disgust, self-control deficiency and investors sentiment into asset pricing theory, so it believes that the decision making preferences are generally multifaceted and volatile. The investors are strong adaptable of changing or volatility, so they can manage the whole decision making process.

The traditional efficient market hypothesis (EMH) (Malkiel, B., 2003) is a very important

theoretical model in finance. EMH believes that the stock price contains all the relative market information, at the same time, it considers that every price is the most optimized estimation of investment value. According to behavioral finance, EMH theory has two main assumptions about investors behavior: One is that it does not exist biased behavior of investors when they make decision of maximize their investment portfolio profits. Another is investors are always interested in maximizing their returns. Behavioral finance argues that EMH theory does not guarantee that both prerequisites must be established. On the contrary, behavioral finance, which is based on the analysis of actual situation, can question the correctness and rationality of these two assumptions. It believes that investment subjects often violate these two assumptions because of several psychological factors (Colin, C. & Loewenstein, G. , 2004).

Our investigation focuses on the subject behavioral finance, a non-traditional financial field that is interesting. And we mainly discuss two subjects of behavioral finance, momentum investment strategy and mental accounting.

Momentum effect is also known as "inertial effect". The momentum effect is proposed by Jegadeesh and Titman (1993), which means that the tendency of the yield of stocks will be continuous. The stocks with high yield in the past will have higher future yield than others stocks. It seeks the continuity of price changing during a determined future period, for example, when the price keeps increasing, investors will sell their portfolios; when the price keeps decreasing, investors will keep their portfolios or buy more stocks. Investors disposition effect will cause a deviation between the basic value of the market value, which can be applied by momentum strategy. Momentum strategy is based on the historical stock performance, people take long position of stocks with high historical returns and take short position of stocks with low historical returns, so they will obtain price difference. In addition, the overconfidence of investors will lead their under reaction of new information. The increasing or decreasing of stock price may maintain a period, so by applying momentum strategy, we can catch the opportunity of earning more profits when the stock price fluctuates.

Mental accounting (Thaler, R., 1999) is an important concept in behavioral economy. Because of the existence of mental accounts of consumers, individuals often make decisions in violation of simple economic rules, and they may make a lot of irrational decisions or have many irrational behavior. These behaviors are focus on the following psychological effects: non-substitution effect (Daubanes, J. & Lasserre, P., 2012), sinking cost effect (Cunha, M. & Caldieraro, F., 2009), transaction utility effect (Hong, T., Lee, C. & Wang, S., 2011). All these effects reveal the

influence mechanism of mental accounts on individual decision-making behavior. Decision-making is ubiquitous, it can be a big business decision and also can be a small decision as to buying which house, which stock, even if for people's daily life as what to eat at dinner. Since the decision can be rational and irrational. Everyone has two accounts, one is the economic account, another is the mental account, and the mental account can affect our consumption decisions. In the economic account, as long as the absolute value is the same, each euro can be replaced by any other euro. In the mental account, people do not treat the same amount of euro at the same way. People evaluate the money by its utility, so they have different attitude in spending the money of different mental accounts. There are three types of mental accounts (Thaler, R., 2008): one kind is divided income into different accounts by the original of incomes, people will not replace one account by others; one kind is use income of different origins to propensity of consume; the last one is to treat different amounts of income by different attitudes. The existence of mental accounts affects people with different attitudes towards different expenses or benefits, so people will make different decisions or have different behaviors. For example, in mental accounting, people believe that their loss of sold stocks and their loss of un sold stocks are different, they feel more painful of the first loss, which means that people put these two situations on different boundaries, even if these two kinds of loss have the same value. From the book value loss to the real loss, the latter loss can caused a stronger feeling of loss in mental accounting, so it is more painful. People think that these two losses are different and they cannot treat them with the same way. When the book value loss becomes a real loss, the account of book value loss is finally closed. In general, people do not move their money back to their mental accounts, so their real losses will become permanent losses. Mental accounting not only affect people's investment decision making, but also makes unexpected impact on people´s daily life as their consumer behaviors.

Chapter 1. Object and structure of investigation

1.1 Object of investigation

The purpose of this paper is as following :

Object 1

By introducing the new concept of behavior finance, we try to explain the irrational behaviors of investors with the knowledge of behavior finance.

Object 2

Today, the international economy integration has grown gradually, so the oversea investment is attracted more and more attention of oversea investors. This thesis compares the Chinese financial market and the European financial market, compares their differences and intends to help investors to make more appropriated investment decisions in these two markets.

Object 3

By using the momentum investment model and choosing the right investment period, we design an optimal profit portfolio for different business cycles, both in the bull market and in the bear market environment.

Object 4

Investors psychology plays a vital role in their investment behaviors. We analyze the investors risk appetite for designing an investment portfolio that is according to their mental accounts of profits and risks.

1.2 Structure of investigation

The structure of this thesis includes a brief introduction, four main chapters, references and appendices. Each chapter includes the details and a brief summary. We summarize the main contents of these chapters as following:

Chapter 1

The chapter one is about the purpose and the main structure of the thesis.

Chapter 2

The chapter two mainly describes the origin of the behavioral finance, the concepts and some interesting examples of behavioral finance in the real life. In this paragraph, we also compares the differences between Chinese financial market and the European financial market, which lays a theoretical basis for the next chapter.

Chapter 3

The chapter three describes how to apply concepts of behavioral finance - momentum model and mental account in the risk investment. We use the data of the Chinese stock market and the European stock market to analyze the efficiency of these two investment markets. According to the characteristics of each of these two market, we design a suitable momentum investment model. Furthermore, we study the risk preferences of different investors, and design the optimal momentum investment model according to the investors risk appetite and profit expectation.

Chapter 4

The chapter four summarizes the main conclusions drawn from the thesis, and points out the limitations of the study and the future investigation.

Chapter 2. The origin and development of behavioral finance

2.1 The concept of behavioral finance

Behavioral finance combines the traditional economy and finance by applying social science and scientific decision. It attempts to explain some abnormal situations in the financial market and to investigate how investors commit inevitable errors in their investment decision. Traditional finance is the core of behavioral finance, while psychology, social science are expansions. As what Robert Shiller (2011) said, *"Behavioral finance is a revolution in the economy and finance in the last twenty or thirty years. It is not only the combination of finance and psychology. It has a broader concept that represents the mixture of finance and different social sciences. Behavioral finance can express, in the essentially, what is investment and how investment forms. This new science shows us how can psychological and social factors affect the investors in decision making."*

In general, traditional finance is based on efficient market hypothesis. The efficient market hypothesis assumes that all information are reflected on price or market value, so all the transaction prices are fair. The supporters (Sewell, M., 2011) of this theory believe that an active trader or portfolio manager are impossible to beat the market trend and earn excess benefits in a long time period. Therefore they consist that investors have to admit that the market is perfect and they are impossible to beat the market price rule. Traditional finance theory, psychological concept, even if social science are widely used in behavioral finance expression. But how people can find out the relationship between these elements and combine all of them in behavioral finance. Let us show a series of good examples that are from the behavioral finance course of Duke University (Behavioral finance course, Duck University, 2015):

Anchoring theory

What is Anchoring? Anchoring (Tversky, A., & Kahneman, D., 1974) is the process of seeding a thought in people's minds and having that thought influence their later actions. The first time we make a decision about something, in which way we have thought about it will keep in our mind for a long time. Barberis and Mukherjee (Barberis, N. Mukherjee, A. & Wang, B., 2016) tested

that investors mentally represent the stock past returns in its future prospect. So anchoring shows us how can the first impress affect our decision making in long time period.

Smart consumption

What is smart consumption? Smart consumption means that consumers have to understand their consumption well. For example, the young people use internet to do shopping, so they can save more time and seek for more choices. A smart consumption is a combination between information and behavior.

Default option

What is default option? It is about what will happen if you do nothing. Paying the pension for retirement may a choice, but not a requirement, so people can make decision to roll in or not. In this situation, people are more pleasure to participate the plan. This example explains that the importance of personal emotion in economic behavior.

Prisoner's dilemma

What is prisoner's dilemma? Imagine that there are two in crime persons who are failed to hold on their crime. If they confess their crime, their serve years in the jail will be reduced. But if they consider this situation from the point of view of both, they will hold on and both of them probably will be set free. It is a conflict between the best individual selection and what the best common selection . In this case, selfishness can reduce a 100% of freedom to lower probability.

Corporate social responsibility

What is corporate social responsibility? A business concerns for social welfare. There are companies consider about both their long term returns and the society health. By thinking forward revolving around and creating new products, in long term, which may destroy social health. The corporate social responsibility is also called sustainability, if a company make the help for society construction as their main business goal, they will reap success. For example, Ben & Jerry´s has been donating a full 7.5% of pretax profits to different charitable institutions.

All the above examples are frequently appear in people's daily life, so society, psychology and

economy are closely integrated. Since behavioral finance has appeared as a combination between finance and psychology, people try to find out how these two sectors work together? The they make a conclusion with four principle psychological factors: which are Self-conceit, financial cognitive dissonance, regret aversion and expectation theory.

Self-conceit

Humans tend to overestimate their own skills and success. Mahajon (1992) defined self-conceit as an overestimation of the probability of occurrence of an event. A investor, who try to forget the loss or who is enable to draw lessons from loss, for example, from making wrong decisions. But if we cannot admit our errors, our conceits will deepen bad consequence of our overestimation. Barber & Odean (2000) did a research of the investment preference of 35.000 investors based on their gender during six years. They found out that male is more conceited in their investment skill and trade more frequently than female, so men always sell their stocks at wrong moment with a much higher transaction cost then women. In contrast, women prefers to hold their investment for longer period with lower transaction cost. This research shows that male trades 45% more frequent than female, while single man even worse with a frequency of 67%. The total transaction cost reduces 2.5% of the annual net benefit for men, but only 1.7% for women. Finally, female investment portfolios bring more net expected returns than those of male. The difference of thinking between male and female is fundamental of their different confidence degrees.

Financial cognitive dissonance

John Morton (1991) suggested that people often feel stress and anxiety when they run into conflicted beliefs. As individuals, we try to reduce our internal conflict or our cognitive dissonance by two ways; one is to change our evaluation, sentiment and opinions of the past, another is to prove that our choice is correct and rational. His theory can be applied to the investors or traders who attempt to make their behavior rationally in the investment market.

In financial investment, cognitive dissonance (Akerlof, A. & William, T., 1982) plays a role in mutual fund investment, many individual investors have suffered the cognitive dissonance when they invest into mutual funds, especially when they make decisions of purchasing, holding or selling their funds. People prefer invest their money to the funds that performed well in the past swiftly, but they always delay to sell the funds that had bad historical performance. Actually,

these investors reluctant to admit that they had made a mistake in their investment about underperforming funds, but they forget that the right decision is to sell these funds immediately. They pretend to know nothing about their mistakes, by holding these funds for longer time with an expects that their loss will be recovered in the future. If people refuse to admit their mistakes, they have to transform their investment style to support their financial decision. For example, the traditional investors who believe in fundamental analysis are used to evaluating listed companies through their financial ratios (liquidity, solvency, profitability, net earnings ratio...), but they have to convert this costume. Many investors purchase network companies stocks which are enable to provide their financial report information or financial status analysis. These investors prefer to apply two methods to make right decisions; some of them support the "New economy era" theory (Marques, H., 2001) and agree with that the traditional financial disciplines are no more properly in today's investment market; others investors choose to ignore the traditional investment model, they consider to invest into network companies stocks to pursuit more future returns. In essence, by forgetting the basic economic principle is unwise. For example, in the financial bubble of the March 2000, the price of many network companies slide more than 70%, while their investors had suffered terrible losses (Ben Geier, 2015).

Regret Theory

Regret Theory proposes that when facing a decision, individuals may anticipate their of regret after their uncertainty of result is resolved, thus they incorporate this feeling in their choice and their desire to eliminate or reduce the possibility of regret. (Loomes, G. and Sugden, R., 1982), David. E. Bell (1982) described regret aversion as the emotion produced by comparing the result of a given event with its expected result. For example, when customers have to select between a familiar brand and an unfamiliar brand, they may be afraid of the regret effect of choosing the unfamiliar one, so they rarely choose an unfamiliar brand.

Regret theory also can be applied in the investigation of investors' psychology. No matter the investors will purchase the falling or rising stocks/funds or not, in fact, purchasing a favorite stock can cause their satisfaction actively. At the same time, investors avoid to sell a falling stock, because making wrong decision embarrasses them and the loss makes them feel regretful. In addition, investors find that it is easier to buy a weekly popular stock because that they have herd mentality (James Suroweicki, 2004). If a large number of investors lose money in the same investment, their regret aversion will be reduced. Regret theory is also called decision theory, it is a kind of emotion that can be caused by decision making directly.

Expectation Theory

Expectation Theory (Victor H. Vroom, 1964) believes that the investors behavior is not always rational in uncertain circumstance, psychological factors can produce behavior bias in decision making. Expectation is based on a series of information that is processed from this bias. To Observe the reflex reactions (over reaction or under reaction) of the market volatility which is a simple technique to study how the expectation bias is aroused. One of the most important reflex reactions is overreaction, overreaction means that investors are excessively focus on new information in predicting future price; under reaction means that investors do not pay enough attention to new information. Why people represent in different ways in a same case? Their behavior bias is depends on the context of a background of earning a profit or suffering a loss. A typical phenomenon is that people are more frustrated to the loss. The pain of loss can exceed the happiness of an equivalent profit. The loss aversion permits people to take more risk to avoid losses, even more than to pressure benefits. Although people are confident of earning more profits, most of the them will also choose to avoid the risk, when they face an evitable risk, they will become more adventurous to take the risk.

John Maynard Keynes (1926) classified expectation into two types, short term expectation and long term expectation. He thought that short term expectation is a short term reaction of price which is determined by outputs, generally, manufacturers determine their production according to the commodity sales and consumer demand. And long term expectation is the expectation of future return. It is related to the type and quantity of products, consumer preference, products demands, cost of wage and possible changes of product. Due to the long term expectation will not able to revise based on the actual situation in a short time period, it is fraught with uncertainty.

As usual, the expectation theory considers preference as a function of "decision weight" (Chen, 2014), and assumes that these weights are not always consistent with their probability. The decision making tends to give much more weight to small probability, and less weight to high probability. Investors tend to evaluate the probability by a relative reference point, but not by the final return. To illustrate this point, we will give an example:

Choice one: certain return of 1000 euro

Choice two: 80% of 1500 euro and 20% of zero return

Most of the investors will choose the first choice, because it is a certain return. Investors are loss aversion when they face to financial return, so they choose 1000 euro. If you are convinced that the loss has a high probability, this choose makes sense, but actually, this choice is not reasonable. If investors choose the second choice which has low loss probability, they may receive 1000 euro, 200 euro more than the first choice:

(1500×80%)+(0×20%)=1200

Expectation theory represents the exceeded return (comparing with the market expected return) (Greenwood, R. & Shleifer, A, 2014) by **α**, in others words, **α** is the exceeded part more than the average level of market value which is earned in the investment. If **α** is greater than 0, the value increases, if it is less than 0, the value reduces. **α** can be defined as the difference between the adjusted return of risk portfolio and the return of benchmark portfolio. Most of active investors try to maximize the **α**. In contrast, passive investors usually accept to match the benchmark return.

Another example is stock transaction. In the process of constructing the investment portfolio, active investors purchase or sell stocks based on their expectation of future returns which is form the evaluation of the future return and the risk character. Therefore, the stock price is depended on the expected future return of the investors expectation generally.

If today's stock price is based on the future market expected return, in predicting the price volatility, people have to predict the future better than the market trend. In this case, all **α** must have a capacity of prediction much more precise than the market expectation. But people cannot predict the future accurately, there always exists a bias. Psychology scholars suggest that investors do not try to maximize their wealth under a certain circumstance (Fuller, R., 1998), they will commit systematic error. There are many factors will cause an error of security pricing, and all these factors are the result of behavioral bias. In general, common behavioral biases can be sorted to two categories:

Non Maximization of Wealth behavior

Rational economists assume that investors only maximize the expected return of their investment portfolio. In fact, they also maximize others events which are more important than wealth for them.

Heuristic bias and systematic cognitive errors

Heuristic bias allows investors to make systematic cognitive errors that the result was produced by the incorrect information. When the investors believe that they have processed the information correctly and they will be possible to maximize their wealth. But when they realize that they have systematic cognitive error, they do not accept this error as a mistake. Unfortunately, their regret will produce another problem of non maximization of their wealth. In the expectation theory, Kahnamen & Tversky (1979) emphasize that investors suffer the loss more than they enjoy the success, actually, that is why investors tend to hold falling stocks such a long time while selling rising stocks so fast. Since non maximization of wealth leads to stock pricing error, the investors take advantage of this mispricing in investment strategy, while the market will react with a system of non-wealth-maximizing behavior.

Heuristic bias misleads investors to make systematic cognitive errors (Croskerry, P., 2003). This cognitive error will produce expectation bias of market return and will result to mispricing of security, so heuristic bias is a potential instrument to understand the pricing bias. There are four common heuristic biases types:

Typicality: In the formation of expectation, people evaluate the similarity between the probability of uncertain future event and recent observed results. Typicality leads people to make mistakes of overreacting to new information and gives too much weight to this new information.

Significance: If a low probability event has occurred recently, people tend to overestimate the probability of occurring the same event in the future. For example, an aircraft crash happens rarely, however, if the media public the news of an aircraft crash, people will overestimate the probability of occurring more aircraft crashes. Significance may stimulate people's allergy of new information.

Conceit: People are very conceited of their ability and knowledge. When people believe that the probability of occurs an event is 90%, even if the truth is that this probability is less than 70%. Conceit may lead investors to be over reactive to new information.

Detention (First impression lasts more longer.): Psychologists (Praveen K. Paritosh & Matthew E. Klenk, 2006) have proven that when people carry out quantitative estimation, their estimation may be severely affected by the past impression. For an example, a second hand car dealer

usually bids a high price at the beginning of the negotiation, and then cuts the price. This dealer strives to detent a price, when he reduces the price, the customers will consider this low price as a high value. Detention may lead investors to be under reactive to new information.

Heuristic methods (Simon, H. & Newell, A., 1958) only cause cognitive errors under certain conditions that have low occurred probability. Otherwise heuristic method will not be improved all over the time, because of its improvement can mostly correct the mispricing of the stock has low price but high return ratio. To select mispricing stocks from low PE stocks, to understand their certain conditions are necessary, all these certain conditions may illusion investors heuristic bias, especially, over reaction. While some heuristic methods (Detention or Conceit) rises investors under reactive behavior. In this case, heuristic methods can conduct investors behavior to an opposite direction.

In this chapter, we have talked about some basic concepts of behavior finance. As we know, the world is flat and relative, social science factor, psychological factor, economic factor and many others factors are probably correlative with behavior finance, all these make the investigation of this area more interesting and necessary.

2.2 Differences of the Chinese and the European financial markets

After introducing the basic theory of behavioral finance, in this part, we will present two financial markets, Chinese financial market and European financial market. One of the purpose of this paper is compared between Chinese stock market and European stock market in the sector of behavioral finance, so we have to find out the similarities and differences between these two subjects.

2.2.1 The Chinese financial market

The history of Chinese financial market is very short, so Chinese financial market has many problems that it is still in the stage of reform and improvement to become to an efficient market. Chinese financial market is dominated by four sections, money market, capital market, insurance market and foreign exchange market. Firstly, we will explain how these four markets are formed and developed in China.

Money Market

Chinese money market includes interbank market, Inter-bank Bond Market and bill market. In January of 1996, China established the first national unified interbank market, and formed the national unified china inter - bank offered rate (CHIBOR) for the first time. Since June of 1996, People's Bank of China abolished the limit of CHIBOR, totally opened the market up to the whole financial market. The reform of the unique interbank market ended the period of disruption of financial market, regulated the interbank lending behavior of financial institutions, improved the financial efficiency between banks, promoted the interest rate market and strengthened the macro control of the People's bank of China. Recently, the trading volume of interbank market is expanding year by year. By the end of 2014, the whole trading volume has a turnover of 37.7 trillion yuan and interbank market has became the main market for the financial institution's position management.

In June of 1997, China established interbank bond market, which allowed commercial banks and other financial institutions to repurchase treasury security, policy financial bonds and cash bond trading. Currently, interbank bond market has became the fastest growing and largest scale capital market. It is an important platform of open trading operation of China Central Bank. By the end of 2014, the whole volume of bond repurchasing and cash bond trading have cumulated to 352,5 trillion yuan.

Chinese bill market is based on commercial bill market. In these years, bill market develops stably and graduals to an important way to improve the enterprise short term financing and bank capital liquidity management. It is also a conduction mechanism of providing the central bank monetary policy. By the end of 2014, the total commercial bill trading volume has discounted to 3.1 trillion yuan.

Capital Market

In October of 1990 and April of 1991, Shanghai Stock Exchange and Shenzhen Stock Exchange was founded. After about 30 years of reform and development, Chinese capital market has be formed to a cooperative market of various financial products as securities, bonds and stocks. The stock exchanges, market intermediaries and supervisor institutions are more regular day by day, the regulatory of capital market is also more specified than before. By the end of 2013, China had 2.489 listed companies in total, 24 trillion yuan of stock market capitalization, 56.9 trillion

yuan in GDP, the stock market capitalization is 42% in proportional of the GDP. The capital market has played an important role in many aspects, for example, reforming of investment and financing system, promoting industrial restructure, encouraging the change of operational mechanism of enterprises and improving the corporative governance structure.

At the same time, the booming development of Chinese capital market can be reflected by increased amount of securities market financing capital and the increased ratio of bank loans. In 2014, Domestic equity financing amounted to 706 billion yuan and had raised to 319.3 billion yuan. In addition, the development of stock market as bond issuance expansion, especially the expansion of government bond and policy financial bond, made an important force in promoting the growing of China's financial assets and in changing of financial assets structure. In 1986, China started to issue corporate bond and financial bond, but government bond accounted for 73% in all varieties of bonds. After 1994, the amount of government bonds issuance was raised rapidly whose proportion for GDP also was increasing quickly. In 1995, policy financial bonds appeared that these two main bonds began to dominated the capital market together. Until 2014, the inter-bank bond market had a total capital of 5.28 trillion yuan bonds while the government bonds had reached to 10.07 trillion yuan.

Insurance Market

Chinese insurance market has grown sharply. It has an increased amount of insurance products and services, expansion of business scope and premium income. At the end of 1989, the national insurance premium income accounted to 14.24 billion yuan. In 2014, this number reached to 2 trillion yuan. Among all these premium income, the property insurance premium income was 720.3 million yuan, with an increasing of 16% compared with 2013; life insurance premium income was 1.1 trillion yuan, with an increasing of 15.7% compared with 2013; the health insurance premium income was 58.7 billion yuan, with an increasing of 41.3% compared with 2013; the casualty insurance premium income was 54.3 billion yuan, with an increasing of 17.6%. In 2014, insurance industry provided 1,114 trillion yuan of risk insurance for the whole society, with an increasing of 25.5%. The total compensation pay - outs was 721.6 million yuan, with an increasing of 16,2% compared with 2013.

Foreign Exchange Market

The foreign exchange market is an important sector of Chinese financial market. It has played an

irreplaceable role in many aspects, for example, in improving the formation mechanism of exchange rate, promoting the convertibility of RMB and the quality of financial service, fasting the change of macro control system and prefunding the development of financial market system. Since 1994, the foreign exchange market began to transform from a foreign exchange swap market to an interbank foreign exchange market whose core is the China Foreign Exchange Trading Centre. This change made a great progress in China foreign exchange market undoubtedly. In 2014, the foreign exchange reserve amounted to 3.84 trillion. The cross border trade in goods, services and direct foreign investment, which settled by RMB, were 656.5 billion yuan and 862 billion yuan.

Although Chinese financial market is a young market, its reform have never stopped carrying out till today. In the last 30 years, Chinese financial industry has almost completed the transformation from a planned economy to a market economy. Finance has became one of the core industries of the national economy, and affords a strong support to the reform of other economic sectors. The reform of financial market is to adapt to the rapid economic development. Since the Third Plenum of the Republic of China of 1978, Chinese financial industry achieved a great development, and has formed a financial organization system and a financial control regulation system with a serious of clear complementary functions. The financial market reform can be divided into three stages.

The first stage, the initial stage of the preparation of financial reform, from 1978 to 1984. In this stage, China went through a period of financial system adjustment. The financial system and structure began to change. The most obvious change was to implement the diversification of financial institutions and to break the traditional system which is called united organization structure. A new framework that is named second tier banking system has been established with the following main features:

Financial institutions transited from a united structure to a diversified structure, specialized banking institutions were set up. The Agricultural Bank of China, Bank of China, China Construction Bank were established independently in 1979. The Agricultural Bank of China is responsible of unified management of agricultural funds whose duty is centralized and developed the process of rural credit. The Bank of China is a specialized state foreign exchange bank for unifying and centralizing the management of the country's foreign exchange business. The State Administration of Foreign Exchange was established too. The State Administration of Foreign Exchange and the Bank of China cooperated with each other in foreign exchange management.

In August of 1982, in order to centralize the management of foreign exchange business, the State Council decided to incorporate the State Administration of Foreign Exchange to the People's Bank of China. Since 1980, the China Construction Bank has not only provided loans, but also used its deposit to provide construction loan, by focusing on supporting the enterprises in fulfilling the urgent demand of products. It started to provide loans for urban and real estate constructions. The Construction Bank has graduated from a bank that completely handled the financial business to a bank transaction in both financial industry business and financial specified service, while its financial service proportion is growing day by day. On September 17th of 1983, the State Council decided to found the Industrial and Commercial Bank of China which hosted the industrial and commercial credits and savings service of the People' Bank of China. The Industrial and Commercial Bank of China was set up on January 1st of 1984. Although it has a short history, it is the largest commercial bank in China who has the largest amount of businesses. Its total amount of savings deposit, short term loans, capital settlement are rank first in all the commercial banks.

To steer a secondary banking system from a single bank system by separating the implementation and issuance of credit on arrangement. After the establishment of the Industrial and Commercial Bank of China, the People's Bank of China got rid of the specific service and no longer operated the commercial banking service directly. It exercised the credit management and currency issue rights, while really began to play an important role of central bank. The formulating and implement monetary policy have more powerful autonomy. The secondary banking system can strengthen the regulation ability and supervision capacity, prevent the financial risks effectively, protect the stability of economic system and promote the reformation of economic construction.

Bank depending on deposit restraint mechanism. Because of the system adjustment, a new mechanism is called "Banking depending on deposit" was burned. In the past, banking system never paid attention to deposits, but the truth was, all the banking business were based on deposits. If the bank did not have sufficient deposits, it was difficult to develop other businesses. The capital allocation was transited from a system of "state control over deposits and loans" to a system of "holding branch offices responsible for the deficits". The "state control over deposits and loans" system referred to the right of the centralized power of the central bank in using all deposits. All loans should be allocated by the central bank and all the branch banks had to grant loans according to the central bank's application. However, this system was not conducive to increase deposits. Whether or not increasing deposits could not affect the benefits of branch

banks, so they were not active to absorb more deposits for granting more loans. In addition, the branch banks were not free to allocate their credit funds, some project with low potentiality could get loans, while some projects with high potentiality could not get it. For the reason of short come of "state control over deposits and loans", this system was instead by "holding branch offices responsible for the deficits" system in the reform of 1979. In the new system, the central bank did not control the total deposit and loan of branch banks any more. It allocated the deficit of deposit and loan for each branch bank, and all branch banks were free to give out loans below the deficit standard of central bank. The more deposits had, the more loans could be granted. This system stimulated the motivation of creating more deposit of branch banks, gave them freedom of allocating credit funds and help them improve the quality of capital operation.

To coexist of new institution and old mechanism. In the changing stages, the institution was new, but the mechanism was old. The arrangement of new institution basically worked on the old mechanism.

Transformation and exploration stage (1985-1996)

The second stage was an exploration stage that the national financial system transformed to a marketization system. From 1985 to 1996, the financial system carried through a series of innovations for providing a preliminary financial market framework. The main elements of this reform were about several aspects:

Consolidating the central bank system. After establishing the central bank system, this system was keep reforming continuously. In March 1995, central bank published *Legislations People's Republic of China People's Bank of China* and *Regulations Monetary Policy Committee*. These laws stressed the important position of the central bank and played an role of providing a legal guarantee for central bank.

Diversifying the financial institutions and innovating the organization. Firstly, a number of non-bank financial institutions were set up for complementing the bank system, including rural credit cooperatives and urban credit cooperatives. On one hand, these cooperatives could facilitate the people's lives, especially for providing the farmers more convenient services; on the other hand, they could absorb more social surplus funds. Secondly, constructing a number of insurance company. In 1980, the Chinese People's Insurance Company restored the domestic insurance business. Since 1988, Chinese insurance market accelerated the pace of financial development. A series of insurance companies had built, China Ping An Insurance Company,

China Pacific Insurance Company, Tian An Insurance Co., Ltd. and Shanghai Dazhong Insurance Co., Ltd. In 1995, the China People's Insurance (Group) Company was separated to Limited three specialized subsidiaries, the PICC Property Insurance Company Limited, PICC Life Insurance Company Limited and PICC Reinsurance Company, while the scope of insurance was wider and more specific. Thirdly, rising securities industry rapidly. After 1990, the Shanghai and Shenzhen Stock Exchange were established as a symbol of Chinese stock market. China financial market started a regular stage of development and began to open the market to foreign financial institutions. Fourthly, setting up trust investment companies, financial companies and various foreign banks enrich financial market.

Taking a huge step of the marketlization of financial system management. In this step, more power had been departed to inter banking and the market competition mechanisms had been introduced. Banks started to make competition between each other by interacting business. By separating the commercial banks and financial policy banks, the management system could be separated to three parts, risk management, profits management and cost management. Three financial policy banks had been established in 1994, they were China Development Bank, Export-Import Bank of China and Agricultural Development Bank of China. The original state owned banks had been distinguished from commercial banks, and transformed into commercial banks gradually. In 1995, *the Commercial Bank Regulation* had been published. The new regulation required commercial banks to operate with efficiency, safety and liquidity, to make decisions and to take risks. All the process would help the banking system improve their risk management, assets and liability ratio management and internal control system.

Transiting macro economy to micro economy in financial system and changing from single administrative regulation to complex administrative regulation. Capital management not only changed from "state control over deposits and loans" to a system of "holding branch offices responsible for the deficits", but also developed to "Demand - capacity balance control" and actual loans and deposits. The central bank enabled to use more policy instruments to adjust financial market mechanism, replaced the control of loan ceiling to the control of assets and loans ratio.

Financial market construction had made a great stride as stock exchange, interbank market and bill market. In 1985, a new credit management system called "unified planning, divided funds, actual loans and deposits, mutual intermediation," was burned by allowing inter- bank to lend money to each other. By the end of 1987, except a few areas, many major cities were opened to

intangible or tangible interbank market. In March 1990, the People's Bank of China issued the "Interbank Pilot Management Approach" to control the duration of loans, purpose and interest rates with more stringent requirements. On June 1st of 1996, the People's Bank of China liberalized interest rates to the cap of interbank loans. The interest rate was decided by market supply and fund demands, without any intervention of the central bank. Day weighted average interest rate of a single variety of transactions formed the "national inter-bank lending market interest rates". In May 1993, People's Bank of China issued "commercial bills approach" for the bill market. On May 10th of 1995, China passed the "People's Republic of China Bill Market Law", and implemented it with effect from January 1st of 1996. By making principles for the bill market, commercial bills became an important financing instrument in the market and rediscount bills were more and more important to the central bank as a monetary policy tool.

The Chinese foreign exchange market was growing with the deeply economy reform and was opening to the outside market. In December of 1985, Shenzhen Special Economic Zone set up the first foreign exchange swap centre to launch foreign exchange swap operation officially. In 1988, all provinces, autonomous regions, municipalities, special economic zones had established in foreign exchange swap centre. The foreign exchange swap price was liberalized from a maximum limitation, which allowed the foreign exchange rate fluctuated with supply and demand of foreign exchange market. In September 1988, the Shanghai foreign exchange market transformed to an open transaction market and set up an open foreign exchange swap market in few years. However, regional foreign exchange market had inherent limitation that took the establishment of a unified national foreign exchange market into the agenda. On April 4th of 1994, the trading centre of China Foreign Exchange was established in Shanghai, interbank started to transact foreign exchange. On June 20th of 1996, after the foreign-invested enterprises settled into the banking exchange system, all regional foreign exchange markets transformed into sub-centers of the central foreign exchange market. In January of 1994, central foreign exchange market realized unification of the foreign exchange rate as a market-based, single and floated exchange rate. By the end of 1996, RMB achieved current account convertibility.

After all, China carried forward the first stage of transiting to Mark to Market financial system and achieved great success in this exploration.

Adjusting Stage (1999 till now)

The third stage was the transformation of China's financial system to the adjustment and

fulfilling of the financial market framework. Since 1999, the Chinese macro economy started a new stage by changing from a traditional market without sufficient supply to a market with surplus supply. The main features of this stage can be summarized as following:

Reducing the ratio of non-performing assets, establishing the financial asset management companies and consolidating the securitization of assets. In 1999, Cinda, Orient, Great Wall and Huarong four financial asset management companies had been set up. They utilized their professional knowledge and special legal status to maximize the recovered value of the non-performing assets by debt restructuring, listing or auction...All these measures helped the state owned commercial banks recover bad assets and improved their financial position. The non-performing assets ratio of four state-owned banks, the Industrial and Commercial Bank of China, the Agricultural Bank of China, the Construction Bank of China, which presented a downward tendency. Till 2006, all financial asset management companies handled totally 866.34 billion yuan of bad loans. The return ratio on assets was up to 24.2%, while the cash return was 20.8%. They reduced the burden of commercial banks bad loans, created favorable conditions for further development and also constructed a consolidated foundation for company listing.

Improving sub-sector regulatory system, establishing separated supervision mechanism. In October 1992, the State Council decided to set up the Securities Commission of the State Council (the Securities Commission) and the China Securities Regulatory Commission (CSRC). In 1998, the State Council revoked the Securities Commission, while its function was undertaken by the Securities Regulatory Commission. At the same time, the People's Bank of China transferred all its regulatory duties of supervision of security market to CSRC, which reformed a new centralized securities regulation system only based on the Securities Regulatory Commission. In November 1998, China Insurance Regulatory Commission (CIRC) was established, the insurance regulatory started to be independent from the People's Bank of China financial regulatory system. On April 28th of 2003, China Banking Regulatory Commission (CBRC) was set up, which ended the centralized mode of Chinese People 's Bank of macroeconomic regulation and banking supervision management officially, indicated that China's financial system was founded by a regulatory structure of three supervisors, the Securities Regulatory Commission, the Insurance Regulatory Commission and the Banking Regulatory Commission. According to the new regulatory structure, the China Banking Regulatory Commission was responsible for the unified supervision of national banks, financial asset management companies, trust and investment companies and other deposit-taking financial institutions; the China Securities Regulatory Commission took the responsibility of national

securities and futures markets; the China Insurance Regulatory Commission was supervisor of the national insurance market. The People's Bank of China as the central bank fulfilled the supervisory duties and coordination tasks of these three regulatory commissions, while played an important role of preventing the financial system risk as a lender of last resort.

Accelerating the development and improvement the function of capital market. On December 1st of 1996, China promised to the International Monetary Fund (IMF) that RMB was freely convertible under the current account that made a great improvement the opening degree of national economy. On the basis of the policy of encouraging foreign direct investments, this policy also properly controlled the external debt and prudently opened the security investment market. For example, only allowed foreign investor to B shares that issued in China and H shares of foreign exchange that issued oversea, not allowed them to invested directly in denominated stocks or bonds. In May 1998, the People's Bank of China allowed eight foreign banks in Shanghai to enter the national interbank market that meant foreign financial institutions began to participated in Chinese bond market with limitation.

By the end of 2007, six foreign banks could carry out RMB business in China, they were HSBC Bank (China), Bank of East Asia (China) , Standard Chartered Bank (China), Citibank (China), Hang Seng Bank (China) and DBS Bank (China). Among them, the first five corporate banks obtained the approval of the China Banking Regulatory Commission to start bank card business in September 2007 if they measured up to relevant technical standards.

On November 7th, 2002, the "Provisional Measures on Administration of Domestic Securities Investments of Qualified Foreign Institutional Investors" (QFII) was promulgated. In the OFII system, qualified foreign institutional investor would be allowed to import certain amount of foreign exchange and convert it to local currency. They could investment these funds to the security market by special account under strict supervision. This development injected new vitality to Chinese security market. In May 2003, UBS Bank and Nomura Securities C. were approved by the China Securities Regulatory Commission as the first batch of qualified foreign institutional investors. The QFII system was launched officially that foreign investors could legally into China A-share market that only opened to domestic investors in the past. By the end of 2007, 49 qualified foreign institutional investors held by nearly 200 billion yuan of national security market value and became important institutional investors of China's capital market. Since 2003, the Chinese government initially worked out various relevant schemes, as Qualified Domestic Institutional Investors (QDII) Regulation, social security funds and insurance funds

overseas investment, foreign multinationals operating funds ect. By accessing to the World Trade Organization (WTO), Chinese capital market was much more open than before.

Accelerating the commercialization of the reform process of state-owned banks, the joint-stock reform was taken into the agenda. In January 2004, the Central Huijin injected 45 billion dollars to the Bank of China and China Construction Bank. On October 27 of 2005, China Construction Bank listed on the Main Board of Hong Kong stock market. In June 2006, the Bank of China also was listed. On October 2006, the Industrial and Commercial Bank of China achieved to list A + H shares simultaneously. On September 2007, China Construction Bank returned to A-share market successfully.

Improving the legal system and preventing financial risks. After promulgating the *People's Bank of China Law*, China promulgated the Commercial Bank Law, *Negotiable Financial Instruments Law, Insurance Law* successively. The four basic financial laws made up for the deficiencies of financial legal standards, formed the basic framework of Chinese financial law system initially. In recent years, the bank sector, especially the four state-owned commercial banks, took measures to strengthen risk management and to promote reform continuously, and these measures had achieved great results. Firstly, to strengthen risk management and internal control mechanisms. Most banking institutions established assets and loans controlling system, five-tier qualified loan classification system, prudent accounting system and internal audit system. An independent unified management system had been set up. Secondly, these new systems kept the amount and proportion of non-performing loans continuously declining. From 1999 to 2002, four state-owned commercial banks' non-performing loan ratio fell to an average of 13%, with an annual average decreased to 4%. Financial asset management companies, which set up stripping non-performing loans, made a great effort to achieve this result. Since 2000, non-performing loans and non-performing loan ratio achieve "double declining." successively. The banking centralized risk decreased, because the risk level had dropped efficiently.

Implementing a prudent monetary policy that following the controllability principle of foreign exchange rate regime. From 1981 to 1994, China adopted a dual foreign exchange rate system implemented internal trade price settlement and foreign exchange rate announced regime. Since 1985, Chinese government began to reduce central administrative intervention while liberalized the foreign exchange swap market to fluctuate the market supply and demand. In 1994, China achieved the foreign exchange rate unification. Chinese economy developed rapidly, the international balance of payments reached to a double surplus, foreign exchange reserves

increased, a market-based, single and managed floating exchange rate regime was set up. All these improvements helped the RMB exchange rate took a further step towards the financial market. Since July 21th of 2005, China has started to implement more flexible RMB exchange rate mechanism. A floating, market-based with reference to a basket of currencies exchange rate regime made the RMB exchange rate no longer to pegged to the dollar.

Expanding the financial services sector and starting consumer credit market. Recently, housing loans and car loans were extremely common in cities, this consumption style had been widely accepted by costumers, so many banks were racking their brains to increase the varieties of consumer credit services. These specific varieties of products are included: The first one, short-term consumer credit. Most of them were the purchase of consumer durables and services, and it was a small proportion in total. The second one, payment of installment. This forms of credit was become an integral part of Chinese consumer credit market, mainly for the purchase of cars and houses with a repayment period of 3 years to 4 years or 10 years. The third one, mortgage loans. Mortgage loans for housing buyers worked out in process: the first payment who accounted for about 5% of the sale price, the balance was as collateral of buyers to obtain guarantees loans from financial institutions, the borrower had to sign a clear defined contract about the repayment period and interest rates with the financial institution loan. The fourth one, credit card. Compared with developed countries, Chinese credit card business was still in its infancy, because our credit card merchants were mostly for large shopping malls, star hotels and large service enterprises, so we needed to expand credit cards customer segments gradually.

There was a lot of cooperation among banking, insurance and securities sectors that becomes a tendency quietly. In recent years, Chinese economy is growing quickly and the financial reform is continuously deepening. The relationship among the banking, securities and insurance industries is even more closely. In August 1999, People's Bank of China promulgated the *Securities Companies to Enter the Interbank Market Regulations* and *Funds Management Companies to Enter the Interbank Market Regulations*. In October, China Securities Regulatory Commission and China Insurance Regulatory Commission were agreed with allowing insurance funds to enter the stock market. In February 2000, People's Bank of China and China Securities Regulatory Commission issued the *Securities Company Stock Pledged Loan Management Approach* jointly. In June 2001, People's Bank of China promulgated the *Provisional Regulations on Intermediary Business*, which explicitly states that commercial banks could carry out financial derivative business, information consulting, financial advisers service and investment fund custody banking service. In December 2003, People's Bank of China promulgated the

revised version of *Commercial Bank Law* that provides state-owned commercial banks to operate other businesses through the approval of banking regulatory agency of the State Council, which made the participation of mixed banking sector more convenient.

In September 2004, China Construction Bank started to operating the franchise financial derivatives trading. On February 20th of 2005, People's Bank of China, China Banking Regulatory Commission jointly announced the *Commercial Banks to Set Up Fund Management Companies Pilot Management Approach*, which was in accordance that commercial banks could fund a fund management company directly as an approval of the right of entering the stock market. The Bank of China and China Construction Bank had been listed that represented a booming period. The way of participating in mixed banking operation also showed diversified characters. The current mixed operating participations are: Bank & Insurance Cooperation, five forms of overseas branches, bank holding companies, financial holding company...By the innovation of financial asset securitization and stock collateral loans, this mixed trend has become the future trend of Chinese financial industry.

2.2.1.1 The Chinese investment market characteristics

According to the evolution of China's financial market, Chinese financial market is a distinctive market that is very different from others foreign developed financial markets. In this special market, exists diversified special investment patterns and investors.

Government Investment

Coexisting investment shortage and expansion

Since national productivity was poor and backward, research capability was weak and investment resource could not be utilized effectively, which had a serious impact on investment returns. Chinese government investment appeared a short of supply of capital, especially long term capital.

Investment cyclic fluctuations

"Investment fever" is based on strong economic strength. Therefore, Chinese economic strength was weak, the government investment had to face the problem of "bottleneck effect." When

economies declined, the market supply had shortage, foreign exchange balance of payments was deficit, inflation and other factors leaded social economy to reach a certain "threshold" that forced "investment boom" to calm down inevitably. Many investment projects were be postponed or be canceled. However, the internal economic adjustment and rigid control of the government did not stop their expansion. Since government investment had be impulsed by a temporary inhibition, the national economy started to recover, a new boom caused by inadequate of investment constraint mechanism might be replayed. In a long term, government investment showed a "expansion - contraction - reflection - shrink," circle, fluctuations and cyclical fluctuations brought on economic growth increasingly.

Inadequate investment regulatory mechanisms

Chinese market economy was not developed enough because it had not formed a complete market mechanism, so market regulation mechanism was not perfect. Budget constraints were not strict, legal and financial credit system was not accomplished, the macro-control measures was not reasonable, policy banks and commercial banks were not completely separated. Under the imperfect investment regulation mechanism, it was difficult to form an efficient self-regulation and self-restraint mechanism, which was not conducive to the standardization of government investment behavior. It was difficult to control the investment scale and structure effectively. There was not a good investment environment where we could keep the stability of the government investment decisions.

Enterprise investment

Normally, company is the main group that is affected by the market volatility and changes. For own interests and benefits, companies are the most motivated subjects that try to improve investment efficiency. In general, enterprise investments are included: investing with own funds; investing with bank loans; conducting by mutual fund; bonds purchase, stocks purchase or other business investment.

International Investment

International Investment represented a cross-border investment structure tendency, cross-border investment projects were concentrated distributed. Currently, foreign trade companies expanded the proportion of investment in manufacturing abroad gradually, such as export of labor services,

catering services, textile and light industry, but recently, the international investment trend was converting to electronic navigation and heavy industry.

The Subject of international investments includes various forms of ownership, various industries, various business scale enterprises. Among all these subjects, the dominant state-owned enterprises had a diversified structure, its distinctive investment entities could mainly divide into two categories:

The foreign-based international corporations. A representative of professional trade groups as Sinochem, China Resources, China Minerals and other professional foreign trade corporations whose advantages were engaged in import and export trading, with a lot of marketing experience, established information systems, high prestige and sufficient financing. They imported and exported goods through the establishment of foreign base where existed abundant resources, produced local processing products and distributed directly these products to abroad market. This process helped them to bypass trade barriers and to expand share of Chinese goods in the international market. With the collapse of the bipolar structure of the world and economic globalization, the international economy showed regional trends, such as the EU, NAFTA, ASEAN. The cross-border investment was focus on concentrating in regional integration, regional groups were often implemented to completely own internal trade, then built various barriers for foreign investment companies, which increased the probability of national trade protection.

Industrial international groups. As Shougang, the steam, SEG and other large state-owned industrial enterprises on behalf of these enterprise groups operated in good condition.

2.2.1.2 Difficulties of Chinese financial industry development

Banking sector is the dominant financial sector of China, reform and development of the banking sector has a significant impact on the opening and developing Chinese financial market, so it needs to improve in many aspects:

Corporative governance structure

Foreign banks in China are mostly listed companies that have clear property rights, improved functions of sufficient corporative governance structure. Chinese commercial banks had been

failed to achieve an effective corporate governance structure for a long time, resulting in a unreasonable decision enforcement system, inadequate effectiveness of regulatory and complex relationship among the internal control, banks and government. Therefore, the government shareholding reforms of state-owned commercial banks were in the WTO transition period. Chinese government intended to transform state-owned commercial banks to banks with adequate capital, strict internal control, safe operating process, qualified service. To be modern commercial banks with international competitiveness, the cooperative governance reforms were the core of the reforms of state-owned commercial banks. The China Construction Bank, Bank of China and Industry and Commercial Bank of China were listed, which meant that the state-owned commercial banks had started to establish a corporative governance structure. However, compared with foreign banks, Chinese banking industry was still in its infancy step, after the reconstruction of full liberalization of the banking sector, foreign banks with efficient internal management and high risk control ability will be seized the Chinese financial market. So Chinese government should implement the conversion of corporate governance structure as soon as possible to strive to this competition.

Risk management

By the development of modern commercial banks, banking sector had to face the evolving of a variety of risks as credit risk, market risk, operational risk and so on. Foreign banks generally adopted to advanced risk management techniques by using quantified risk models to allocate their capital, this method implemented a risk management system. But Chinese commercial banks were based on interest rates, fixed exchange rates and commodity prices in the past, so they did not aware the importance of risk management. The risk prevention system was not effective for the internal risk control, because the main analysis was applied to qualitative techniques, not quantitative techniques. There existed a series of problems as decision making errors or lack of professional talent of risk management, all these disadvantages made Chinese commercial banks to enable to compete with others foreign banks. With the establishment of new exchange rate mechanism, risk ratios were increasing in the foreign exchange business, for example, currency risk, interest rate risk, internal control risk and settlement risk. Among these risks, the most important risk was the market risk that coursed by interest rate change, foreign exchange rate, stock or commodity price. After the WTO transition period, Chinese financial market was totally liberalized, the interest rate and foreign exchange rate mechanism was further improved. If people cannot manage the risk of Chinese banking industry effectively, it could be eliminated by the new open the competitive environment.

Financial Innovation

Chinese banks have significant gaps in business innovation comparing with foreign banks. Chinese banks have low intermediate business income, because of that their main incomes are come from low-cost business, as bank cards service, , billing, electronic remittance and insurance or fund agents, while the corresponding proportion of intermediate service of foreign banks excess 50%. Since the intermediate business is low risk, low cost and high profits, Chinese banks should innovate this business to optimize the income structure and to reduce the capital cost meanwhile improving the quality of service.

Mixed Operation

The advantage of mixed operation were economic advantage and diminished risk advantage. Chinese mixed operation was based on a weak macroeconomic environment. Firstly, financial market was not enough mature, there were not exist, so the mixed operation could not diversify investment portfolios by efficient financial instruments to avoid risks. Secondly, a suitable regulatory system had not been established. the China's Securities Regulatory Commission, the China Insurance Regulatory Commission and the China's Bank Regulatory Commission carried out their own duties without clear division of cross section supervision. Once mixed operation loosed strict supervision, it may easily derailed by conducting high risk speculation and result unexpected loss.

The access to WTO brought the Chinese securities market a series of new problems, such as foreign securities institutions could be involved in B-share trading directly; set up joint venture companies; engaged in domestic securities fund investment management; involved in the underwriting and trading of A shares, B shares and H shares, government and corporate bonds and establishments of initiated funds etc.

Normally a large foreign fund management company had more than hundred billion of assets, while the Chinese securities market set up much later than foreign market. The gap of size and strength of capital had caused some negative effects. Its small amount could not compare with the foreign financial institutions in varieties of service, efficiency of management, innovation or competition policy. Chinese securities institution's asset amount was not enough to upgrading the competitiveness of Chinese securities agency. After the WTO transitional period, Chinese securities market faces more intensive pressure and competition. The securities business would

become more diversified, such as mergers, acquisitions, asset securitization and other new banking investments. The asset scale of these operations of securities institutions had higher requirements, so Chinese securities institution must obtain sufficient asset to accommodate the new competition in the field of banking investment. The foreign securities institutions in China had a huge scale of assets that could result instability of capital market easily, because of that they own sufficient funds. Their high frequency and large speculative trading might manipulate and control Chinese stock market that would interfere with the healthy development of Chinese financial market, even if it would bring out a huge risk of the entire economic system.

Foreign securities companies generally had professional advantages for constructing their core competitiveness, so foreign securities firms were in a dominant position in their expertise areas. The business structure of Chinese securities companies was simple whose main revenues were underwriting, brokerage, proprietary three traditional business. The important aspects of innovative services, such as asset management, mergers and acquisitions, asset securitization business, which had just started but failed to form a new profit growth points of business. The Chinese securities company profits were mainly from the three traditional business, but foreign securities firms (investment banks) business had grown to cover the issuance of securities underwriting, securities trading, financial advisors, bond financing and derivative products, which had a diversified source of profits. Chinese securities business scope was similar and lacks of a unique market position.

Recently, Chinese financial regulatory system is belong to sub-sector regulatory system. At the end of WTO transition period, the open degree of Chinese financial market was deepening, the existing sub-sector regulatory system had to faced the tremendous pressure. The prominent problem was the separation and coordination of financial supervision regulatory mechanism was not perfect, which could not coordinated between the various regulatory bodies effectively. On one hand uncertainty of supervision regulatory had caused by repeating regulatory responsibilities that raises the regulation cost; on the other hand, crossing business areas had pruned to supervision crack gap. On June 28th of 2004, the "three financial regulatory bodies of financial supervision division of labor memorandum" determined the establishment of joint mechanisms of supervision and regular contact mechanism by CBRC, CSRC and CIRC. However, among these three regulatory agencies that were separated from the central bank information system, so they could not obtain entire regulatory information, so it was difficult to coordinate the regulation among these three regulators. Meanwhile, the various regulatory bodies were of the same administrative level, a single regulator was difficult to understand the overall

financial market risks, and establishes a overall systematic decision-making mechanism.

Although the current legal framework of financial supervision established, there still existed gap between framework and financial regulatory requirements. The main subject was the lack of financial laws and supporting with full implementation details. The law was the main outline-style for financial regulation, which needed a series of financial laws supporting the implementation of regulatory. A robust legal financial system was very important of achieving the quantitative management targets of risk quantification in strengthening the operability of financial supervision.

Individual Investment

Insurance investment

In Western countries, many investors took purchasing insurance as the first step of individual investment. The insurance was an investment tool whose yield is low, but its cost is high, so that the insurance was not one of the best investment. Because of that insurance investment was tax-free, individual investors were very interested of it. The Chinese insurance industry just began to peel away, but it had great potential because the accession to WTO and the further improvement of the social security system.

Real Estate Investment

The maximum investment demand of urban residents should be real estate. With the enhance of purchasing power of residents, real estate had become an important investment objective of many urban residents. One of the unfavorable factors of real estate investment was that investors would focus on most of its funds in real estate, which enforces them to give up more diversified investment portfolios.

Deposits

Deposits were prepared for unexpected demand of people. The amount of money were mainly depends on personal income and the liquidity of other assets. When the liquidity of assets increased, the amount of holding cash held for preventing accidents could be reduced. In addition, if investors had adequate protection of insurance investment, the amount of cash for

unexpected purposes may also be decreased.

Education Investment

The investment in education was called human capital in economics. Many investors invested to their children's future through the purchase of education insurance reserves.

Individual investments were more and more popular today, what were the financial targets of individual investments? Why it was so important to people?

Capital Safety

Individual investment purpose was to earn money, so the security of individual investment was the anxiety of most investors. Since capital security was greater than the investment returns, which meant to protect the capital purchasing power. Therefore investors should invest to securities that have high expected return. For example, although stock was not a perfect way to hedge inflation in the short term, but in long term, stocks would provide a better hedge against inflation effect than fixed-income securities.

Stable income

When Investors made investment choices, they should consider the stability of income. Because the stability of income allowed investors to make long-term investment plans more accurately, investors pursuit stable income that provide the expected income, such as fixed-income securities.

Capital appreciation

The reason that investors wanted to invest in capital investment was to increase capital value, which was the most important criterion of individual investment decision making. In general, in order to achieve capital appreciation target, investors reinvest proceeded or buy growth stocks. This was the way of achieving personal long-term financial goals. Investors could preserve the purchasing power of investment funds, and they had to construct a reasonable investment portfolio fits their needs.

Preventing inflation

The elimination of the impact of inflation had become an anxiety of investors, especially, the individual investors relied on investment income as the main income, they were more concerned about the loss of money's purchasing ability. When investors designed an investment portfolio, they must consider the inflation factor. Therefore they always considered about the ability of preventing inflation risk and choose the securities with less inflation risk.

2.2.1.3 Development of behavioral finance research in China

Although Chinese financial market was an emerging market, new economic concepts could obtain more potential investigated value. In general, modern financial theory believed that the arbitrage owns a "value discovery" function, which promoted the asset prices return to fundamental values. How to find complete risk arbitrage alternatives? Noise traders risk, cost and other reasons prevented the implementation of perfect arbitrage in real market. In reality, the limited arbitrage retarded market to achieve optimal efficiency of perfect arbitrage. Many researchers had studied the non perfect arbitrage of stock market from the perspective of behavioral finance. Under the impact of noise trader, not only rational arbitrageurs earnings would be affected, but also leaded more and more fund managers to become irrational investors that would give up value investment philosophy.

In China, behavioral finance research was still in its infancy. It had a review of more theory and less empirical research, more explain of domestic financial market phenomenon and less practical application, more introduction of aboard theory and less original interpretation. Behavioral finance theory was introduced to China in 20th century, so in China there were fewer experts with academic background in psychology and economy, this restrict the development of behavioral finance research. Because that behavioral finance explained the phenomenon more focus on the theory application, and emphasized on qualitative techniques but not on quantitative techniques. All these disadvantages were restrict its research prospects. In China, current study of behavioral finance mainly concentrated on investor behavior research of stock market.

As an emerging capital market, in nearly 20 years, Chinese financial market has undergone tremendous changes. This process has provided a rich investigated resource for researchers and investors. However, the current study combines the domestic data with foreign theory, and then verifies the applicability between these two factors in Chinese financial market. The main current

research revolves around behavioral finance test both theoretical and empirical: what determines the price and fundamental value of securities departure and why arbitrage is limited that it cannot eliminate market inefficiencies. These two themes are the most important points of behavioral finance theory that will be able to challenge traditional financial theory.

Chinese researchers have spent a lot of time in the application of behavioral finance to explain why the emergence of the Chinese stock market deviates from its basic value by combining the great policy effect in Chinese stock market. For example, Shi Donghui (2002) analyzed the stock Shanghai Story during 1992 to 2002 that showed 52 abnormal fluctuations. More than 30 of these abnormal fluctuations were caused by policy factors, and the actual policies had a significant impact on the monthly stock price volatility. The over reactive behavior of Chinese investors come from psychological deviation, which was resulted the exceeded reaction to policies or information in the stock market. The common psychological deviations included overconfidence, under reaction, excessive optimism, gambling, herding, risk aversion etc.

In the 1990s, Chinese financial market just begun to study investor behavior, Shen Yifeng, Wu Shinong (1999) did an empirical test of the existence of overreaction in Chinese stock market showed that the market did not exist overreaction. Zhao Xuejun, Wang Yonghong (2001) did an empirical analysis about "inertia strategy" and "reverse strategy" in Chinese stock market, which resulted that the Chinese stock market existed inversion phenomenon, but did not exist inertia phenomenon. Pengxing Hui, Wang Xiaohong (1995) analyzed Shanghai investors' behavior and personality psychology, they found out that hyper responsiveness individuals tended to be more conservative and to use low-risk investment strategy, while the low-reactive individuals tended to choose higher-risk investment strategy. Wang Lei, Zheng Xiaoping (2003) did a research about Chinese investor behavior and psychological characteristics, which showed that the Chinese stock market was a political market, the more investors knew about investments technique, the more independent they were and may obtain more investment return. Liu and Wei (Liu, L. Shu, H. & Wei, K., 2017) proved that the uncertainty of political risk could cause stock prices to fall, especially for politically sensitive firms in the Chinese stock market. On contrary, Jiang and Zhu (Jiang, G. & Zhu, K., 2017) also tested that the limited investor attention contributed to short-term uncerreaction in the U.S. equity market. Lin Shu, Yu Qiao, Tang Zhenyu and Zhou Jian (2006) found that the "gambler's fallacy" effect was more obvious in individual investors with high education level, while "hot hand effect" of stock price changes was less important of them. Li Xin Dan, Wang Jining and Fu Hao (2002) investigated transactions data of 7, 894 investors , discovered the existence of cognitive biases of Chinese

individual investors. After several years behavioral finance study, Li Xin Dan (2005) proposed a research framework that conducted behavioral finance research into three levels: the research of individual investor' behavior; the research of group investors' behavior and the research of limited arbitrage and non-effective market. Rao Yulei proposed a framework behavioral finance research about investors' cognitive biases and institutional investors' predict ability of market volatility. For example, institutional investors concentrated their portfolio based on the risk-adjusted returns (Choi, N. Fedenia, M. Skiba, H. & Sololyk, T., 2017). After testing whether the institutional investors are rational, as inspecting if institutional investors are heuristic or not. The empirical studies showed that the presence of anchoring and cognitive biases of institutional investors. Rao Yulei proved that there did not exist correlation between institutional investors sentiment and future investment returns, while the Chinese institutional investors could not predict the market effectively. Hersh Shefrin (2011) said that behavioral finance was very important of understanding of the operation terms of Chinese financial market. Chinese investor behavior represented an obvious phenomenon. Thus, it seemed that Chinese investors and Western investors had similar characters. For example, both Chinese investors and Western investors demonstrated a strong disposition effect, none of them was reluctant to sell the current stock price when the price was lower than the purchase price. But in some ways, Chinese investors and Western investors had different characters. For example, Asian investors seemed to be more over-confident than Western investors. And the behavior between genders were different not only between the Chinese investors but also between the Western investors. In the West, the man seemed to trade more frequently than women, but in China, the trading patterns of men and women were similar, women has a significant proportion of 50%.

In recent years, behavioral finance has developed rapidly in China, but it still lacks of a systematic framework. Overall, Chinese scholars do not have sufficient experience of cognitive biases, investor sentiment and investment decision optimization and asset pricing. But in the future, people will be more concerned about the efficiency of the securities market, which relates to the validation of stock market, for example, whether asset price can reflect all market information without any bias or whether investors are rational. The research of behavioral finance will be a good prospect of solving this kind of problems as financial market anomalies.

2.2.2 The European financial market

The actual situation of European stock exchanges is fundamentally different than how it was in

the past decade, because of that the European financial integration has much progressed in recent years, especially following the adoption of the single currency and the gradual implementation of the Financial Services Action Plan, which leaded to a remarkable transformation of European capital markets. A corporate euro bond market had emerged whose issuing activity in 1999 had even exceeded that of the dollar market. Primary issues in European equity had reached new highs, with new markets becoming prominent internationally. Europe-wide indices had emerged. Portfolios began to be allocated on the basis of pan-European sectoral strategies and some financial markets, such as money markets, had become largely integrated and pan-European in nature. All European banks had merged or formed alliances on an unprecedented scale, while cross-border mergers in all industries had also increased strongly.

This process was profound changes in the structure and operation of the financial services sector throughout the continent. Through a more open and effective European financial market a number of benefits was expected for both consumers and the corporate sector. Investors will benefit from higher risk-adjusted returns on savings, through enhanced opportunities for portfolio diversification and more liquid and competitive capital markets. The corporate sector will benefit from generally easier access to financing capital. Competition in the financial intermediation sector will offer corporations a wider range of financial products at attractive prices. The economy-wide improved allocation of financial resources to investment projects should impact positively on the equilibrium level of GDP and potentially also on GDP growth through higher investment in human capital, physical capital, and R&D.

A single securities market may be considered as one in which supply and demand for a given instrument/security can interact freely on a European wide basis. An efficient market should also support frictionless reallocation of capital across different asset classes (including to small caps and venture capital). In short, there should be a single EU pool of liquidity for each instrument. This will transfer liquid and efficient pricing of financial capital for enterprises/issuers, maximize the efficiency and competition between intermediaries and service providers. Efficiency and liquidity are ephemeral concepts. However, in the context of building an integrated EU securities market, integration and transparency can serve as operational policy targets. Efficiency and competition should operate at all levels of the trading system so as to ensure that European markets are globally competitive.

The new securities market can also be benchmarked by how it serves in the different sectors:

Issuers should be able to sell newly created securities to investors located in other parts of the market without encountering regulatory/administrative barriers or additional compliance costs. These opportunities should be open to all types of capital raising (including, initial public offers, SMEs and venture capital);

Investors should be able to purchase a financial asset traded on a partner country market without additional impediment/delay, risk/uncertainty or costs when the purchase is compared to the same transaction executed on a local market;

Intermediaries should be able to transact freely with clients in other Member States on the same terms and conditions as business transacted in their home country, and should not be constrained for legal, administrative or fiscal purposes to establish a physical presence in the partner country. Intermediaries and service suppliers should also have non-discriminatory access, on commercial terms, to essential services or facilities required for the effective provision of investment services;

Infrastructure suppliers. all providers of infrastructures (trading systems, clearing, settlement, depositaries) should be free to offer services/establish in partner countries on the basis of home country authorization.

Supervisors/regulators should be able to rely on a seamless web of market supervision which guarantees stringent and effective real-time enforcement of commonly agreed provisions to all securities related activities and structures. Without the necessary confidence in the effectiveness and impartiality of supervision elsewhere in the system, the prospects for rational and efficient supervision (based on home country principle) will be compromised.

Within these years, the European financial market had undergone a remarkable transformation. Part of it could have been expected as the consequence of what we termed the direct effects in euro. The less immediate potential consequences of the euro could not have been counted on, however. After the single currency, these indirect effects were collectively producing an outcome that astonished every observer and industry participant. Single European financial market where all intermediaries, private investors and firms met to carry out their financial transactions. All these consequences can produce a number of expected impacts.

Increasing competition among exchanges/market places. More competitive exchanges and alternative market places can imply lower listing and transaction costs. Competitive pressures can also increase the incentives for technological innovation in trading procedures, in turn to lead

to faster but less costly transactions.

Increasing competition among financial intermediaries. This should result in lower brokerage and transaction fees, and greater incentives for innovation and increased variety in financial products.

Lower costs due to economies of scale. Both exchanges and other intermediaries are likely to have lower costs per unit of transaction, which provides an additional avenue through which trading related charges should be lowered.

Banks and other more traditional sources of corporate finance face tougher competition from financial markets. Given the widening of the markets, in every European country, firms are likely to have wider and easier access to financing. Under these competitive pressures, it is likely that banks will decrease their loan rates and related fees.

Improving price transparency. Financial assets price may more closely reflects underlying value since they have pooled information from a larger number of sources. Firms actions are more closely scrutinized since there has larger demand for information about their performance.

Increasing market depth and lower liquidity risk. When investors throughout Europe can trade assets from firms in any European country on equal terms, this corresponds to a much larger demand of each firm's issuing of debt or stock. This will result in deepening of the market and in expanding markets that rises to higher trading volumes and reduces integration liquidity risk.

Larger markets for high risk capital such as venture capital. Currently, the level of venture capital in Europe is only about one fifth in the US. The development of larger financial markets allows to increase the possibility of risk diversification, which may result in lower required rates of high risk capital.

The European financial market can also be divided into two parts by transaction mode:

One part is the exchange market. In Europe, there are two major exchange groups: Deutsche Boerse Group and Euronext N.V.. Both of these two exchange groups provide bid trade, which are included financial products as stocks, bonds and index-based products, options or futures derivative transactions that are based on stocks, interest rate and currency. In addition, most countries have one or several national stock exchanges, such as the Italian Stock Exchange (Borsa Italiana), the Vienna Stock Exchange (Wiener Borse), the Spanish Stock Exchange Group

(BME group), all these stock exchanges can offer a variety of financial products for brokered deal.

Another part is the OTC (Over the Counter) market. In recent years, the OTC market has performed electronic, centralized features strongly, many types of electronic trading systems have appeared. The OTC electronic trading market can be divided into inter-dealer (inter-dealer) transaction systems and trader/client (dealer-to-customer) trading systems. Currently, inter-dealer electronic trading system is included MTS system (EuroMTS and national MTS Systems), eSpeed system, BrokerTec/ICAP systems. In BrokerTec/ICAP system, which is an electronic trading system and a large inter-dealer, its transaction products are included credit, energy, equities, foreign exchange, interest rates and other types of OTC financial products. The Dealer/customer trading system mainly refers to big financial institutions that develop one or more market makers belong to a single market. For example, there are Autobahn Electronic Trading (Deutsche Bank developed quotation system), Tradeweb, Bloomberg Bond Trader (Bloomberg develop a trading system), Bondvision (MTS Group is a subsidiary) and MarketAxess. In Tradeweb, which has dealer/customer trading systems, several large traders continue reporting trading price of all kinds of financial products to their customers (mainly retail investors). Various financial products as European government bonds, US Treasury bills, commercial bills European credit notes, credit default swaps, interest rate swaps, asset-backed securities, mortgage bonds and other German financial products can be traded in European market. Overall, most of the OTC financial products are traded through traditional telephone and voice brokerage.

Finally, a note on the meaning of cross-listing. Companies cross list their stocks for various reasons, which cannot be covered here fully. One of the reasons is to allow foreign investors to trade in listed stocks as if they were domestic stocks. Technological advances can reduce the transaction costs by pertaining to trade abroad with the regulatory liberalization. As a result, this motivation may gradually be losing its force, with the inevitable negative effect on the level of cross-listing. Thus, both an increase and a decrease in the level of cross-listing may attest to a growing level of stock market integration. That is why western European countries grew faster than any other region in world in the process of international stock market integration. These initiatives were conducted in various scales, from a two country to a seventeen-country system, and with varying geographical coverage.

Comparing with Chinese financial market, European financial market has high level of

development with a regulatory system much more efficient. We can learn from the European financial experience from four mainly aspects for our further improvements of the OTC financial market regulatory system: Firstly, to establish a distinction between OTC market regulatory system for strengthening the retail market supervision and self-regulation in the wholesale market; secondly, covering in the OTC market supervision to the multilateral trading system and internal electronic trading system; thirdly, is to establish OTC reporting system; Fourthly, to promote the clearing and settlement system and to promote the introduction of Central Counter Party (CCP) mechanism in OTC market.

2.2.2.1 European financial market supervision system

European financial supervision authorities provides a subject that it is engaged in "investment business" as an access or a license. This subject that is engaged in the investment business that needs to have adequate resources and a complete internal control system. On this basis, the regulatory authority, which requires investors to distinguish between different counterparties, and to assume different rights and obligations of different investing counterparties. In general, the rules are applicable to sophisticate customers are more liberal than the rules are applicable to non-sophisticated customers. If the counterparty is a non-sophisticated customer, the investors should ensure an "appropriation" of the transaction and strict to constraints of regulators. The identification of the counterparty is decided by a mutual agreement.

Because of that European Exchanges provide centralized clearing for buyers and sellers as central trading counterparties that guarantee the good performance of investors in transaction and settlement. Therefore, European Exchanges usually have strict access standards and ongoing risk management requirements of participants, regulators are also very strict of the admission of Exchange. The OTC market is not such a guarantee mechanism, so the OTC market participants access standards are not so strict, and the regulation of OTC market is relatively loose. However, with the development of technology and electronic trading systems, the difference between the exchange market and the OTC market is gradually narrow. For example, some OTC market's introduce CCP mechanism arrangement, the rise of multilateral electronic trading system makes the traditional OTC market more centralized. Many exchanges have also launched OTC trading system to satisfy the different levels of trading participant's demand. The institutional regulator of the exchange market and the regulation of the OTC market are more and more converged.

In recent years, according to the general spirit of the "*Financial Services Action Plan*" (FSAP5),

for the financial infrastructure consolidation, the unification of regulatory standards to regulators cooperation, EU member states and their governments have taken many measures to promote European financial markets integration.

The most important guidelines of European financial market integration is the *Directive on Markets in financial Instruments* (MIFID). MIFID was made into effect on November 1st, 2007, it has promoted the unification of financial instruments of wholesale market and retail markets, while improving the investor protection. MIFID is the most important and influential rule of conduct guidelines in EU financial market, all national financial market regulators have to adapt their regulatory rules to MIFID. MIFID is composed by three core principles: the first principle, strengthening the investors protection, especially retail investors, in investment activity of the financial markets; the second principle, expanding the regulation of different types of trading platforms, not only includes traditional regulatory scope in exchange market, but also includes multilateral trading system (Multilateral Trading Facilities) that recently rise and internalized trading system (Systematic Internalisers). The third principle, ranging the regulation of financial products more widely. The financial products with regulation are increased to derivatives products (spot and forward), credit derivatives and CFDs contract for the first time. The derivative markets are not regulated, but futures and options are within the scope of regulation. MIFID requires that financial institutions provide investment services should have a sound organizational structure that has a comprehensive compliance arrangements, internal risk control system, a complete bookkeeping system and interest conflicting management mechanism and so on. In the process of investment activity, investment Companies should be "the best guest instruction which is executed," "more refined of customer segmentation", "more prudent of investment research" and "prepared of an effective management for interest conflict ", "pre- and post-trade transparent ". MIFID requires a consistent access and daily supervision standards of the exchange market, the multilateral trading system and trading system.

The European Union set up a number of cross-border cooperation mechanisms to provide guidance for EU cooperation in securities, banking and insurance industries. In the security market, it set up the "European Securities Regulatory Commission" (CESR) to promote a unified EU securities regulatory system. The regulation of financial markets covers all main securities regulators. In the banking supervision, it set up a "European Committee on Banking Supervision" (CEBS) to promote the EU banking prudential supervision and the harmonization of sharing the regulatory information. In the insurance sector, the establishment of the "European Insurance and Pensions Regulatory Commission" (CEIOPS) promotes cooperation and unity in

pension management and insurance industry regulation. These committees of national financial regulations do not have mandatory right, but its release recommendations and guiding principles are an important guiding of EU regulatory regimes.

2.2.2.2 European financial market risk

Although European financial market is well developed in many sectors, it also has several week points and risks, especially in euro zone countries. For example, there are fundamental risk and liquidity risk. Fundamental risk (usually called credit risk in the bond market) is the risk that the quality of the asset underlying a given financial asset changes; conceptually, this risk is completely independent of market trading system. Liquidity risk, on the other hand, refers to trading risk: it is the risk that investors who need to sell with discounts, because their tradings cannot be absorbed easily by the market. Fundamental risk is minimized by diversification, hence calls for the consideration of many assets, liquidity risk is the smaller or the larger the volume of trade in the given asset, hence can be analyzed by one asset only. If assets are not strongly correlated, typically diversification possibilities are best in a market with many (possibly less actively traded) assets ("breadth"), whereas for liquidity risk a market with (possibly few) heavily traded assets is preferable ("depth"). The depth of a market can be measured by factors such as the participation rate of investors in that market (a demand side criterion), the outstanding stock of the asset (a supply side criterion), and the availability of close trading substitutes for this asset. The breadth of a market (or of a set of markets), on the other hand, is typically measured by supply-side criteria such as the number of assets traded or the institutional barriers to trade different assets. But also demand-side aspects are important, such as the investors' willingness to trade assets with different characteristics.

Interestingly, while breadth and depth are important issues in all types of asset markets generally, in the discussion of the performance and the potential of the capital market, the former criterion has mostly been applied to equity markets and the latter to bond markets. Indeed, with respect to the bond market, the hope of creating "the largest financial market in the world" has usually referred to the possibility of bond issues of size sufficiently large to rival those of the American treasury or large U.S. corporate, whereas for the equity market the emergence of stock markets with large numbers of listed firms and many active stocks has been viewed as important. Conceptually, the issues of market breadth and market depth are closely related to transaction costs. They are the main reason why investors, on the demand or the supply side, do not enter markets and thereby improve risk sharing.

In euro zone, the bank customers behavior makes an important role in financial market risk management. The euro is intended to serve as a powerful political symbol uniting Europeans and reducing the importance of national differences. Would it not then be expected to play the same role in the financial sector? A single currency could also change the behavior of financial institutions, inducing them to internationalize both their corporate and retail businesses. The need to change internal computer and information systems could (indeed should) prompt a strategic rethinking of the business functions those systems are designed to support. Turning first to corporate lending, it must be noted at once that this is not at present a very profitable business in continental Europe. This system could inhibit expanded competition, as could concerns by lenders that most available foreign clients would be clients that no-one else wanted (the adverse selection problem). In contrast, it could also be argued that cross-border "cherry-picking" might become even more attractive in giving a single currency.

The direct costs are associated with the introduction of a single currency and the increased competition in association, which will put further pressure on bank profits and encourage adjustment of various sorts. The severity of that pressure will partly depend on the extent to which the introduction of the euro catalyses other changes and may well vary in intensity across countries. Even if one believes in this particular regard, market sentiment shows that the European banking industry will be radically transformed over the coming years. It is worthy in considering briefly how banks might react to increased competitive pressures and some of the pitfalls along the way.

The first and the most important thing, at least in principle, is whether supervisory authority could rest with the European Central Bank (ECB) or the national supervisors. At the moment, it was clearly intended that the national supervisory authorities should continue to carry out their current responsibilities. This would have the effect of helping to separate the monetary policy function from the supervisory function, and of ensuring that supervisors are physically close to those being regulated. Moreover, it would seem broadly consistent with a system of national deposit insurance. However, such a diffuse system may also make it harder to monitor exposure to single creditors borrowing in different parts of the integrated market and may put a high premium on the efficient information exchange. It also seems likely to encourage the maintenance of existing differences in both supervisory practices and capital standards among member nations, which, as we noted above, continue to impede formation to the single market. It is important to maintain an efficient information flow under the currently envisaged supervisory arrangements. About half of the national supervisory authorities are central banks, whereas other

agencies are involved in other countries (some attached to treasuries and some not). Domestic relations between these generic groups of institutions have not always been easy, though to date it appears that the different kinds of national supervisors interact in an admirable way at the international level (Kapstein, 1994). A second problem may be differences of philosophy about the extent to which privileged supervisory information should be shared, not only between institutions, but also between supervisors and those responsible for monetary policy. A third issue has to do with the prospective role of the Banking Supervisory Sub-Committee which meets at the European Monetary Institute. On the one hand, playing up its role implies that non-central-bank officials have an important role within the framework of the ECB. On the other hand, to the extent that its influence is downplayed, which means its influence might migrate to the Banking Advisory Committee of the European Commission. Since this Committee also has included Treasury representatives, a number of parties requiring to be fully informed in banking sector difficulties rises or even further, as does the scope for misunderstanding in times.

2.2.3 Comparison between the Chinese and the European financial market risks

Each race has its unique nature respect to others races. No matter which race, when the individuals gather into a "psychological groups" for a purpose of action, we can observe this action and find that they not only show the original race characters, but also show some new psychological characters that sometimes are quite different from their original characters. (Gustave Le Bon, 1895)

Some research showed evidence of the existence of short-run integration among emerging stock markets and the developed markets, but these markets did not have high relationship with developed financial markets in long period (Al Nasser, O. & Hajilee, M., 2016). After studying the differences between the Chinese financial market and the European financial market, we will compare and analyze the investment risks and investors behaviors of these two markets.

"Risk" is usually associated with "uncertainty". The "risk" status means that each possible result has a unknown probability of occurring the event. So it is called "uncertainty" refers to the probability that each outcome is about an unknown period of time. Meanwhile, the investment risk can perform in various of forms. Kolaric and Schiereck (Kiesel, F.. Kolaric, S. & Schiereck, D, 2016) also tested the market integration and efficiency with a data set of US and European firms. They found out efficient stock markets were more sensitive with uncertain information than credit default swap markets. Not only the U.S. and the European stock markets indicated that high daily return stock performed poorly in the future, an emerging market like the Chinese

stock market also had the similar effect (Nartea, G. Kong, D. & Wu, J., 2017).

Subjective risk and objective risk are based on different perceptions of risk as the standard division. A subjective risk is a concept of personal psychology, which is an estimation of subjective result by objective triangle. it cannot be measured by objective standards, so the risk is considered as a subjective risk. if we consider the "risk" as a "loss of uncertainty", this "uncertainty" is actually an subjective estimation, which includes an uncertain loss, uncertain time, uncertain situation and uncertain result. Static risk and Dynamic risk are based on the division of the loss environment. Static risks are the risks occur under normal circumstances, which is due to the irregular variations of natural forces, or errors that caused by personal behavior. Dynamic risk refers to the risk is associated with changes in social and economic environment or the changes in consumer demands, organizational structure, technology, mode of production and so on. Special risks are associated with the origination of risk. Special risk is from particular individuals, such as unnatural death, disability, or accident. Pure risk and speculative risk are based on the nature of the loss. Pure risk is the risk of losing an opportunity without profit; speculative risk refers to both the loss of opportunities, and possible profit . The pure risk can cause two results: one is non loss, another is loss. Speculative risk can lead three results: loss, non loss and profit.

After talking about the speculative risk, we should firstly distinguish the behavior of investment and speculation. Investment is mainly in order to obtain long-term capital gains with the expect of getting investment income; meanwhile hoping to obtain profit by the increment in asset prices in the long term. Stock investors generally should select the listed companies with strong economic strength and good management. Before investing, investor try to grasp more completed information for analyzing the possible risks and expected benefits of the purchased stocks.

Speculation intends to obtain greater profits in the short term and accepts to assume more risk. Different from the purpose of investment, speculators engage in stock trading with the expect of obtaining profit in short term. Normally, they do not care about the listed company economic strength or operative performance. Their speculation behavior is based on guessing of inside information and technical analysis, and then make speculation decision. Although the future return will be uncertain, speculators prefer to take high risk and tend to get expected return in short term. Absolutely, also get the unexpected loss.

People often compare between investment and speculation, investment is considered to have a limited risk, and more stable future income with relative safety, but speculation has a high risk. However, it is difficult to distinguish between these two behaviors clearly. In general, in stock transaction, the purpose of investor is to get a stable dividend and long-term capital gains, while speculators purpose is to obtain capital gains in the short term. Investors concern about the equity security without an expectation of very high income, so they usually invest in low risky stocks. Speculators tend to invest in high risky stocks to get a higher expected return, so they are willing to take greater investment risks. Before making investment decisions, investors will select all aspects of information of listed companies and analyze the market information carefully; speculators do not pay attention to the information of listed companies, but more focus on the analysis of market information, sometimes they only make decisions according to the inside information. Considering about the holding period of stocks, investors keep holding their stocks in more than one year, while speculators may sell their stocks in a few weeks or several months.

The Chinese financial market risk has an inefficient market risk because of its own financial system. For example, insider dealing is very common in the Chinese stock market, so investors are often warned to pay attention to main institutions and super institutional investors, if they have large buy or sell, their movements can indicate the market change of big "bear" or big "bull" news. So people always know the Chinese stock market as famous "news market" or "policy market" where the original news can control the life of investors.

Comparing with insider dealing, false financial reports has more negative impacts on financial market, and its illegal consequences are more terrible. Faking entirely false financial reports to cheat on the investors, it leads a huge loss that can destroy the whole stock market and stability of financial market.

Some companies delay to disclose important information or news deliberately that cause serious asymmetry of information between most investors and minority individuals. This is called incomplete information disclosure. Many major issues of company that must be disclosed but were not disclosed in the specification and annual report, or are evaded to disclose the important parts, so information disclosure is not serious and legal. Raised funds have not be used as the plan of instructions, investment projects have been changed, all these phenomenon reflect the lack of stability in information disclosure. At the end of year, a number of listed companies are always busy to do their work of asset restructuring, the huge amount of restructuring

announcements become a major landscape of Shanghai and Shenzhen stock markets. Normally, the most busy companies are the ones have bad annual performance. Obviously, they have to create some profits or gains in the annual report before touching the real assets. According to *Accounting System of Cooperative Company Regulation* promulgated by the Ministry of Finance, it is acquired that the company was purchased by corporative performance should be included in the main company at the same day of the equity purchase, so the future operating results after the purchase day can be accounted as proportional shares that are included in the financial account. The share purchase day, in accordance with international practice, should be based on the actual purchase date with a symbol of company mastering and controlling the operation of the net assets. In the assets restructuring at the end of year, this information presumably not be reflected in the annual report so quickly. Otherwise after reading all kinds of restructuring announcement, we can find out that the calculation of restructuring profits is determined by its own company.

In recent years, Chinese financial industry has entered a high risk period. Base on the general concept credit, Chinese society debt levels jumped to 210% from 145% from the end of 2007 to the end of 2013. It was significantly 10% higher than the credit to GDP gap index threshold ratio, in the second quarter of 2010, this ratio reached 20%. In 2011,the gap index declined, but it rebounded again in 2012. Latest data showed that the gap index reached 18.4% in the third quarter of 2014 that was closed the cordon level of traditional researches. In September 2008, all the major countries in the world were attacked by the global financial crisis. Even if several researches showed that there was no influence of board independence to bank risk after the financial crisis (Vallascas, F. Mollah, S. & Keasey, K., 2017). For reducing its impact on economic growth, Chinese government pushed up to 4 trillion economic stimulus debt plan to improve bank credit and to increase investment in infrastructure projects. This caused a large number of financing lending program in local financing platform. In 2009, Chinese local government debt substantially increased to over 60%, even more than the balance of the central government debt. In 2009, Chinese government announced the policy that the central government provided compensation on behalf of local government debt of 200 billion yuan. It was not only stimulate local governments to issue local bonds unreasonably, but also was allowed the state budget to avoid the legal regulations of local governments that may not restrict the direct bonds, this are main factors lead to the deterioration of local government. By the end of 2012, the local government debt was 39.43% of the total national government debt, which was lower than the common reference international standard 60%. In December 2013, the National Audit Office announced that the total national government debt are 20 trillion and 698.8 billion yuan, while government debt was mainly used for economic and social development and related

projects of improving people's living conditions. In June 2013, the total government debt-GDP ratio reached 53.5%, while in local government debt, bank loans amounted to 10.1 trillion yuan, accounting for 56.5%. The National Audit Office announced that local government debt that must be repaid is up to 5.6 trillion yuan, and 53% of the repayment maturities are concentrated in the 2011 to 2013; while the second peak of the repayment will be in 2016 to in 2018. Although a corresponding provision rate can be increased through various steps, in the current regulatory policy, repayment pressure on local governments is still very impressive. In the process of economic reform, in order to passing the direct financing ban of central government, the local governments established more than 8,000 financing platforms. If the financial institutions to provide local government financing platform of loans or real estate developers that have a debt ratio too high, it may create an overall default rate of banking sector over 30%.

The rapid rise of entire credit process also appeared bubbles of asset price. In view of the national average real estate price, the house price of 2009 and 2010 increased more than 30% comparing with last period. In 2011 and 2012, there appeared a small adjustment. Since 2013, the house had a new round of rising. Till 2014, the real estate market started to a downward adjustment. But since 2009, most of housing prices rose rapidly, especially in Beijing, Shanghai and others big cities, the price earnings ratio and rent prices shows an obvious bubble. There are more than 70% consumers believe that house prices are too high, while the financial institutions have put an amount of approximated 8 trillion dollars in debts, which more than the total increasing debt in Europe. The high risk of the real estate market is not easy to downward. In addition, house prices have risen to a new dangerous high level, aging population problem and urbanization disorders have shown that the bias of high house price will find no consistent support, while the real estate market will face a huge risk in the future.

In 1990, the total amount of capital was 1.53 trillion yuan, but this number increased to 89.56 trillion yuan in 2011. During 21 years, the amount of money have grown almost 60 times (58.5), but within the same period, the US dollar supplied only increased by 1.99 times. On the first six months of 2012, the total broad money amounted to $ 14 trillion, equivalent to 190% of the GDP. It is similar to the US QE monetary easing policy that has become a systemic risk in Chinese financial market.

In 2011, the central public finance revenue was 5.13 trillion yuan, with an increase of 20.8% comparing with 2010, but the total expenditure amounted to 5.93 trillion yuan, while the public deficit occupied about 800 billion yuan; After 2012, the Chinese government started to control

new local government debts strictly, prohibit all forms of security breaches of all levels of local governments, but the local government deficit in 2012 was still higher than in previous years, over to 8,500 billion yuan. In 2013, the total public revenue was 12.91 trillion, while the total public expenditure was 13.97 trillion and the fiscal deficit was about 1.01 trillion. In 2014 it was still to be implement a proactive fiscal policy, the deficit will further expand with an estimation of 1.3 trillion. Because of the continued growing GDP, the deficit ratio forecast remained at the level of 2%.

After 2000, the Chinese economy rises gradually, so the foreign exchange risk was also increased. China played a world factory role. In the past few years, as rising wages and the appreciation of yuan, the Chinese unit labor cost continued to rise comparing with neighboring countries, as Thailand, Philippine, India and Indonesia. In fact, since September 2012, the RMB showed a continuous one-way appreciation up to 16 months, investors enlarged their investment leverage. In February 2014, China intervened RMB exchange rate vigorously that caused a depreciation of 1.5%, so investors must be careful of exchange rate fluctuation risk. In addition, because of the money and credit expansion, actual Chinese inflation rate were higher than many countries, while its living costs was rising significantly, even more than many high-income countries. Chinese financial system risk and asset price bubbles also increases the future depreciation risk of RMB. Chinese debt had grown rapidly. In February 2014, it has reached 229% of GDP, this introduced the reduction of capacity of financial system and made a slowdown in economic activity. In fact, a current economic slowdown had been unable to avoid in China. No matter the RMB appreciation was too high or too low, it would affect the export respectively, under the dual pressures of trade protection and trade friction in, it would bring a certain degree of risk to the Chinese financial market.

The main European financial risk was form debt crisis. Euro zone banking system was affected by the debt crisis of south Europe, and introduces its liquidity ability continued declining. On one hand, the euro zone bank deposits are flowing out. Not only the deposit of south European countries that caught in the debt crisis, but also the deposits of Germany, France and other core countries are flowing out of the banking system. On the other hand, the liquidity ability of euro zone banks to obtain US dollar was increasingly vulnerable. Since counterparties worried the debt crisis has further outbreaks, and the euro zone might be affected the payment ability of commercial banks. so many agencies were reluctant to provide lending funds when they face the dollar borrowing requirements of European banking industry. Dollar interbank market liquidity shortage is also reflected in the recent increase of the dollar LIBOR. In such case, if it is not

intervened, then the payment loss risks will increase. Once appears a similar problem, by the spread and proliferation of the risk, market and depositors will be over reactive, then bank system will fall into chaos inevitably.

European debt crisis spread from four levels (Constancio, V., 2012): state, market, sector and field in the euro zone, resulting in a global risk aversion and cross-border capital out flows, triggering financial market turmoil more intensively, and causing a huge negative impact on the global economy growth by international trade. Essentially, the Greek debt crisis performed as a landmark event in the European sovereign debt crisis, then it developed to global financial crisis. The dependence changed after the 2008 financial crisis for equity markets but not as much for exchange rate markets, especially for developed and emerging markets that still had some important differences compared with other markets but not as they were before the crisis (Sensoy, A. & Tabak, B., 2016). The global financial crisis risk mainly concentrated in the private sector, then risk transferred to the public sector which was focused on the sovereign debt crisis, and fatherly included currency crisis and banking crisis in different regions as systemic financial crisis. With the escalating European debt crisis, Portugal, Spain, France, Ireland, Italy and other countries had to increase government revenue, to reduce salaries and layoffs, to freeze pension and privatization fiscal austerity for reducing the deficit. These measures aroused a strongly opposition of citizens and commercial unions, all the major European cities continuously erupted all kinds of demonstrations, while social contradictions are getting worse. The Greece, Spain and Italy and other countries have changed many government members, and the European social security risks increases. The debt risk is transformed from the economic sphere to political and social spheres. Since the debt crisis broke out, the European bond market has showed two trends: the substantial increased risk led to more serious substantial upward trend of government yields bonds of euro zone countries. From 2010, the risk of debt default in Greece, Ireland, Portugal, Spain and Italy continued to increase, resulting an overall swings increase in the 10-year bond yields.

The international bond investors and financial institutions, preferred to convert the five-nation sovereign government bonds to hold the government bonds of less risky bond market such as Germany and France. This resulted the difference between Germany bond yields and 10-year bond yields rate of others euro zone countries exacerbated which differentiated the European bond market revenue. European debt crisis continued to expand its negative impact on the euro zone economy from two aspects: On one hand, euro-zone countries forced to plan to slash government spending and social welfare spending, to increase the tax, which will suppress

private consumption, thereby restricting investment and domestic demand growth, while resulting of declining economic growth or slowing economic growth. On the other hand, to protract European debt crisis, the government increased financing costs sharply that introduced a huge fiscal deficit and debt burden. The expansionary economic stimulus did not work, unsustainable economic growth lack of adequate funding, and ultimately led the European countries to recession.

European debt crisis had to face three major risks: Firstly, Spain is the most urgent, the largest member with potential risks and financial black hole in euro zone countries. The country's economy was in recession, public debt levels rises, asset quality deteriorates in the banking sector. This may lead a repeated short-term debt crisis in Europe. from one side, Spain would have a huge maturity debt. From 2012 to 2014, Spain needed a total of 245 billion euro of refinancing demand, because it faced enormous financing pressure; from another side, the Spanish local governments were involved in financial crisis that fatherly increase the financial burden of the central government. European debt crisis continued to face three major risks: Firstly, Spain was the current situation of peripheral euro zone countries most urgent, the largest member of the potential risks and financial black hole, the country's economic recession, rising public debt levels, asset quality deterioration in the banking sector between Triangle had constituted a vicious cycle, may lead to short-term debt crisis in Europe appear repeatedly. Spain had a huge debt maturity. 2012--2014 Spain needed to refinance a total of 245 billion euro, which had enormous pressure market financing; so the Spanish local governments dropped into financial crisis that further increased the financial burden on the central government. Secondly, the debt crisis spread to the real economy, the euro zone appeared a short-term economic downside risks. The euro zone economy was expected to shrink by 0.4% in 2012. Thirdly, the European banking industry losses would exacerbate the European debt crisis. The real estate market may deteriorate fatherly beyond the recession and rising unemployment may expand the debt problem of banking system.

The European economic recovery was slowing down, overall, the structural problems of the euro zone economy did not improved significantly after the rebound of the slowdown in 2013. While the European Central Bank launched a series of loose monetary policy and liquidity injection programs to reduce sovereign bond yields in heavily indebted countries and to stabilize market, it had made a pronounced effect. The overall unemployment rate in the euro zone remained at a high level of more than 11% , the youth unemployment rate was as high as 23.3%. The economy growth of periphery countries in the euro zone lacks of motivation, while Ukraine geopolitical

crisis continues deteriorating that became a significant drag on the core countries. Since 2013, the crisis in Ukraine and Russia not only impacted on the economy of these two countries, but also made a greater negative impact on the terms of oil and gas transportation, international trade and financial markets of others euro zone members. If the crisis gets worse, it will drag on the pace of economic recovery of euro zone.

In 2014, the inflation index continued to decline. Euro zone Price Index (CPI) increased less than 1% compared with 2013. The producer price index (PPI) was continuous negative growth during 13 months. Member States were weak to stimulate domestic demand, in the first six months of 2014, the euro area household final consumption expenditure still had 1.3% point gap compared with three years ago. To stimulate economy, the European Central Bank relaxed monetary policy, the main refinancing rate was as low as 0.05%, the overnight deposit rate dropped to -0.20%, "negative interest rate" policy failed to achieve its goal. The traditional monetary policy almost lost maneuvers space.

Euro zone financial markets had slowdown the economy growth, major indexes fell sharply, bond prices also fell, the sovereign bond yields of some members countries raised quickly. In October 2014, the Eurostaxx 50 index fell 9.3%. On October 16, 2014, Greece, Portugal, Italy 10-year bond yields respectively rose to 8.96%, 3.48% and 2.58%. At the same time, German bond yields fell to 0.82%. Greek sovereign borrowing costs sounded the alarm of the debt crisis. On one hand, Greece may withdraw from the "troika" rescue plan. if Greece intend to obtain a more independent policy and exit the rescue before really resolving the crisis, its future reoccurrence of the debt crisis may be worse.

Although both of Chinese financial market and European financial market exist debt risk, Chinese debt risk is from internal debt, such as local government debt; European debt risk is from external debt, such as the Greek economic crisis. Considering as another perspective, the Chinese financial market risk is closed, mainly affects the national economy, but European financial market risk is open, all EU member states will be affected.

2.2.4 Comparison of the Chinese and the European psychology and behavior

After comparing between the investment risks of Chinese and European financial markets, we will discussed the psychology and behavioral characters of the investors in these two markets. In general, investors have several investment motivations (NMG, 2014), for example, capital

appreciation motivation, speculative motivation, participation in decision-making motivation, hedging motivation, self-expression motivation, curiosity and challenge motivation and tax avoidance motivation.

Mental set refers to for a certain motivation readiness of individuals, it is constrained by two factors (subjective situation and objective situation). Under repeated situations, when the individual needs is totally met, individual behavior that triggered by the need will be consolidated, so they form their mental set. Mental set is a state of readiness of individual activities, which sometimes tends to help solve problems and sometimes tends to hinder solving problems.

In the stock market, when investors enter the market, they lack of investment experience and have no mental set, so they can make decisions according to the market changes. With more investment practice, after repeating to proof and strengthening their investment experience, investors will form their mental set of stock market. Mental set will affect the stock market investors' subjective judgments. For example, some investors are accustomed to judge the stock market according to the message, some investors tend to speculate by daily ups and downs of stock market. However, once the mental set fail, investors are likely to lose mental balance, as well as they will start to doubt and waver on the obviously correct experience, and will make wrong investment decisions again.

Different investors have different mental set about stock market, but after the upward or downward of stock market, investors overall mental set is doing better, or doing worse. The existence of this mental set stops the stock market to continuously going up or dropping down, so sophisticated investors can use it efficiently, before most of the people understanding the trend, they can adjust their investment strategy immediately. Obviously, the premise is that they cannot struggle by the mental set of stock market, they should always observe the changes of the stock market, accumulate more experience and update new information.
In the investment market, there are two types of investors, institutional investors and individual investors.

Institutional investors are always on the opposite side of individual investors. Institutional investors can manipulate the stock market, because of that they have large amount of funds, great trading volume, and there are individual investors help them to build the base. So when institutional investors invest, they need the majority of retail investors to follow their steps, to

drive up the share price and to take advantage business exposure. When institutional investors start to enter the market, many individual investors come to help them, then share prices will be skyrocket. During this process, exist profit-taking leavers and new additional promoter. Once the force is regressive, institutional investors begin to retreat, share prices will be sliding and falling down, some people will suffer economic loss inevitably. The behavior of institutional investors in stock trading has a high reference value in the study of stock price volatility. Because of that institutional investors select stocks based on performance status and potential increase of companies, while institutional investors have strong financial strength and huge trading volume that can affect stock prices easily.

The Institutional investors control the market operation is basis of the psychological anti-public (Mosse, D, 2006) actions. Anti public is to sell holding shares in optimistic market situation and to buy shares in passive market situation. The institutional investors manufacture certain circumstances of these optimistic moment or passive moment by repeating some "show shape", "cheating line" or others operating practices to achieve the purpose. It means that they achieve their purpose by mental intervention of individual investors. Institutional investors use their advantage in the market and market trends in the initiative, pulled up by a series of acts to achieve their intentions psychological vitality. Bodnaruk and Simonov (Bodnaruk, A. & Simonov, A., 2016) had studied how institutional investor preferences affected their performance, they believed the risk aversion was an important factor in their investment decisions. Generated by manipulation of psychological and behavioral inhibition, pushing manipulation. An important aspect of institutional investors to manipulate the market psychology, is through the possession of certain stocks or stock index, the majority of outstanding shares, to realize their own market manipulation intention. By manipulating practices in order to achieve a large number of cheap chips to absorb and profiteering purposes. On the one hand available for their own profits through market manipulation; on the other hand can be deceived to follow suit. Generally, institutional investors in order to put the individual investors in a slow on the uptake or unknowingly situation of the operating state of the stock market, they make great efforts to hide their purchase intention. The Institutional investors use their advantage in the market trends, pull up a series of action to satisfy their vitality intentions. The manipulation generates by psychological and behavioral inhibition, the produces manipulation. An important aspect of institutional investors to the market manipulate psychology is the possession of some certain stocks or the majority of outstanding shares to realize their own market manipulation intention. By manipulating practices to achieve a large number of cheap shares and to absorb more benefits. On one hand, they can obtain huge profits; on the other hand, they can cheat the individual

investors.

In general, individual investors tend to be the first victim in the stock market volatility. In front of the large amount of funds, institutional investors with rich experience, the ones who lose money will be individual investors that lack of organization and effective plan. As the "scattered" feature of individual investors, but it is easy to be trapped in stock market volatility. Stock market investors have different gender, age, physical condition, so they will show an extent of the different risk preferences. When the crash occurred in the stock market, immature investors who lack completed information and professional investment skill are afraid of loss, they escape from the investment market , and produce a series of irrational investment behavior. In the stock market, people will often chase sell. The stock market herd behavior is also a mentality herd, it usually presents as investors ignore their own private information in the transaction process and follow and imitate the behavior of others investors. Normally, within the same period, individual investors trade the same stock or use the same investment strategy. In normal circumstances, the decision of the major of people is always correct. Human herd mentality (Chwalek, D., 2011) accords with human evolving requirements, group behavior has certain advantages. To do the same thing as others not only can save a lot of time and efforts, but also enhances the probability of success.

2.2.4.1 Chinese investor psychology and behavioral characters

The Chinese individual investors are older, investors are over 40 years old accounted for 49.4 percent, investors are about 30 years old accounted for only 21.8%. Most of the Individual investors are service workers, laid-off workers and retirees also accounted for a large proportion. In these investors, state officers, enterprises employees, foreign-funded and joint-stock enterprises employees accounted for 45.4% of the total. Laid-off workers and retirees accounted for 28.7% of the total. Individual investors in low-income, small retail-based whose main source of household income is wages. Individual investors with less than 10 thousand yuan accounted for 44.9% of the total. The individual investor group has low risk solvency ability.

These investors participate in the stock market in a short period, but have a strong sense of security investment. They invest a large proportion of households financial assets into stock market with a strong "emotional support". However, they lack of relative investment experience,

so their overall anti-risk capability is weak. Their major of investment (81.7%) of funds is from their own funds. In general, investors have short investment history that is less than four years accounted for 57.7%, so they do not have much accumulative experience of stock market. Individual investors in stock investment of bull market years, they usually have benefits, but most investors are not satisfied with their return on investment, there exists a clear " quick rich mentality" of investment. Their main investment motivation is to earn the difference of secondary market. Although individual investors in a bull market yields are generally higher than bank deposit rates over the same period, 60.1% of the income of individual investors is higher than bank interest rates, but only 37.1% of them are very satisfied or relatively satisfied of the stock market. The majority (69.8%) of individual investors are not satisfied of the gains on the stock market. The profit-oriented investors eager to get rich quickly. Although the vast majority of individual investors have losses in the bear market, they are optimistic about the prospects of Chinese stock market. When investors face loss, the majority of individual investors expect to get a better return on investment in future market. 80.4% of individual investors would like to have higher income than bank interests. 87.8% of individual investors are optimistic of the prospects of Chinese stock market. However, most investors take a conservative approach (reduce funding or holding the same fund) in the arrangement their investment funds in the bear market.

In Chinese investment groups, individual investors accounted for an absolute proportion, and they are highly fragmented, with an opposite trend of international investment community structure. Despite China Securities Regulatory Commission made a great effort in promoting the extraordinary institutional investors development, but in the short term, the stock market will continue to be a dominant retail market. In contrast, in developed stock markets, investment funds numbers are even exceed the shares numbers. Chinese investors transact too frequently, for example, in an Exchange, 7,894 individual investors have average annual transaction number of 115, the highest actually reach 578 times, six times much higher than United States. This phenomenon reflects investors' anxious of rich, and their overconfident in investment. They believe that they have the ability to get more income than the average income to earn excess profits, so they trade frequently. According to the statistical test results, the transaction frequency and its investment returns of investors was a significant negative correlation between each other. The higher the frequency of investment is, the lower the investment income will be. The highest average income trading frequency group even is failed to reach risk-free interest rate of the bank over the same period, or even negative. On the contrary, those investors committed in the long term, most of them have had good gains. High transaction costs can explain the reasons why

investment income is low, in addition, overconfidence or excessive fear or other psychological factors can lead to frequent selling, which an important factor of the low return rate.

In Individual investors or potential individual investors with a higher level of education in the Chinese capital market, there existed 'gambler's fallacy' effect on stock prices were stronger than the role of sequence variation 'hot hand effect' ', to say that, whether stock prices will go up or go down, investors believe that prices will change reversely. Based on this discovery, we believe that "when the Chinese stock market in a long term of 'bear market', individual investors with higher level of knowledge expect that the market will rebound in the future." "In the case of continuous rising, the longer the rising time is, the less purchase probability will be, but the greater probability of selling will be. On the contrary," in the case of continuous declining, the longer the fall months are, the greater the likelihood of buying will be, and the less possibility of selling will be. This shows that, with the increasing length of time, "gambler's fallacy" effect of investors is increasing obviously. But "by the extent of this effect, investment experience, age and even gender can affect investors". In the same is the case of continuous rise, "the possibility of selling and investment experience of investors has a significant negative correlation that means a experienced investor with higher level of understanding of the market has less to sell. While the level of understanding the stock market, experience have significant positive correlation with the age. "In terms of gender differences, "female investors significantly sell more than men when the stock has a rising tendency, while men sell much more when the stock has a dropping tendency."

2.2.4.2 European investor psychology and behavioral characters

Comparing with Chinese investors, European investors are more accustomed to financial instruments or investment portfolios as options, futures, guarantees and equities. The online international trading is also more advanced in Europe, retail investor trading presents an important part of European online trading industry. Starting in March 2012, In the survey of Celent started in 2012, which included retail investors across six European countries: the United Kingdom, France, Germany, Switzerland, Italy, Spain, and Switzerland. In the survey they discovered that, the European investor community is incredibly diverse. Within each market, there are different affluence levels, skills, knowledge, and instrument preferences. There are also different characteristics, wealth segments, trade behaviors and skill levels within each individual European market.

According to the research of European Value Survey (EVS) Foundation: The pursuit of personal happiness is the core value of Europeans value system, while the majority of West Europeans also believe that they are very happy (the people of small countries and south have a stronger sense of happiness). Health and happiness are the most relevant values (most of Europeans are willing to pay money for exchanging health), then is family, the last is work. For young Europeans, friends are more important than family, leisure is more important than work. The less important things of happiness are religion (except Poland) and politics. Meanwhile, the Europeans believe that the happiness needs to be support by two traditional ancient values of western world - freedom and equality - to measure. Nordic especially prefer to liberty, Southern Europeans (and Ireland) especially emphasis on equality. In one word, the differences of social culture and tradition have formed a greatly diverse character within Europe. Europeans aspire to a dynamic society and look forward to be able to use Sciences and the European Community Strength to promote the realization of a dynamic society. Typical Europeans like the progressive reform, do not like revolutionary or reactionary. They believe that a unique Europe is the inevitable choice to ensure the future, but on the other hand, they still intends to continue to be loyal to their hometowns, provinces and countries. The majority of Europeans are favor to peace, in generally, they support human rights and environmental protection. Most of the women and young people support to the women emancipation, the Nordic has more positive attitude (Italians have the lowest support rate). Europeans are less confident to their social institutions than before. In recent years, their trust of education and legal systems, the media, guilds, large enterprises, government and the military continuously decline. The only abnormal thing is that the Europeans are more confident in the European Community.

In general speaking, Europe is enveloped in an increasingly personal trend. At work, most people emphasize their personal development; In politics, people ask someone to listen to their opinions (so more and more people participate in demonstrations). A new trend of de-institutionalization has appeared in Europe, the rules are no longer dependent on external authority, but are dominated by personal life. The Europeans are concerned about health, income, family friend relationship, quality...

In many European countries institutional investors are dominating, in terms of capitalization, the markets over time; the institutional investors are the most important role of financial investment market. Although the international investment market is more advanced than before, normally, institutional investors always perform a home bias in their investment. In the regression analysis of Ghulame Rubbaniy (2013) with an example of Dutch institutional investors, he investigated

the co-variation between asset allocation and individual fund characteristics. He found out that Dutch institutional investors reduced their domestic fraction of investments from 37% to 13% on an asset-weighted average basis. This change was much more pronounced in less-risky assets and was influenced by the specific characteristics of PFs. Both the introduction of the euro and the dot-com crisis led to a significant downward shift in home bias. An overview of the data descriptive reveals that the fraction of domestic holdings in portfolio holdings varies between 0.01% and almost 100%. The asset-weighted, average home bias (foreign holdings) over the observed period remains at approximately 22.5% (53.8%). On average, home bias, the portfolio choices was decreasing over time, i.e., it decreased, on average, from 37% in 1997 to 13.2% in 2006. The decreasing of home bias was driven by the growing integration of financial markets, increased financial knowledge and more risk awareness over time, all of which foster international diversification. A significant reduction in average home bias in the portfolio choices of Dutch institutional investors over time. When the Dutch foreign investment was strict, it was in an era of higher and increasing average domestic bias (before and including 1997) and when a new foreign investment policy was developed by the prudential supervisor, it was in a period of lower and decreasing average domestic bias (after 1997) in comparison to international portfolio holdings. Home bias can be considered as a portfolio risk that precludes better returns through inefficient international portfolio diversification.

When deciding on portfolio size, an institutional investors made a trade-off between the increased transaction costs (decreased return) versus decreased risk due to more effective diversification by adding more securities to its portfolio (Alan M. Rugman, 1976). In rational efficient markets, an investor is likely to keep adding new international securities to his portfolio as long as the marginal benefit of international diversification is greater than the marginal cost. Moreover, a common notion in finance is that trade in bulk can reduce the marginal transaction costs. Their higher domestic positions would result in inefficient portfolio diversification through capturing virtually the entire domestic market, which would, thus, influence the market prices. Likewise, international diversification becomes inefficient for small PFs owing to higher trading costs. Therefore, for big institutional investors, it is inevitable to diversify their portfolio holdings internationally, whereas the converse prevails for small PFs; hence, the argument of higher trading costs in combination with scale economies could provide large PFs with more opportunities to internationally diversify their portfolio.

Another curious phenomenon that exists among the institutional investors is herding. Herding can be understood as a special type of feedback trading. It measures the degree of correlated

trading among identical or homogeneous groups of investors and shows the average tendency of traders to end up on the same side of trading for the same security at the same time. At the macro level, by considering the financial market as a whole, the number of buyers for a security should be in equilibrium with the number of sellers, therefore, herding should not be possible. However, in any subset of a financial market, such equilibrium may not be found because the number of buyers for a particular security may exceed the number of sellers, or vice versa. Thus, herding can occur in a group of similar investors rather than among random traders. He observed herding asymmetry in investment behavior, indicating that herding is more common in buying than in selling securities. He noted an obvious variation in herding measures across different asset classes, with money market papers exhibiting the highest herding and stocks experiencing the lowest herding.

In European financial market, there are less individual investors than institutional investors, because of the advanced investment policy and system. But for every buy, there is a sell. If one investor beats the market, someone else must underperform. Collectively, we must earn the market return before costs. The presence of exceptional investors dictates the need for subpar investors. A big part of the performance penalty borne by individual investors can be traced to transaction costs (e.g., commissions and bid-ask spread). Individual investors also seem to lose money on their trades before costs. Grinblatt and Keloharju (2012) analyzed two years of trading in Finland and provide supportive evidence regarding the poor gross returns earned by individual investors. Individual investors were net buyers of stocks with weak future performance, while financial firms and foreigners were net buyers of stocks with strong future performance.

In Finland, individual investors lost money on executed limit orders, but make money on executed market orders. When combined, the gains and losses left individual investors in his sample with profits that were indistinguishable from zero. Finally, Barber and Odean (2001) compared the performance of men and women using data from the LDB dataset. Unlike the studies on cross-sectional performance discussed above, this study focused on the net returns (i.e., returns net of spreads and commissions) of men and women. The study was motivated by the two observations: (a) men tended to be more prone to overconfidence than women in areas culturally perceived to be in the male domain (Deaux and Farris, 1977), and (b) models that assume investors are overconfident tended to predict investors will trade excessively and to their detriment. When we combined these observations, they predicted that men would trade more than women and that excessive trading would hurt their performance. Barber and Odean document that men traded more than women; the annual turnover rates of men were about 80%,

while those of women were 50%. The excessive trading of men leaded to poor returns. While both men and women earn poor returns, men perform worse. Virtually all of the gender-based difference in performance could be traced to the fact that men tend to trade more aggressively than women. Neither men nor women appeared to have stock selection ability (i.e., the gross returns earned on their trades are similar), so men's tendency to trade aggressively and the resulting trading costs drag down men's returns. Dorn and Huberman (2005) found out that men with accounts at a German online brokerage traded more actively than women, but gender effects were reduced if one accounts for differences in self-reported risk-aversion.

Combining survey evidence with trades and positions for 1,345 German investors, Dorn and Huberman (2005) documented that investors who think themselves more knowledgeable than average churn their portfolios more. Similarly, Glaser and Weber (2007) used survey evidence and trading records for 215 German investors to document a link between the "better-than-average" type of overconfidence and trading activity.

Despite several years passing since the financial crisis, investors around the world are still highly risk-averse. According to the statistic analysis of NATIXIS (NATIXIS, 2014), market volatility has eroded confidence in the markets for two-thirds (66%) of investors worldwide. For example, 41% said that achieving stable returns amid market volatility are most important in their investment decision-making, yet only 19% of investors are very confident that their current investment approach will protect their portfolio from dramatic swings in value, and only about 55% feel knowledgeable about investment strategies that produce stable returns/income. One exception is the U.S., where 47% (39% in 2013) disagree that they are only willing to take minimal investment risk, which contrasts with Europe where 71% (68% in 2013) of investors are risk-averse. The fear of market volatility is also slowly decreasing; 54% of Americans understand market volatility as a factor that undermines their ability to reach their savings and retirement goals, down from 58% a year ago. Similarly, it was down from 70% to 67% for British investors. The overall more positive mood is also reflected in the fact that global economic and political uncertainty has also become less of a concern for investors. 28% of American investors are very concerned by this compared to 34% a year ago, and 20% of British investors are worried about this compared to 30% in 2013. In Europe, 71% of investors still are unwilling to increase risk, up from 68% a year ago. By comparison, 56% of investors share a similar view on risk in the U.S., where risk tolerance and investor confidence are higher and evidence of behavior change is accelerating faster than in most other countries. More than five years on from the financial crisis and although a lot of healing has occurred and much water has

passed under the bridge, scars remain. Europeans are most affected by events over the past five years – 50% more so than U.S. investors. Concerning about European debt issues has fallen and particularly in countries within the euro zone. 62% of Spanish and 63% of French investors are very concerned about a year ago, now only 38% and 35% are respectively. In contrast, Europeans are the least positive about their financial situation over the last 12 months, with only 21% of Italians, 25% of French, 28% of Spanish and 28% of Germans having seen an improvement. The increment in confidence across many countries coupled with a pervasive risk-averse attitude could reflect a new normal, in which increased confidence does not translate into increased risk-taking. Germany on the other hand see a fall in willingness to take more risk from 38% to 29%, which could be due to a slowdown in economic growth. Attitudes toward risk across the Atlantic are moving apart. This is even more pronounced in markets like Germany and France. For being more prudent, 82% of investors worldwide say they only invest in products they understand, yet only 18% of investors feel that their overall investment knowledge is very strong. Fully two-thirds of investors are agreed that a traditional approach (equities and bonds) to portfolio allocation is no longer the best way to pursue returns and manage investments. Not surprisingly, the top asset classes investors intend to maintain or increase allocations to over the next 12 months are stocks, bonds and cash. Nearly 57% of investors say they do not understand alternative investments. 49% of them do not even think they have access to alternatives as an individual investor, including 44% of high net worth investors. And given their lack of knowledge, it's not surprising that 69% of investors perceive alternative investments to be risky, despite their potential to produce returns are not correlated to the broader market. Nearly three in four (72%) American investors would take safety over performance if forced to choose, almost exactly the same proportion as a year ago (73% in 2013). The proportion is even higher among British investors; more than eight in ten (83%) would take safety over performance (80% in 2013). The proportion of U.K. and U.S. investors who are willing to take more risk remains largely stable from 2013, at 47% and 43% (44% and 43% respectively in 2013). More than half of U.S. and U.K. investors have never discussed alternatives with their advisor, a higher proportion than in Switzerland, Spain, Mexico, Germany and Chile. In Europe, more investors have turned to advisors over 2013, but fewer have an ongoing relationship with a dedicated advisor. With the exception of the U.K., European investors are least likely to have clear financial goals or a financial plan. Switzerland is the country where the fewest investors have clear financial goals, only one in four (27%).

In this section, we have compared between the Chinese financial market and European financial market from many sectors as politic environment, economic policy, financial market evolution

and characters, financial instrument, investors characters and investors behaviors. By this comparison, we find out that China and Central Europe have certain similarities that are mainly in the following aspects: The rapid economic growth. The economic growth is strongly dependent on exports; The main form of investment is foreign direct investment, which is more than the stock investment and domestic banks investment; The high foreign capital proportion in the banking sector and foreign bank sector. In international trade, Central European countries have similar trade structure as China. For example, the automobile exports, the main European automobile companies have entered in China. Especially, China has a closer relationship with Germany, once Germany changes its product demand or supply, it will directly affect the Chinese economy and trade. In the past 20 years, Central European countries gradually integrated in banking system, many European countries banks have established their branches in China, which have occupied a large part of Chinese bank assets. Although foreign banks can offer lower interest rates and foreign currency credit to promote the growth of consumption, as the impact of the economic crisis, foreign banks will bring a great distress to Chinese financial market. After a sudden devaluation of RMB, it will create difficulties to pay back foreign currency credit, which will make negative effect on domestic consumption.

However, there are many significant differences between China and Europe, the main reasons of these differences are from politic strategy and social background. Chinese people use their perspectives to think over Europe, while Europeans also use their perspectives to valuate China. As a socialist country, China has its Chinese characters, as the character of development policy, social structure, economic development and cultural background. Unlikely, the European Union is a sovereign nation which is established by capability of different mechanisms of different European countries. Each mechanism has its own rules. In the economic sphere, the EU has also established a unified market. However, among the EU members, there also exist many differences in the military, politics, economy and social culture, so there often exist inconsistencies. If we want to compare Chinese financial market and European financial market, in many cases, we need to investigate their specific features separately.

Chapter 3. Behavioral Finance in Risk Investment

3.1 The efficiency of the Chinese and the European financial market

In this part, we compared the Chinese financial market and the European financial market in many sectors as policy, investment environment and investor character. All these factors were the reason of the differences between these two markets and here we compared their market efficiency.

3.1.1 Research object

In this research, 300 companies of the Shanghai and Shenzhen 300 Index and 600 companies of the Eurostoxx 600 Index were selected as objects of study for comparing between the Chinese and the European stock market. Both of these two indexes are two of the most important indexes in international financial market, and all the companies of these two indexes are leaders of the industry, of which they belong to.

The Shanghai and Shenzhen 300 index was the first index obtained the authorization of Shanghai and Shenzhen Stock Exchange as a cross-market index. Till the end of 2013, the total capitalization of Shanghai and Shenzhen 300 index amounted to 17.24 trillion Yuan, accounting for 63.95% of the total capitalization of a shares market and 64.35% of the circulation market value.

The Eurostoxx 600 Index represented large, mid and small capitalization companies across 18 countries of the European region: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. It covers 10 industries, basic material, cyclical consumer goods & services, non-cyclical consumer goods & services, energy, financials, healthcare, industrials, technology, telecommunications services, utilities.

This research consisted of two sections; the first section was the demonstration for Markowitz Mean - Variance Model with the analysis of stock figures of 900 companies of these two indexes. Considering to the high-speed update of stock market, we selected a 9 year investigated period (from 2005 to 2014). The second section was the Monthly Momentum Model and Daily

Momentum Arbitrage Model. For the monthly model, we choose the daily data from May to November of 2006, 2008 and 2014. For the daily model, the periods from July to September of 2006, 2008 and 2014 were selected.

3.1.2 Efficient market hypothesis

By creating time series, Sukpitak and Hengpunya proved the cross-correlation between market efficiency and trading volume. The results of their experiment showed that the trading volume could hardly affect the market efficiency (Sukpitak, J. & Hengpunya, V., 2016). In order to prove the Efficient Markets Hypothesis, we calculated daily expected return, daily increase volume, monthly expected return and monthly increase volume separately with the Shanghai and Shenzhen 300 index and Eurostoxx 600 index from 2005 to 2014, the increase ratio was calculated as the following formula (Marling & Emanuelsson, 2012):

$$\mathbf{R_{it} = (\sum (Price_{it} - Price_{it-1})/Price_{it-1})/N} \quad \mathbf{(1)}$$

$$\mathbf{VOL_{it} = (\sum (Volume_{it} - Volume_{it-1})/Volume_{it-1})/N} \quad \mathbf{(2)}$$

Where:
$Price_i$: individual stock price
$Volume_i$: trading volume of individual stock
t: the same day or month
t-1: the previous day or the previous month
N: number of day or month

For investigating the relationship between these two variables, we used Paired Sample T – test to define their independence, and used Pearson Correlation to calculate their correlation factor r.

Paired Sample T – test of model

Paired sample t-test is applied to compare two samples means in the case of these samples that are correlated (Herrero & Villar, 2014). In our research, we sat up the null hypothesis as independence. If the calculated value was greater than the P-value (0.05), then we accepted the null hypothesis for the paired sample t-test, there was significant mean difference (independence) between the two-paired samples. If the calculated value was less than the P-value (0.05), then we

rejected the null hypothesis and believed that there is no significant mean difference (dependence) between the two-paired samples. The formula of calculation was as following (De Coster, 2006):

$$t = \frac{\sum d}{\sqrt{\frac{n\left(\sum d^2\right) - \left(\sum d\right)^2}{n-1}}} = \frac{\overline{x1} - \overline{x2}}{\frac{Sd}{\sqrt{n}}}$$

Where

d: is the mean difference between two samples.

n: is the sample size.

$\overline{x_1}$: is the mean of the first measurement, $\overline{x_2}$is the mean of the second measurement, Sd is the standard deviation of the difference score, and n is the sample size.

The p-value for the test statistic t can be taken from the t distribution with n-1 degrees of freedom.

In the Paired sample t-test between expected return/volume and their variance (Table 1 of Appendix), the result came to several conclusions: the daily increase return/volume rate of Shanghai and Shenzhen 300 Index/Eurostoxx 600 Index and their variance were dependent with a high significant P – value (<0.01); It indicated that the investors of these two markets were sensitive with the market volatility, especially the investor European stock market. Only the monthly increase return of Shanghai and Shenzhen 300 Index and their variance were independent with a P – value greater than 0.05. It indicated that the investors of Chinese stock market were sensitive in a daily volatility but no longer than one month; we surmised that they are only overactive in a very short time scale (Naderi & Mekanik, 2012).

In the Paired sample t-test of expected return/volume between the Shanghai and Shenzhen 300 index and Eurostoxx 600 index (Table 2 of Appendix), the result drew a conclusion that the Chinese stock market expected return and the European stock market expected return were definitely independent (P-value>0.05). It meant that these two markets may have distinct characters. We considered them as two independent stock markets.

In the Pearson correlation coefficient between expected return and increase volume of the Shanghai and Shenzhen 300 index and Eurostoxx 600 index (Table 3 of Appendix), the result came to two conclusions: Firstly, the daily/monthly expected return and volume of Shanghai and

Shenzhen 300 Index were dependent with a high significant P–value less than 0.01; It meant that the daily/monthly expected return/volume could affect the investors trading behavior. Theoretically, a rational investor will not buy or sell recklessly, especially in one day, so we could believe that the investors of Chinese stock market were not rational. Secondly, the expected return and volume of the Eurostoxx 600 Index were independent with a P–value greater than 0.05 meant that the European investors are more rational than the Chinese investors.

Pearson Correlation test

The Pearson correlation coefficient is linear correlation (dependence) between two variables, giving a value between +1 and −1 inclusive, where 1 is total positive correlation, 0 is no correlation, and −1 is total negative correlation (Cheung & Chan, 2004). In our study, Pearson's correlation coefficient is represented as the estimation of the covariance and variance based on the sample data during the investigation period.

In the Paired sample t-test between expected return/volume and their variance of the Shanghai and Shenzhen 300 Index and Eurostoxx 600 Index (Table 1 of Appendix), the formula is as following:

$$r = r_{re,VARre} = \frac{\sum_{i=1}^{n}(\mathrm{Re}_i - \overline{\mathrm{Re}})(VARre_i - \overline{VARre})}{\sqrt{\sum_{i=1}^{n}(\mathrm{Re}_i - \overline{\mathrm{Re}})^2}\sqrt{\sum_{i=1}^{n}(VARre_i - \overline{VARre})^2}}$$

Where

Re_i : daily or monthly expected return of individual stock

$\overline{\mathrm{Re}}$: average expected return

VARre_i: variance of daily or monthly expected return of individual stock

$\overline{VARre}$: average of variance of daily or monthly expected return

From the test, we discovered a curious phenomenon. The daily expected return rate of Shanghai and Shenzhen 300 Index and its variance had a negative correlation (γ=-0.058). In the Markowitz Mean - Variance Model, the higher the return is, the higher risk will exist. And the mean is proportional to the variance. But according to our research, the mean of expected return was inversely proportional to its variance in Chinese daily stock market. It proved that Chinese stock market was not qualified for the Efficient Markets Hypothesis. The expected return of Eurostoxx

600 Index and its variance had a totally correlated (r=1). This Beta was in accordance with the Efficient Markets Hypothesis perfectly, so we could consider the European stock market as an efficient market.

$$r = r_{VOL,VARvol} = \frac{\sum_{i=1}^{n}(VOL_i - \overline{VOL})(VARvol_i - \overline{VARvol})}{\sqrt{\sum_{i=1}^{n}(VOL_i - \overline{VOL})^2}\sqrt{\sum_{i=1}^{n}(VARvol_i - \overline{VARvol})^2}}$$

Where

VOLi : daily or monthly increased volume of individual stock

$\overline{VOL}$: average increased volume

VOLi: variance of daily or monthly increased volume of individual

$\overline{VARvol}$: average of variance of daily or monthly increased volume

In the statistical test, the volume increase rate was significant correlated with its variance in both of these two markets.

In the Pearson correlation coefficient between expected return and increased volume of the Shanghai and Shenzhen 300 Index and Eurostoxx 600 Index (Table 3 of Appendix), we used the following formula:

$$r = r_{\mathrm{Re}\,i,VOLi} = \frac{\sum_{i=1}^{n}(\mathrm{Re}_i - \overline{\mathrm{Re}})(VOL_i - \overline{VOL})}{\sqrt{\sum_{i=1}^{n}(\mathrm{Re}_i - \overline{\mathrm{Re}})^2}\sqrt{\sum_{i=1}^{n}(VOL_i - \overline{VOL})^2}}$$

Where

Re_i : daily or monthly expected return/increased volume of individual stock

$\overline{\mathrm{Re}}$: average expected return/increased volume

VOL_i: daily or monthly increased volume of individual stock

$\overline{VOL}$: average of daily or monthly increased volume

On the basis of the statistical test, the daily/monthly expected return and increased volume were positive related in the Chinese stock market. It revealed that the investors of Chinese stock market were overactive and irrational. But we also found out that its correlation between the expected return rate and increase of volume rate was not very relevant (r day = 0.138, r month =

0.237). It meant that the volatility of price may not cause investors transaction behavior, sometimes investors could be under reactive with the market volatility.

3.2 Momentum Strategy

3.2.1 The concept of momentum strategy

Momentum trading strategies is an investment strategy that previously sets filter criteria for stock returns and trading volume, when stock returns or stock returns and trading volume satisfy these criteria, people accomplish the stock purchase or selling behavior. In finance, the propose of Momentum Strategy is from the intermediate income continuity of equity prices in the stock market.

Momentum effect was firstly mentioned by Jegadeesh and Titman (1993), they believed the stock return had the extended tendency of movement. The stocks with high expected return in the past will have more future return than those with past low expected return. Base on the stock momentum effect, investors persuit their benefit by buying stocks with high past return and selling stocks with low past return. This investment strategy that takes advantage of stock momentum effect structure is called momentum investment strategy. When Jegadeesh and Titman (1993) studied the time of the mid-income assets portfolio, they found that it was different from the result of the long term price regression of DeBond and Thaler (1985) and the short term price regression of week intervals of Jegadeesh (1990) and Lehmann (1990), the intermediated return of the stock investment portfolio with to 3-12 month intervals preformed its continuity, which was described as the momentum effect of intermediated stock price with a continuous movement tendency. The opposite side of momentum effect is reversed effect, which meant that the stocks with high return in the past will obtain less return than those with low past return in the future. Wang and Yan (Wang, H. Yan, J. & Yu, J., 2017) proved that the negative risk-return relation was much more pronounced among firms with prior losses and the positive risk-return relation was more pronounced among firms with prior gains.

Momentum effect has a long history in the stock market. It commonly exists in all of the stock markets in the world. Recently some researchers discovered that momentum effect even existed in others trading market, so more and more scholars started to investigate the cause of momentum effect and its relationship with efficient market hypothesis. Some scholars tried to

explain the momentum effect from the aspect of behavioral finance. Barberis, Shleiffer and Vishny (1998) believed that investor were under reactive with new information because of conservative bias. This caused the exhibits inertia of stock price in short term. While investors were over confident with the new information that they had, so the stock price reversed. Daniel, Hirshleifer and Subrahmanyam (1998) explained that the momentum effect took advantage of people's over confident and self-attribution bias. Hongand Stein (1999) explained it with the self interaction mechanism of investors. His model (HS Model) emphasized the Heterogeneity of investors. He separated the investors to two groups, one group was called information observer and another group was momentum trader, while private information was spreading among the information observers. He drew a conclusion that the slower the information spread, the stronger the momentum effect or reversal effect would be, so the stock of small companies with lower turnover rate may obtain more momentum return or reversal return. But, in the research of Lee and Swaminathan (2000), he exposed that the stock with higher turnover rate obtained higher momentum return. Obviously, His detection challenged the conclusion of HS Model. The disease transmission model was also introduced into HS Model, they believed that the information diffusion degree was limited by two elements, the information dissemination speeded and extended of information absorption. The information dissemination (Riabov, A., 2004) speed is an objective indicator that was related to turnover rate and price volatility. The extent of information absorption is depended on the value and the reliability of the information that is depended on a series of subjective factors. Assumed that there are two kinds of investors in the stock market, informed investors and non-informed investors. At first, informed investors have private information, but non-informed investors lack sufficient information, so they are under reactive with new information that causes the momentum effect of stock price. As private information gradually spread among investors, information graduates in the market, the non-informed investors become to informed investors then they respond to the private information. The momentum effect reduces, or even converts to reversal effect because investors overreaction. Supposed that the momentum effect (Merlo, P. & Konarzewskf, P., 2015) indeed caused by investor heterogeneity and the spread of information among the investors, so the speed of information diffusion is absolutely related to the momentum effect. The greater the degree of information diffusion is, the faster the momentum effect will disappear. Obviously, the speed of information diffusion makes effect on the duration and degree of momentum effect directly, the factors that can affect information diffusion are:

a. Informed investor proportion
b. Information dissemination speed
c. The extent of information absorption

The main steps of basic momentum strategy (Kolanovic, M. & Wei, Z., 2015) and reversal strategy are:

a. Determine the target stock market as the range of investment object;
b. Select the observed time window for evaluating the stocks' performance. In general, this duration is called the formative and ranking period of investment portfolio;

c. Calculate the portfolio's return of the formative period, ranking all returns in ascending and descending order and divide all stocks of the investment portfolio into several groups. Define the group with highest return as winner group and the group with lowest return as loser group;

d. After the formative period, repeat the **a** to **c** steps certain times;

e. Evaluation of performance. Calculated the momentum/reversal strategy's average return and T test in every formative period. If t-statistics shows that the momentum/reversal strategy's average return is significantly larger than 0, then investors claim that momentum/contrarian strategy is successful, while academia accepts the presence of the momentum/reversal phenomenon.

3.2.2 The development of momentum effect in the Chinese and the European financial markets

The main argument of momentum strategy is under reactive and conservative mentality. Some result of study suggest that momentum investment strategy is profitable have many reasons: One of them is, "Earning momentum", that is, when the increased stock returns is more than expected return or all investors predict that the future return will increase, the stock price will tend to rise. Therefore, the profit of momentum trading strategy is due to the changes in fundamental value of stocks. Another reason is based on price momentum and earning momentum that cause by investors under reactive with different information of investment market. Earning momentum strategy takes advantage of the lack of short term prospect of company that finally reflect on the short term profit. Pricing momentum strategy uses the under reactive of company evaluation and the lack of long term prospect of company without sufficient reaction in short term profit. Since

Jegadeesh and Titman (1993) found the presence of momentum effect in stock market, the study of momentum effect has become more and more popular as the most core theme in behavior finance. Behavioral finance and conventional finance theory always exist different explanation of this problem. Fama and French (1996) explained momentum effect from traditional theory: the momentum effect was not the evidence of market inefficiency, the excess earning of momentum strategy may be related to the theoretical tools - Capital Asset Pricing Model. β values were not good risk indicators. They just need to add a new risk factor in the factor model, the excess return would probably disappear. But researchers were unable to reach a consensus about what kinds of risk factors should be added in the factor model.

In China, many scholars have did amount of researches about momentum strategy in Chinese stock market. Zhou Linjie (2002) found that the profit of momentum strategy are sensitive of the duration of formative period and holding period, the momentum strategy with one month period of formative period and holding period is more profitable. Liu yuhui, He Junhuang and Shen keting (2003) believed that momentum strategy with formative and holding period between 2 weeks and 24 weeks is more profitable. Yu Shuwei (2004) found that momentum strategy with formative and holding period between 10 days and 15 days is more profitable. Cao Min and Wu Chongfeng (2004) believed that as an emerging market the Chinese mainland stock market was different from western stock market in reversal strategy, because its reversal cycle was shorter than the western market. Although there were various empirical studies with different sample period, the same conclusion was that only exist momentum strategy profit in the formative and holding period less than 4 weeks, but in western stock market, the momentum strategy profit normally appeared in a midterm formative and holding period (3 to 12 months). Zhu Zhanyu, Wu Chongfeng and Wang Chengwei (2003) believed that none of the BSV Model, DHS Model and HS Model could reveal the mechanism of momentum effect of Chinese stock market. They said that in the BSV Model or DHS Model, investors predicted the future stock price by evaluating the prospective performance of listed companies which is in line with the investment pattern of investors' behavior of developed capital market. The Chinese investors did not care about the fundamental value of company. They prefer to short term operation and have herd behavior commonly. The investor awareness bias was not appropriated to the momentum effect of Chinese stock market.

In their research, scholars often relate the momentum strategy with uncertainty. Knight (1921) separated future uncertainty to two situations: one is uncertainty with determined probability distribution, another is uncertainty without determined probability distribution because its

subjective probability is uncertain. This is called Knight uncertainty or ambiguity. If you toss a coin, you will know how big the risk is. A positive bet has 50% of probability to win. Knight believed that when you totally did not know the status of various possibilities and probabilities of various states, there existed Knight uncertainty. Savage (1954) said that, although sometimes the probability of certain events could not be calculated as a probability distribution, people could specify a priori belief in this event, which was the same of establishment of a mathematical model. Therefore, the Knight uncertainty's classification made no sense. Ellsberg (1961) denied Savage hypothesis thorough a series of tests. His test proved that the Knight uncertainty's classification had its reason. These tests also showed that people generally hate the Knight uncertainty, even if they told their experimenters that the Ellsberg text existed a logical contradiction, people still insisted on the option, and willed to pay an excess price for avoiding the Knight uncertainty. They found out that some people who were enjoined in gamble (risk), did not like Knight uncertainty, but people dislike Knight uncertainty is not necessarily risk-averse. This conclusion confirmed the view of Knight: Knight uncertainty and risk aversion were two different phenomena. They also found that, when people faced Knight uncertainty, they were more care about what others thought, which was easier to form a "herding behavior".

How is Knight uncertainty formed? Modern natural science has proved that the nonlinear mechanism within the system (or a positive feedback mechanism, or a complicated mechanism) causes the evolution of the system, thus Knight uncertainty is formed. If the system is a simple system, then the random process is ergodic, which can be obtained the probability distribution of this process by the frequency tests. Most of the random events in nature are of this process, while this process is the general uncertainty - Risk. But if the system is an evolutionary process, so it is non-ergodic, even we have the history and all current information (complete information), the probability distribution of uncertain future event cannot be obtained, because it is not a simple repetition of the process and there is always a new state is created. We cannot predict the state and obtain its probability distribution. Most of the economic and social systems are of this process, while this uncertainty is Knight uncertainty.

LS Model (Lewellen & Shanken, 2002) believed that the series of stock price's predictability was related with "parametric uncertainty" of stock pricing process. When the decision makers were not sure about their priori belief of future cash flows (uncertainty of the existence probability distribution), representative investors gradually updated their belief through the Bayesian process, this process of learning was penetrated into the stock pricing process and performed a positive correlation between stock prices. Xu Yuandong and Huang Dengshi (2002), Xu Yuandong (2004)

discussed the microscopic mechanism of momentum effect in the stock market from the perspective of Knight uncertainty. Similar with the conclusion of LS Model, investors could not accurately determine the probability distribution of future cash flows, and the reason was Knight uncertainty. Different with the conclusion of LS Model, they believed that all investors could not be replaced as a "representative investor", they are heterogeneous and they had different prior beliefs on their future cash flows. When these heterogeneous investors infect each other in the market, it would cause the momentum effect. Ford, Kelsey and Pang (2006) studied the momentum/reversal effect mechanisms from the aspect of microscopic finance. When the market appears ambiguity signal or uncertainty of stock fundamental value, if the market makers and investors showed optimism or pessimism emotion, the stock market will appear momentum phenomenon. Gerdjikova (2006) tried to explain all the anomalies in the stock market with the CBD theory (Casebased Decision Theory, Decision Theory cases). Because of investors have to face the Knight uncertainty, he was unable to determine the fundamental value of the stock. If the stock value is within a reasonable range, investors in pursuit of more benefit in the stock market that causes momentum effect by frequent trading. From the view of Knight uncertainty in momentum effect mechanism theory, stock investors cannot determine the probability distribution of future cash flow, heterogeneous investors optimism or pessimism emotion leads to momentum effect. These models can be used to explain the Chinese stock market momentum phenomenon. In Behavioral Finance, the probability distribution of decision makers on stock cash flow is determined, there do not exist "Knight uncertainty". It is the finite rational investor makes a mistake of awareness bias that results the momentum effect. These two difference lies in the interpretation of uncertainty process.

Recently, western scholars began to study the profit of momentum strategy from the disgust of Knight uncertainty. Andrew and Hodrick (2006) found out that there is a positive correlation between the excess profit or different return rate of momentum strategy with Knight uncertainty. Anderson, Ghysels and Juergens (2007) attempted to add "Knight uncertainty aversion factor" in asset pricing model to explain the momentum effect phenomenon in the stock market. From the perspective of Knight uncertainty, investors not only have to face normal risks, but also have to "higher risk" - Knight uncertainty. If we consider this "higher risk" factor in the pricing model, abnormal excess returns will disappear.

We can study Knight uncertainty from two aspects: One is the mechanism momentum strategy under Knight uncertainty; another is to join "Knight uncertainty aversion factor" into momentum strategy as its origin of excess profits. From a logical point of view, these two concepts are not

contradictory, the microscopic mechanism momentum effect defines Knight uncertainty Perspective as a "process", while "Knight uncertainty aversion compensation" model refers to a "result." Knight uncertainty is the logical starting point that links these two aspects. Behavioral finance model mainly explains the momentum strategy or others anomalies from the angle of cognitive bias (or noise) or lack of sufficient information. Since Jegadeesh and Titman (1993) found out momentum effect, they attempted to explain it with traditional risk pricing models. They used the capital asset pricing model (CAPM) to apply momentum effect, and found out that market risk could not assume the high profit of momentum arbitrage portfolio. Fama and French (1996) represented the size and value risk factors in traditional capital asset pricing model. Then these three-factor model was widely used. They found out that three-factor model for could explained many anomalies even include reversal effect, but it still could not explain the momentum effect. By contraries, Jegadeesh and Titman (2001) proved that the combination of size and value risk factors are negative, after correcting the risk factor, the income actually increased rather than decreased. The time-varying risk model was considered the macro factors as the condition information that were added into three-factor model, and got the momentum effect that fitted three-factor model. Their study showed that the conditional factor combined winner portfolio and looser portfolio had a negative crossed relationship, which indicated that winner portfolio and looser portfolio could obtain different input time-varying risk characters. Based on the same idea, Chordia and Shivakumar (2005) used a slightly different approach. They examined the effect of time-varying risk factor in momentum strategy earnings. The result showed that momentum earnings was from higher conditional expected return, which was a compensation of the macro risk of momentum investment strategy. They believed that the momentum effect was related to the business fluctuation cycle, which mainly reflected the continuity of expected returns of investors in stock market. But Griffin, Ji and Martin (2003) applied momentum earnings on core macro variables of the regression equation but did not find any evidence to support the existed correlation between momentum earnings and macro risks, so their conclusion was that macroeconomic risks could not explain the momentum effect. In addition to use macroeconomic risks to explain momentum effect, some scholars tried to analyze bonus risk. Dew and Giglio (Dew-Becker, I. Giglio, S. Le, A. & Rodriguez, M., 2017) discovered that variance was significantly priced by fitting different disaster models that made a big challenge to many structural models of the variance risk premium as CAPM and Epstein–Zin.

In behavioral finance, the explanation of momentum effect is always tested through establishing behavioral models, but what sorts of investor behavior bias lead to momentum earning? At present, there are several theories about this theme:

Under reactive model

These models consider that investors are under reactive with new information, momentum effect generate by time delay that causes smoothly increasing of stock price. In the classical model of Barberis, Shleifer and Vishny (1998) assumed that the real company earnings subjected to random walk process, but investors were not aware it. There are two kinds of investors, one presences anchoring bias, their company earnings are subjected to mean-variance regression, so they express conservative bias and do not change their preconceived opinions. Another kind of investors thinks that the company earnings are certain, so they presence exhibited bias and focus too much on recent data. When Griffin and Tversky (1992) said that when the company posted earnings information, conservative investors were not sensitive to such kind of information. Because of the influence of conservative bias, conservative investors believed the volatility of stock price may be temporary. When their prediction was proved, the stock price demonstrated a delayed reaction to previous earnings that caused short term under reactive response, resulted a slow rise in stock price, at last led to momentum effect. The unified theoretical model of Hong and Stein (2000) explained the presence of under reactive/inadequate response from the perspective of delayed transfer of information. They divided investors into information observers and technical traders. Information observers traded based on the information of future cash flow and completely ignored the historical information of market value. Technical traders were entirely dependent on the limited information of market value in their trading and did not examine the basic information of stocks. The information diffusion of observers existed a lag, it could partially reflected in the stock price at the beginning, while this delayed reaction caused momentum effect. Different from Barberis, Shleifer and Vishny (1998), Hong and Stein (1997) emphasized on different types of game traders rather than the traders cognitive biases. Another theory is based on prospect model of Huang and Santos (2001), this model attributed the under reactive/inadequate response to investor loss aversion and frame dependence bias. Good news and bad news can cause investors' asymmetric reaction like optimistic biases (Tan, E. & Low, R., 2016). The good news of company earnings raised the stock price and brought investors profits, so the investor risk aversion reduced, they used a lower discount rate to discount future cash flows, thereby pushed stock price to the current dividend higher level. On the contrary, the bad news of company loss produced the fall of stock price, so investors had losses, then investor loss aversion increased, they used higher the discount rate to discount future cash flows, so the stock price was undervalued. That was why the rising stock price performance continued, and the fall of stock price kept falling.

Over-reaction model

The investors are overconfident on the accuracy of their private information. When the movement of stock price as their prediction, their self realization promotes them to be more overconfident on their private information, then leads to their over reactive to the information and the continuous increasing or decreasing of stock prices. Daniel, Hirshleifer and Subrahmanyam (1998) constructed a psychological model that was the representative model of overreaction. They separated investors to informed investors and non informed investors. Non informed investors did not have cognitive bias, but informed investors were affected by self attribution bias. Because of the cognitive bias, informed investors believed the good perform of their favorite stocks came from their right investment decision. If the stock performed bad in the future, they attributed the loss to bad luck. This resulted in their overconfidence on their decision, overestimated the accuracy of private information and under estimated the accuracy of public information. So when the transaction was based on private information, investors were over reactive, and when the transaction was based on public information, investors were under reactive. Overreaction to private information and the lack of public information were the reason of short-term momentum effect and long-term reversal effect.

Positive feedback model

This theory said that increasing stock prices and falling stock prices would continue the previous tendency under the investor "chasing market" behavior and positive feedback trading, the "winners' continued to 'win', the 'losers' continued to lose. The representative model was of De Long, Shleifer, Summers (1990) which was called "herding behavior" of investors. Representing momentum strategies in quantitative investment approach an objectively, accurately and efficiently arbitrage opportunities with great potential, so it attracts the attention of many researchers and investors. Chanet (1996) proved that in the US stock market existed the presence of momentum effect of 6 months, Cooper (2004) had similar conclusions, and noted that exited reversal effect in long-term investment of 2-3 years and for longer-term investment did not exist momentum effect. At the same time, he also explained the statistical significance of selected time window and historical tendency. Stock markets outside of the United States also had the momentum effect. Ouwenhorst (1998) pointed out that European markets existed momentum effect for 20 years, and Hon and Tonks (2003) described that the UK stock market only existed momentum effect for historical prices that were valid about six months during 1977 to 1996.

Different with the developed financial markets, in China, researchers held two views of the excess returns of momentum strategy. One was that momentum effect did not exist in Chinese stock market. Wang Yonghong and Zhao Xuejun (2001) used Jegadeesh and Titman (1993) research methods to build a "winner " and "losers" portfolios to test the stock momentum effect before 1993. It could not be found a stable tendency of stock price movement in mid holding period with neither of winner portfolio nor looser portfolio. There existed reversal phenomenon with different degree which indicated that momentum strategies could not bring excess returns in the Chinese stock market and the irrational behavior of investors destroyed the sustained trends of stock prices. Long Honglang and Wang Huanchen (2004) got the same conclusion by using data from 1995 to 2002 of Chinese stock market. Zhu Yu (2003) tested the momentum effect during 1995 to 2001 and mentioned that momentum strategy with holding period longer than one month could not bring significant excess returns. On the other hand, in recent years, with the further development of quantification theory, another view was that momentum strategies was profitable in the Chinese market. Zhou Linjie (2002) believed that the momentum strategies was effective in Chinese stock market, and investigated the relationship between the observed period, holding period and excess earnings of momentum strategies. He found out the shorter the observed period and the holding period were, the higher the excess returns of momentum strategy would be. Liu Yuhui (2003) studied the effect of 49 kinds of momentum strategies which were applied in the Shanghai and Shenzhen stock market from 1995 to 2002 and found that 41 of them could significantly increase earnings.

3.2.3 Momentum model

The Momentum Strategy is designed as a system of buying stocks that had high returns in the past, and selling those had poor returns over the same period. In general, momentum portfolios are constructed using the “6/1/6” convention. Each month t, the equal-weighted portfolio is computed as the past 6-month cumulative returns from month t-2 to t-7, skipping month t-1 (Fan & Yu, 2013). All stocks are ranked in ascending order and are divided into quintiles. The stocks in the first quintile are assigned to the losers’ portfolio and those in the fifth quintile to the winner’s portfolio. The past experience of winners’ portfolio and loser’s portfolio will be used in the future investment with momentum mechanism by taking long position of “winner” portfolio and short position of “loser” portfolio (Ang, Chen & Xing, 2006). By controlling the momentum return probability distribution, Teplova and Nazarov (Teplova, T. Mikova, E. & Nazarov, N., 2017) found out that the past relative winner and loser stocks continued the trend in a certain future period. The momentum strategy has two main hypotheses. In the first one, the efficient

market hypothesis is not valid, so the high return will not be compensated with high risk. The second hypothesis assumes that the investors are over reactive and irrational. It also contains others possibilities, for example, if the trading happens in a small time scale, this model could be used as an arbitrage tool. Or if the trading happens frequently, the transaction cost should be taken in account to reduce the return (Wang, 2008). Our momentum model is based on the first conclusion that has been proved before: the Chinese stock market is inefficient and the European stock market is efficient. Because these two markets are independent; we separate the investigation in two parts for each of them.

3.2.3.1 Design of momentum strategy model

In our experiment of momentum strategy models, we also choose the same data that used to test the market efficiency of Chinese and European stock market, which are the historical data of 300 companies of HUSHEN 300 INDEX and 600 companies of EUROSTOXX 600 INDEX from 2005 to 2014. We divide the momentum models to two groups, one group is about the traditional momentum strategy models, another is the daily momentum strategy model. Wald and Kim (Wald, J. Kim, A. & Tse, Y., 2016) tested that the volatility-scaling returns had high impact on future returns than time series momentum. In the traditional model, we use the monthly expected return as reference and in daily momentum model, we use daily expected return as reference.

3.2.3.2 Traditional momentum strategy model

In many researches of momentum strategy, scholars have mentioned about "The highest stock price and return model in the past 52 weeks "(George, T. & Hwang, C., 2004). This momentum strategy is based on the highest price of last 52 weeks. It has two types: one is to find out the proximity of recent stock price and the price of last 52 weeks, buying the stocks that have similar price with its highest price in the past 52 weeks as winner portfolio (momentum strategy A) and selling the stocks that have similar price with its lowest price in the past 52 weeks as loser portfolio (momentum strategy B).

The core of new momentum strategy is the highest price of last 52 weeks, this price impacts on investor decision and brings them benefits. The theoretical study of the highest price is based on the anchoring rules of Tversky and Kahneman (1974). This rule states that when people make decision in uncertain situation, they are likely to use a reference point

as the initial value, then all the predict value are influenced by this initial point. In other words, when investors predict the future expected return, they will be affected by the past anchoring rules while they will unable to adjust the investment strategy sufficiently. This will result a deviation between the forecast and real future return. Kaustia and knüpfer (2008) verified anchoring effect. Heath investigated 7 companies then found that when the stock price was higher than the highest price of the last 52 weeks, the probability of exercised the company option was twice than normal. He also found that when the stock price was higher than the highest price of the last 52 weeks, its turnover rate suddenly and significantly enlarged. In another research, people considered the highest stock price of the last 52 weeks as an important factor in corporate merger and acquisition, the offer basic value was nearly to this peak price. When the offer price was higher than the peak value, the probability of transaction significantly increased. For momentum strategy B which was sorted by the closeness of the date of the highest price in the past 52 weeks, selected the date of the highest price of last 52 weeks and the date of its closed price, calculated their duration and earnings. The higher the return was, the similar the recent price as the highest price was. By reducing the holding period, the momentum strategy returns showed a decreased tendency, even appeared a negative value. When the holding period was 3 months, the momentum strategy reached its highest return. The results of empirical research was that the more present price was closed to the highest price of last 52 weeks, the portfolio return was higher. The difference of returns between the winner portfolio and the looser portfolio has positive significance at the 5% significance level. The momentum trading strategies was remarkably effective in the western stock markets. But in the Chinese stock market, there was no correlation between the highest price in the past 52 weeks and the present price. New momentum trading strategies was not significantly in the overall market level. The highest price of last 52 weeks model was not fitted the Chinese stock market, there were two reasons. From one side, the 52-week highest price of anchoring effect was proved to be effective in western stock markets, but was not verified in the Chinese stock market, so the last 52 weeks highest price could not significantly influence the behavior of Chinese investors and brought them significant benefits. From another side, the Chinese stock market was affected by the present policy. In the Chinese stock market, major policies often lead to greater fluctuation of stock market, and becomes the market decisive turning point. This process impedes the adjustment of new momentum strategy and impacts its efficiency.

The 52-week highest stock price model

We choose the historical stock price of all the companies of HUSHEN 300 Index and

EUROSTAXX 600 Index from 2008 to 2013 as our basic data. Why we choose these 5 years as the time window? Turtle and Wang (Turtle, H. & Wang, K.,2017) examined the fundamental accounting information in shaping portfolio performance and found that firms with strong fundamental underpinning had high volatility. Because of that the Chinese stock market is an inefficient market that has high volatility in short term, at the same time, it is an emerged market with changes and revolution, so a recent data set can reflect its actual situation better than a long term historical data set. By using the data of these 5 years, we designed 3 traditional investment models, compared their return rate with the return rate of the " 52-week highest stock price model ".

We could only obtain the daily stock price of listed companies, so we need to simply last 52 weeks period to 360 days period. In order to compare the return rate of different periods, we calculated the daily logarithm return rate (Aas, K., 2004) of closing price which formula is:

$$\mathbf{Re_t = ln（Pt/Pt\text{-}1）}$$

- Pt and Pt-1 are the closing price of day t and day t-1

We calculated the highest of last 360 days by the historical price of last year and we simply the cost of carry as 0 in this step.

Some studies showed that the Chinese stock market had momentum effect of 2-3 weeks (Fauzi, R. & Wahyudi, I., 2016), there was no momentum effect in midterm with a sort of monthly holding period. This conclusion was the same of the conclusion of many Chinese scholars which illustrated the momentum effect cycle in Chinese stock market was different other stock market. In US stock market, there existed a midterm momentum effect about a cycle of 3 months.

Taking into account the characters of the Chinese stock market volatility, we calculated a continuous logarithmic daily return rate, which was slightly different from the traditional calculation of arithmetic average return rate. The arithmetic average return rate will lead to an overestimation of the average return rate, especially by dramatic fluctuations in the Chinese market, this overestimation will be more obvious. While logarithmic is much easier to convert to return rate of different maturities, it is also more comparable. In addition, the investment model of this research use non-overlapping formative period of De Bondt and Thaler (1985).

Comparing with the overlapped formative period, this method does not cause serial correlation between return rates.

The "52-week highest stock price model" is our basic compared model. In this step, we observed the highest price of all the companies of HUSHEN 300 Index and EUROSTOXX 600 Index in the last 360 days. At the beginning of the holding period, we selected 10 stocks that had the most similar price with the highest price, and hold them 3 months, at last we calculated their average return rate. In order to unify the time window, we designed three models as traditional investment models to compare with the last 360 days model. Firstly, we calculate the past 360 days highest price - H of each stock, and then used this highest price to divide by recent price - P to get the highest price relative rate P/H. P/H is described as the relative strength of stock, the stock with a P/H near to 1 tend to be the stock constantly refreshes its historical price. P/H sorts these recent strong stocks into winner group. Stocks with lower P/H enter looser group, which means that their recent prices are much lower than their historical highest price, but there still exists the probability of future increasing. Different with the momentum investment portfolio which is based on the return rate over the few past periods, P/H model is not captured rising or falling return rates, it tries to find out their gap with the highest historical price. According to the traditional finance, the highest price and present price is public information of investment market, so people cannot predict the future return with this information. After applying P/H model, we made 10 groups of stocks by the last P/H, the first group was of the stocks with top 10% return rate that was called "Winner", the last group was of the stocks with bottom 10% return rate which was called "Loser". The arbitrage portfolio was to purchase the winner stocks and sell loser stocks. The scholars believed that the momentum effects of P/H model means the existence of anchoring effect. P/H momentum effect implies that the stocks have a present price similar with the highest historical price will obtain excess return, and the stocks have a present price much less than the highest historical price will keep declining. The investors record high prices of stocks as a reference point of stock intrinsic value. When the good news push the stock price higher than the highest historical price, they think that it is impossible to get a higher price, so stop holding these stocks or not willing to buy them. It will impede the market reaction of good news, so that the effect of good news gradually releases over time and the stock price continuously rises in a period. When the market impact makes the stock price so far from their historical highest price, investors will consider that the possibility of further price decreasing may be very low, so they are reluctant to sell such stocks, which will result in a slow declining in the stock price. Both the continuous rising and the slowly declining are the performance of P/H momentum effect.

By applying the evidence of China, Li and Han (Li, Y. & Han, X., 2017) found a striking term structure that could estimate a long term momentum predictor with short term momentum predictor. Zhu and Jiang (Zhu, K. & Jiang, G., 2017) discovered that the market underreaction could controlled others firm characteristics in short horizon. And Blackburn and Cakici (Blackburn, D. & Cakici, N.,2017) proved that there existed significant positive return differential between loser stocks and winner stocks in long term. In this step, we only designed the investment portfolio as "highest return rate model" (Winner portfolio) that included the stock with high returns. We did not consider the "lowest return rate model" (Loser portfolio). The first portfolio was the "highest return rate of last 180 days (6 months) model". We observed the historical stock price of all the companies of HUSHEN 300 Index and EUROSTAXX 600 Index during 180 days, found out 10 stocks with the highest return rate during this period, held them in 90 days (3 months), calculated the average return rate the last day of holding period and compared it with the average return rate of the "52-week highest stock price model" in the same period. The second investment portfolio was the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model". We observed the historical stock price of all the companies of HUSHEN 300 Index and EUROSTAXX 600 Index during 90 days, found out 10 stocks with the highest return rate during this period, held them in 60 days (2 months), calculated the average return rate the last day of holding period and compared it with the average return rate of the "52-week highest stock price model" in the same period. The third investment portfolio was the "highest return rate of last 90 days (6 months) with holding period of 30 days (1 month) model". We observed the historical stock price of all the companies of HUSHEN 300 Index and EUROSTAXX 600 Index during 90 days, found out 10 stocks with the highest return rate during this period, held them in 30 days (1 month), calculated the average return rate the last day of holding period and compared it with the average return rate of the "52-week highest stock price model" in the same period.

We calculated the stock return rate with the logarithm function, which could weaken the impact of stock price fluctuation. The formula is as following:

$$\Delta \mathbf{Re} = \frac{\sum_{i=1} \ln\left(\frac{\boldsymbol{P_{ti}}}{\boldsymbol{P_{ti-1}}}\right) \times \boldsymbol{n_i}}{\sum_{i=1} \boldsymbol{n_i}} - \frac{\sum_{i=1} \ln\left(\frac{\boldsymbol{P_{si}}}{\boldsymbol{P_{si-1}}}\right) \times \boldsymbol{m_i}}{\sum_{i=1} \boldsymbol{m_i}}$$

P_{ti} : Stock price after 90 days/60 days/30 days observed period， the highest stock price of last

180 days/90 days

$P_{ti\text{-}1}$: Stock price at the beginning of 90 days/60 days/30 days observed period，the highest stock price of last 180 days/90 days

P_{si} : : Stock price after 90 days/60 days/30 days observed period，the highest stock price of last 360 days (52 weeks)

$P_{si\text{-}1}$: Stock price after 90 days/60 days/30 days observed period，the highest stock price of last 360 days (52 weeks)

m_i, n_i: The proportion of stock investment portfolio, according to the ranking of individual stocks return rate

The highest return rate of last 180 days (6 months) model

a. The Chinese stock market - all listed companies of HUSHEN 300 Index

Through the comparison of the average return rate of two models after 90 days of holding period, the investment portfolio of the "52-week highest stock price model" had a probability of 71.4% obtains more returns than the investment portfolio of the "highest return rate of last 180 days (6 months) model". Comparing with the market average return of the same period, the investment portfolio of the "52-week highest stock price model" had a probability of 28.6% obtaining more returns than the market average return, the investment portfolio of the "highest return rate of last 180 days (6 months) model" had a probability of 28.6% obtaining more returns than the market average return. But neither of these two models had more capacity to beat the market, they had the same competitiveness in the market.

b. The European stock market - all listed companies of EUROSTAXX 600 Index

Through the comparison of the average return rate of two models after 90 days of holding period, the investment portfolio of the "52-week highest stock price model" had a probability of 85.7% obtaining more returns than the investment portfolio of the "highest return rate of last 180 days (6 months) model". Comparing with the market average return of the same period, the investment portfolio of the "52-week highest stock price model" had a probability of 71.4% obtaining more returns than the market average return, but the investment portfolio of the "highest return rate of last 180 days (6 months) model" only had a probability of 14.3% obtains more returns than the market average return. By comparison with the market average return of

the same period, the "highest return rate of last 180 days (6 months) model" had a greater advantage to beat the market than the "52-week highest stock price model".

By observing the application of these two investment portfolios in the Chinese stock market and the European stock market, we found out that the "52-week highest stock price model" was more applicable in Chinese stock market, which meant that the Chinese stock market had a high volatility in short term. An observed period of 180 days was not a appropriated time window because it was too long for Chinese stock market to predict the future stock price efficiently. But the "52-week highest stock price model" with an observed period of 1 year that used the highest stock price of last 360 days was neither applicable to predict the future stock price correctly. Adversely, the "highest return rate of last 180 days (6 months) model" was much better than the "52-week highest stock price model" for European stock market, which meant that the short term volatility of European stock market was low. An observed period of 180 days could predict the future stock price efficiently. At the same time, the return rate of the "highest return rate of last 180 days (6 months) model" was much higher than the market average return rate. This illustrates that, in short term, European stock market was more stable than the Chinese stock market. With a lower investment risk, we could preserve the asset value efficiently by investing in European stock market in short term.

The highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model

a. The Chinese stock market - all listed companies of HUSHEN 300 Index

Through the comparison of the average return rate of two models after 60 days of holding period, the investment portfolio of the "52-week highest stock price model" and the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" had a similar return rate. Comparing with the market average return of the same period, the investment portfolio of the "52-week highest stock price model" had a probability of 45.0% obtaining more returns than the market average return, the investment portfolio of the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" had a probability of 35.0% obtaining more returns than the market average return. The "52-week highest stock price model" only had a little more advantage of beating the market average rate the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model".

b. The European stock market - all listed companies of EUROSTAXX 600 Index

Through the comparison of the average return rate of two models after 60 days of holding period, the investment portfolio of the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" had a probability of 95.0% on getting more return than the "52-week highest stock price model". Comparing with the market average return of the same period, the investment portfolio of the "52-week highest stock price model" had a probability of 52.6% obtaining more returns than the market average return, but the investment portfolio of the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" had a probability of 100.0% obtains more returns than the market average return. By comparing with the average market return of the same period, the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" had a absolute advantage in beating the market than the "52-week highest stock price model". From this sight, in the European stock market, the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" was an efficient model that has precious investment value and practical value.

By comparing these two models in the Chinese and the European stock market, the "52-week highest stock price model" and the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" had a similar performance in predicting future stock price in Chinese stock market. However, for both of these two models, an observation period of 3 months was relative shorter than an observation period of 6 months, and this shorter observation period could predict the future stock price better than the longer one. We compared the average return rate of these two models with the market average return rate, and their prediction capacity was insufficient. But both of these two models performed better than the models with an observation period of 6 months, which had proved that the Chinese market was more unstable, so it needed a shorter observation period. On contrary, the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" performs much better than the "52-week highest stock price model" in the European stock market. This further illustrated the European stock markets was less volatile in the short term, by relying on 3 months observation period we could estimate the stock price movement efficiently in short term. At the same time, the "highest return rate of last 90 days (6 months) with holding period of 60 days (2 months) model" completely defeated the average market return over the same period, which indicated that the 3 months observation period was ideal for European stock market and it may provide a high reference value in the stock investment in European market.

The highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model

a. The Chinese stock market - all listed companies of HUSHEN 300 Index

Through the comparison of the average return rate of two models after 30 days of holding period, the investment portfolio of the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" had a probability of 55.0% of obtaining more earning than the "52-week highest stock price model". Comparing with the market average return of the same period, the investment portfolio of the "52-week highest stock price model" had a probability of 60.0% obtaining more returns than the market average return, the investment portfolio of the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" had a probability of 50.0% obtaining more returns than the market average return. The "52-week highest stock price model" had little more advantage of beating the market average rate the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model".

b. The European stock market - all listed companies of EUROSTAXX 600 Index

Through the comparison of the average return rate of two models after 30 days of holding period, the investment portfolio of the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" had a probability of 95.0% of obtaining more earning than the "52-week highest stock price model". Comparing with the market average return of the same period, the investment portfolio of the "52-week highest stock price model" had a probability of 47.7% obtaining more returns than the market average return, but the investment portfolio of the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" had a probability of 94.7% obtaining more returns than the market average return. Comparing between these two models, the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" had an absolute advantage of beating the market average return. From this sight, in the European, the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" was an efficient investment model that had a high research value.

Comparing the application of these two models in the Chinese and the European stock market, the "52-week highest stock price model" and the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" had a similar performance in predicting future

stock price in the Chinese stock market. However, for both of these two models, a holding period of 1 month was relative shorter than a holding period of 3 months, and this shorter holding period could bring us more earning. We compared the average return rate of these two models with the market average return rate, their prediction capacity was insufficient. But both of these two models performed better than the models with a holding period of 3 months, which proved that the Chinese market was more unstable, so it needed a shorter holding period. On contrary, the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" performed much better than the "52-week highest stock price model" in the European stock market, but performed a little worse than the model with a holding period of 3 months. This further illustrated the European stock markets was less volatile in the short term, it was the second time proves that, relying on 3 months observation period could estimate the stock price movement efficiently in short term. At the same time, the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" totally defeated the average market return over the same period, which indicated that the 3 months observation period was ideal for European stock market and it may provide a high reference value in the stock investment in European market.

By estimating the model with different observation and holding periods, we found out that the price volatility of the European stock market was much lower than the Chinese stock market. For the Chinese stock market, by reducing the observation and holding periods, even if the prediction capacity of the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model", the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model" and the "highest return rate of last 180 days (6 months) model" were increasing, all the returns of these models could not beat the market average return efficiently in the same period. In summary, because of the high volatility of the Chinese stock market, an observation period more than 1 month or a holding period more than 1 month could not predict well the future stock market returns. In order to find out a new investment model with higher-yielding, we needed to choose shorter observation period and holding period for the Chinese stock market data, and assessed whether a more short-term investment portfolio was more suitable for Chinese equity markets. For European markets, with the shortening of the observation period and the holding period, the prediction capacity of investment model continuously strengthened in obtaining more earnings. The "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" and the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model" could predict better the future return than the "highest return rate of last 180 days (6 months) model". These two models with

an observation period of 3 months almost could beat the market average return completely, which meant that they had precious investment value. From this experiment, we concluded that the Chinese stock market had a higher volatility risk than the European stock market. For a further research of the difference between their future earnings, it was necessary to shorten the observation period and holding period, in order to discover a higher revenue in these two markets, while effectively avoiding their investment risk.

Through the comparison of the return rate of the "52-week highest stock price model", the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model" and the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model", we found out that the Chinese stock market was more risky than the European stock market. So in the next step, we selected a shorter observation period and holding period, in order to observe the Chinese stock market volatility better, and to compare it with the European stock market. In the next experiment, we designed three portfolios: the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model", the "highest return rate of last 30 days (1 month) with holding period of 10 days model" and the "highest return rate of last 30 days (1 month) with holding period of 5 days model". We shortened the observation period to 1 month, 10 days, or even 5 days, to insight into the Chinese stock market volatility in short term, while comparing the experimental results with the market average return over the same period.

The highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model

a. The Chinese stock market - all listed companies of HUSHEN 300 Index

Comparing the return rate of the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" with the market average level, it only had a probability of 26.7% to obtain more earning than the market average return. And its experimental result was similar with the "52-week highest stock price model" and the "highest return rate of last 180 days (6 months) model" (28.6%). Therefore, there was no difference between the predict capacity of shorter observation and holding period (30 days) or longer observation and holding period (360 days/180 days) for the Chinese stock market. We needed to shorten the research period to analyze the Chinese stock market better in short term.

b. The European stock market - all listed companies of EUROSTAXX 600 Index

Comparing the return rate of the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" with the market average level, it had a probability of 83.0% to obtain more earning than the market average return. Although this result was a little lower than the probability of the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model"(100.0%) and the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model"(94.7%), it had a strong prediction capacity of future return. Among these three models, the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model" was the best model in predicting the future return and all these three models are of midterm time window. By reducing the holding period, the prediction capacity of the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" was more weaken than the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model". It meant that in short term, the European stock market was more unstable than in midterm, but it had less volatility than the Chinese stock market. By reducing the observation period, with the same holding period of 1 month, the prediction capacity of the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" was more weaken than the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model". It meant that for the European stock market, an observation period of 90 days was better than 30 days, a midterm observation period was better for future price prediction. Comparing between the Chinese stock market and the European stock market, the prediction capacity of the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" was less predictable in Chinese stock market, while having no more advantage than the midterm models.

The highest return rate of last 30 days (1 month) with holding period of 10 days model

a. The Chinese stock market - all listed companies of HUSHEN 300 Index

Comparing the return rate of the "highest return rate of last 30 days (1 month) with holding period of 10 days model" with the market average level, it had a probability of 53.1% to obtain more earning than the market average return. And its experimental result was similar with the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" (50.0%). Therefore, in Chinese stock market, the "highest return rate of last 30 days (1 month) with holding period of 10 days model" could predict the future return a little better. Meanwhile, comparing with the model with longer observation period, this model was the best among the

"highest return rate of last 180 days (6 months) model"(28.6%) and the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model"(35.0%) in beating the market average return. So the "highest return rate of last 30 days (1 month) with holding period of 10 days model" was the best model that has the highest probability of beating the market.

b. The European stock market - all listed companies of EUROSTAXX 600 Index

Comparing the return rate of the "highest return rate of last 30 days (1 month) with holding period of 10 days model" with the market average level, it had a probability of 55.0% to obtain more earning than the market average return. It had worse performance than the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model"(100.0%) and the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model"(95.0%). In a short term as 1 month, there may exist a cycle of stock price volatility, but considering from the midterm or long term, the short term market volatility will disappear. It fatherly proved that the European stock market was an efficient market. The uncertain factor will affect the stock price in short term, but the market will automatically digested the uncertain effect the market within a certain period of time (for example, 90 days), then the market will rebound to its normal status. The European stock market has recovered ability and self-regulation in a given period, as long as this good investment opportunity, it may not only help us to avoid the market risk but also bring us more expected benefits.

The highest return rate of last 30 days (1 month) with holding period of 5 days model

a. The Chinese stock market - all listed companies of HUSHEN 300 Index

Comparing the return rate of the "highest return rate of last 30 days (1 month) with holding period of 5 days model" with the market average level, it had a probability of 40.0% to obtain more earning than the market average return. Although the Chinese stock market was an inefficient market that had certain volatility in short term. We had to mention that the "highest return rate of last 30 days (1 month) with holding period of 5 days model" performed worse than the "highest return rate of last 30 days (1 month) with holding period of 10 days model" (53.1%) in predicting the future earnings. Comprehending all previous conclusions, we know that a very short holding period will not bring us more return in the Chinese stock market. However, a shorter holding period is a relative concept, because of that no matter a holding period of 5 days or of 10 days, comparing with a traditional investment period, they are considered as a very short

investment period. When the investment period is very short that is often referred to an irrational investment. Because of the Chinese stock market is ineffective, there are many arbitrage opportunities. A short-term holding period for the Chinese stock market is just in line with the traditional theory of rational market.

b. The European stock market - all listed companies of EUROSTAXX 600 Index

Comparing the return rate of the "highest return rate of last 30 days (1 month) with holding period of 5 days model" with the market average level, it had a probability of 36.0% to obtain more earning than the market average return. It performed worse than the "highest return rate of last 30 days (1 month) with holding period of 10 days model"(53.1%) in predicting the future return. By reducing the holding period, in European stock market, the predict capacity of the highest return rate model decreased. Some uncertain factors will introduce market volatility, however, after a certain period, the market will automatically restore to its stable trend.

By estimating the expected return with models of short observation and holding periods, we found out that short term investment model is very different with the midterm investment model. For the Chinese stock market, by reducing the holding period, the "highest return rate of last 30 days (1 month) with holding period of 10 days model" was much powerful in predicting future return than the "highest return rate of last 180 days (6 months) model"(28.6%) and "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model"(35.0%). The prediction capacity of highest return model was increasing. However, the "highest return rate of last 30 days (1 month) with holding period of 5 days model" only had a probability of 40.0% in beating the market average return, which was much lower than the "highest return rate of last 30 days (1 month) with holding period of 10 days model". Although a holding period of 10 days and a holding period of 5 days did not has many difference, the models with these two holding periods had a distinct result in predicting future earnings. Is due to coincidence, or a certain presence that needed a further study. For European stock market, by reducing the holding period, the prediction capacity of the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model"(83.0%), the "highest return rate of last 30 days (1 month) with holding period of 10 days model"(55.0%) and the "highest return rate of last 30 days (1 month) with holding period of 5 days model"(36.0%) was decreasing. At this stage of experiment, we fatherly validated the inefficiency and short term volatility of the Chinese stock market, at the same time, verified the automatic adjustment ability of the European stock market in certain period, which was its important feature of an efficient market. We concluded that the

Chinese stock market and European stock market had obvious differences. Since the Chinese stock market is inefficient, it is more suitable for short-term speculative investment model, while the European stock market is an effective market, it is more suitable for long-term investment model.

3.2.3.3 The best momentum model in different stock market cycles

Since the stock market is influenced by the economic environment, there exists cyclical change in stock prices. The major stock market cycle, including bull market, bear market and stable market (we can call it normal market). A refined stock market cycle (Edwards, S. & Biscarri, J., 2003) is divided into nine stages:

Downturn period. This period is the beginning stage of the stock market fares, at this stage. the stock price has dropped a lot, most investors are pessimistic. Either the institutional investor or the individual investors have loss. Many impatient investors sell their stocks and leave the market, but a few shrewd investors begin to purchase stocks quietly.

Rising period. At this moment the economy has not recovered. But the downturn period has been a long time and the stock price has fallen to unreasonable level. People start to purchase stock because of the cost is very low. Most of the stock holder start to be reluctant to sell. This phase has been irregularly in transaction volume. A large number of investors began to buy stocks aggressively and make short-term investments. It is also an opportunity to buy stocks for long-term investment.

Reactionary period. This period is also known as the bull market return period whose character is in that the turnover is suddenly decreased, most stock prices began to swing. However, when the stock price falls to a certain extent, investors take advantage of this period to buy a large number of stock with low price.

Main raising period. During this period the overall economy is in the boom phase, the surplus shares of the company greatly increases and a variety of good news will continuously pull stock prices. The stock prices grabs more and more, then forms a comprehensive skyrocketing trend. The issuing company takes this opportunity to launch a massive capital and lists new shares. At this stage, smart investors begin to sell their holding stocks.

Last rising period. At this stage, issued company keeps earning more benefits, the stock market is

abnormally active. The turnover of this period is soared, the stock has risen to unreasonable level, then it is difficult to climb. At this time, to do speculative investment in short term is very risk. It is likely to end up bankrupt, but also it is lucky enough to be profitable.

Early falling period. Since the majority of the share price is really high, investors, especially big investors began to sell their holding stocks. The price of unpopular stocks falls sharply is the main feature of this stage.

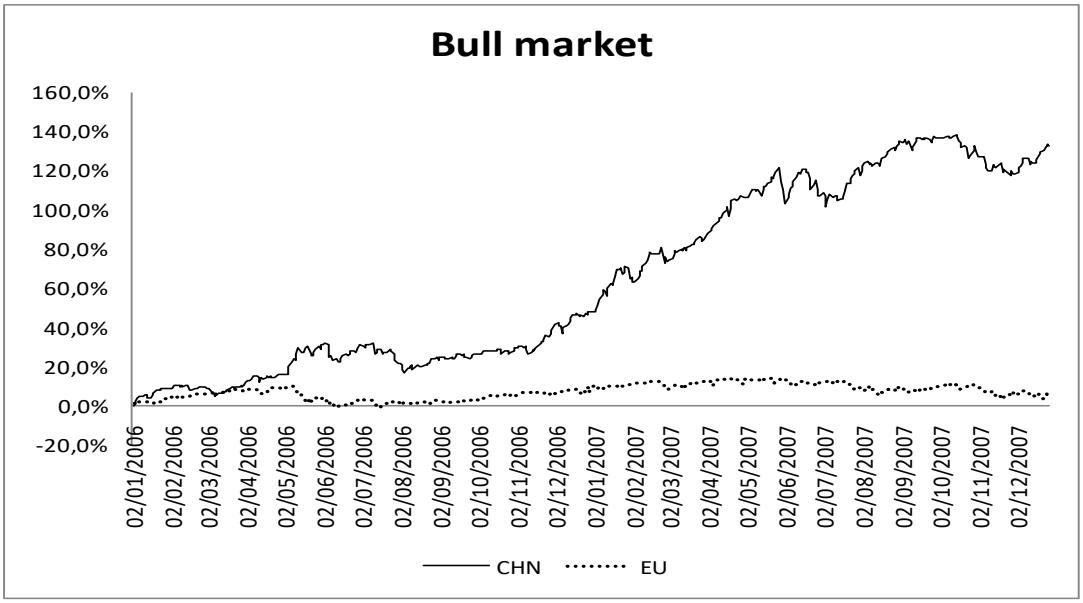
Rebound period. This stage is also known as "escaped period." Since the turnover slumped, the market declines too fast, so there will appear stabilization and rebound. Some inhaled investors enter the market to buy stocks with low price, other investors follow them that pulls a slight increasing of price. But the price will fall soon. Few investors will take advantage of this stage to escape from the market.

Main falling period. During this period, most of the stock prices fall sharply, all kinds of rumors and bad news are over the market. The market is a pessimistic, investors confidence shakes and trading volume continues shrinking.

End of falling period. During this period, the stock price has declined significantly. The turnover is small, but the decreasing of stock price is also shrinking. Most investors have sold out their holding stocks, some investors start to purchase new stocks.

In the experiment of this stage, we separated the time window from 2005 to 2014 to 3 stages, they are the bull market stage (2006 - 2007), the bear market stage (2008 - 2009) and the normal market stage (2013 - 2014). We defined 1st of January 2006, 1st of January 2008 and 1st of January 2013 as the start point and the 31th of December 2008, 31th of December 2009 and 31th of December 2014 as the finished point. We calculated the daily average return of all the stocks of HUSHEN 300 Index and EUROSTAXX 600 Index during these three stages.

The bull market stage - 2006/01/01 to 2007/12/31:

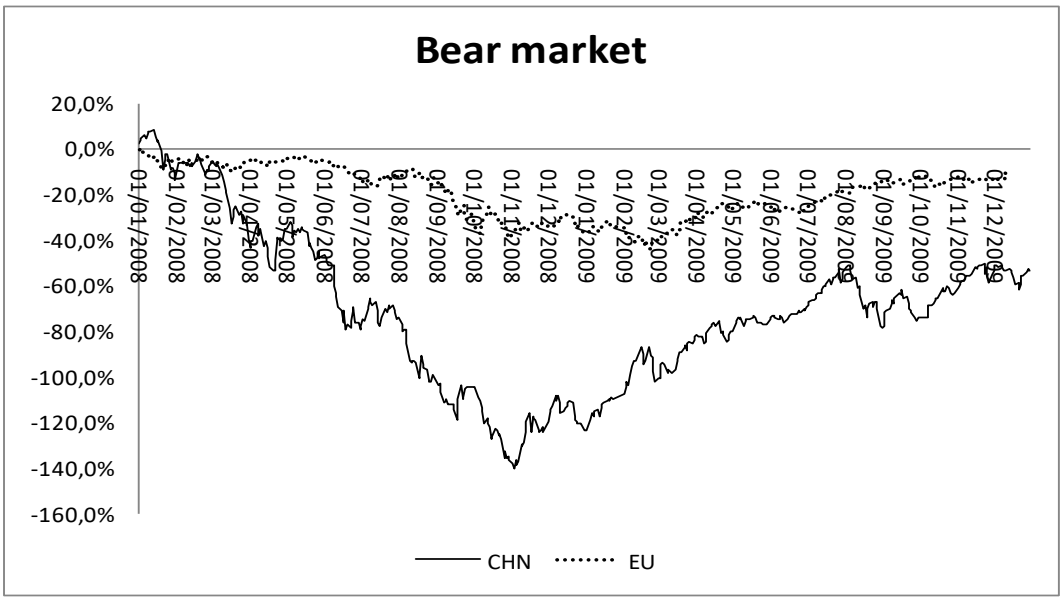


(fig.1)

During the bull market stage, the daily average return of all stocks of HUSHEN 300 Index had increased 132.4%, the highest daily average return was 137.8%, the lowest daily average return was 0%, the average daily return during this period is 64.8%. The daily average return of all stocks of EUROSTAXX 600 Index had increased 5.1%, the highest daily average return was 13.5%, the lowest daily average return was -1.5%, the average daily return during this period was 6.9%.

From fig.1, we saw that during the bull market period, the stock price of Chinese stock market shows an obvious increasing trend, while its average daily return was much higher than the European market over the same period. From the perspective of average daily market return, in the bull market, the Chinese stock market had the absolute advantage of earning greater profits compared to the European stock market.

The bear market stage - 2008/01/01 to 2009/12/31:

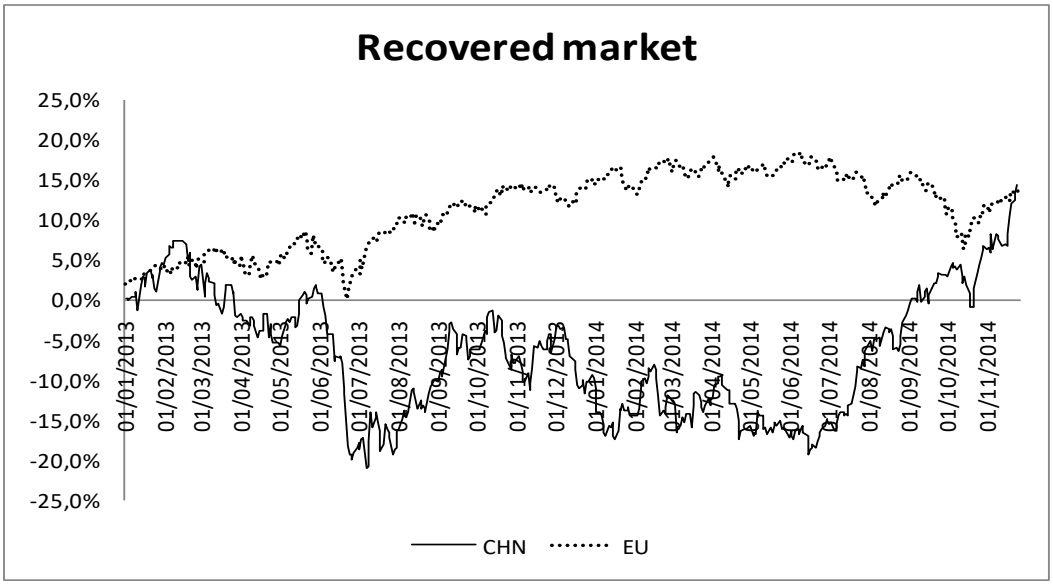


(fig.2)

During the bear market stage, the daily average return of all stocks of HUSHEN 300 Index had decreased 53.9%, the highest daily average return was 8.0%, the lowest daily average return was -140.7%, the average daily return during this period was -71.3%. The daily average return of all stocks of EUROSTAXX 600 Index had decreased 12.8%, the highest daily average return was 0.1%, the lowest daily average return was -43.8%, the average daily return during this period was -19.4%.

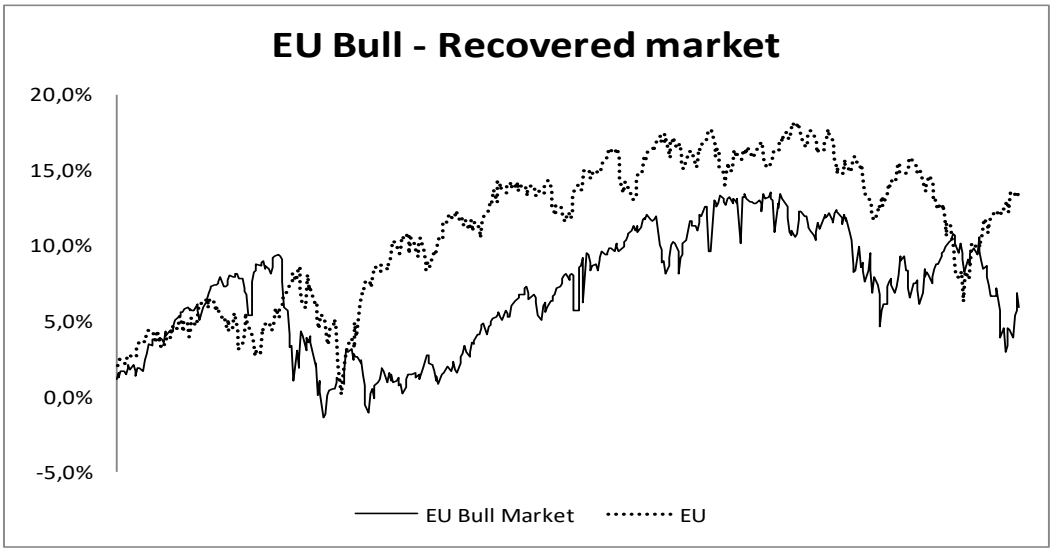
From fig.2, we saw that during the bull market period, the stock price of Chinese stock market shows an obvious decreasing trend, while its average daily return was much lower than the European market over the same period. From the perspective of average daily market return, in the bear market, the Chinese stock market had suffered more and its stock price shrinked more. However, from another side, if we take short position in the bear market, the Chinese stock market may have more probability of obtaining higher earning than the European stock market.

The Normal market stage - 2013/01/01 to 2014/12/31:



(fig.3)

During the normal market stage, the daily average return of all stocks of HUSHEN 300 Index had increased 14.3%, the highest daily average return was 14.3%, the lowest daily average return was -21.1%, the average daily return during this period was -6.8%. The daily average return of all stocks of EUROSTAXX 600 Index had increased 13.5%, the highest daily average return was 18.2%, the lowest daily average return was 0.1%, the average daily return during this period was 11.2%.



(fig.4)

From fig.3, we saw that during the normal market period, the European stock market had shown a positive return rate, comparing with the average daily return of bull market, even had a better increasing tendency (fig.4). It indicated that after the financial crisis of 2008, the European stock market had moved on to recovery period by performing its self-regulation and self-recovery capability of efficient market. However, in most of the time during 2013 and 2014, the average daily return of Chinese stock market was still negative. This demonstrated that the Chinese stock market was suffering a longer recovery period, its self-regulation and self-recovery ability was more weak than the European market, because of that it was not an efficient market.

In summary, through the study of stock market cycle, we found out that the Chinese stock market and the European markets had significant differences in bull market, bear market and normal market. Therefore, when we designed investment portfolios, the models should be designed for different markets and different periods, we could not generalize all models as one. For example, in bull market and in bear market, the Chinese stock market investments may earn more profits, while in normal market, the European stock market may be more beneficial.

In the experiment of last step, we had analyzed the midterm and long term highest return model of Chinese and European stock market. In the next step, we applied the two short term highest return models to do a further research. These two models were the "highest return rate of last 30 days (1 month) with holding period of 10 days model" of Chinese stock market and the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" of European stock market. Based on these two models, we introduced the concept of momentum investment model to design investment portfolios, the highest return model, the lowest return model and the momentum model of these two models. Then we applied these three models into three market stages, bull market, bear market and normal market to observe the performance of these three models in the Chinese and the European stock markets.

The Momentum Strategy was designed as a system of buying stocks that had high returns in the past, and sold those had poor returns over the same period. In general, momentum portfolios are constructed using the “6/1/6” convention. Each month t, the equal-weighted portfolio is computed as the past 6-month cumulative returns from month t-2 to t-7, skipping month t-1 (Fan and Yu, 2013). All stocks are ranked in ascending order and are divided into quintiles. The stocks in the first quintile are assigned to the losers’ portfolio and those in the fifth quintile to the

winner's portfolio. The past experience of winner portfolio and loser portfolio was used in the future investment with momentum mechanism by taking long position of "winner" portfolio and short position of "loser" portfolio (Ang, Chen & Xing, 2006). The momentum strategy has two main hypotheses. In the first one, the efficient market hypothesis is not valid, so the high return will not be compensated with high risk. The second hypothesis assumes that the investors are over reactive and irrational. It also contains others possibilities, for example, if the trading happens in a small time scale, this model could be used as an arbitrage tool or if the trading happens frequently, the transaction cost should be taken in account to reduce the return (Wang, 2008).

Our momentum model is based on the first conclusion that has been proved before: the Chinese stock market is inefficient and the European stock market is efficient. Because these two markets are independent; we separate the investigation in two parts for each of them. Instead of calculating the cumulative return rate, we use the expected return, which is more suitable in explaining the market volatility. Unlike the traditional momentum model, we apply the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" and the "highest return rate of last 30 days (1 month) with holding period of 10 days model" of bull market, bear market and normal market both in the Chinese and the European stock markets.

We arranged the portfolio expected return of observation period in descending order, while only the first portfolio and the last portfolio were included. The top 10% was classified as "Winner" and the bottom 10% was classified as "Loser". At the last of the experiment period, we recalculated the expected return of these two portfolios, and compared their expected return with the market average return of this period. If the result if positive, it means that the portfolio has profitability (Zhou, 2010). The momentum return formula is described as:

$$\mathbf{MOM_{RE} = \Delta Winner + (-\Delta Loser)}$$

$$= \{ \left| \sum_{1}^{winner10} \left(\mathrm{Re}\, i_t - \mathrm{Re}\, i_{t-1} \right)_{T-1} - \left(\mathrm{Re}\, MAT_T - \mathrm{Re}\, MAT_{T-1} \right) \right| \} +$$

$$+ \{ - \left| \sum_{1}^{loser10} \left(\mathrm{Re}\, j_t - \mathrm{Re}\, j_{t-1} \right)_{T-1} - \left(\mathrm{Re}\, MAT_T - \mathrm{Re}\, MAT_{T-1} \right) \right| \}$$

2006 - 2007 bull market

In the bull market of 2006 and 2007, for the "highest return rate of last 30 days (1 month) with holding period of 10 days model" of Chinese stock market, the WINNER_{10} portfolio (the highest

return model) had a probability of 39.1% of obtaining more earnings than the market average return, the $LOSER_{10}$ portfolio (the lowest return model) had a probability of 8.7% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ portfolio (the momentum model) had a probability of 21.7% of obtaining more earnings than the market average return. Meanwhile, for the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" of European stock market, the $WINNER_{10}$ portfolio (the highest return model) had a probability of 40.9% of obtaining more earnings than the market average return, the $LOSER_{10}$ portfolio (the lowest return model) had a probability of 18.2% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ portfolio (the momentum model) had a probability of 31.8% of obtaining more earnings than the market average return.

Comparing the results in the Chinese stock market and the European stock market, in the bull market, whether Chinese stock market or stock markets in Europe, the $WINNER_{10}$ portfolio had the largest possibility to be profitable portfolio. Meanwhile, the performance of the $WINNER_{10}$ portfolio of these two markets was not significantly different. The $LOSER_{10}$ portfolio's performance are the worst in both of these two markets. This indicated that stock prices generally showed a rising trend in bull market, the early low yield stocks may became later high yield stocks which had a greater increasing. The $WINNER_{10}$ + $LOSER_{10}$ portfolio due to the impact of $LOOSER_{10}$ portfolio that had a lower average return than the $WINNER_{10}$ portfolio in both of these two markets.

2008 - 2009 bear market

In the bear market of 2008 and 2009, for the "highest return rate of last 30 days (1 month) with holding period of 10 days model" of Chinese stock market, the $WINNER_{10}$ portfolio (the highest return model) had a probability of 36.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ portfolio (the lowest return model) had a probability of 0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ portfolio (the momentum model) had a probability of 44.0% of obtaining more earnings than the market average return. Meanwhile, for the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" of European stock market, the $WINNER_{10}$ portfolio(the highest return model) had a probability of 50.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ portfolio (the lowest return model) had a probability of 54.5% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOOSER_{10}$ portfolio

(the momentum model) had a probability of 36.4% of obtaining more earnings than the market average return.

Comparing the results in the Chinese stock market and the European stock market, in the bear market, there was a great difference between these two markets. The portfolio more profitable in Chinese stock market was the $WINNER_{10}$+ $LOSER_{10}$ portfolio and the portfolio more profitable in European stock market was the $LOSER_{10}$ portfolio, but the $LOSER_{10}$ portfolio had the worst result in the Chinese stock market. It meant that in a bear market, even if these two markets had a declined tendency, the decreasing of the European market was more predictable. The Chinese market was relatively stable whose stock fell before may be on a recovery rally later, so we could not predict well its losses or gains. The $WINNER_{10}$ portfolio had no difference in these two markets.

2013 - 2014 normal market

In the recovery market of 2013 and 2014, for the "highest return rate of last 30 days (1 month) with holding period of 10 days model" of Chinese stock market, the $WINNER_{10}$ (the highest return model) had a probability of 43.5% of obtaining more earnings than the market average return, the $LOSER_{10}$ portfolio (the lowest return model) had a probability of 43.5% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ portfolio (the momentum model) had a probability of 8.7% of obtaining more earnings than the market average return. Meanwhile, for the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" of European stock market, the $WINNER_{10}$ portfolio (the highest return model) had a probability of 45.5% of obtaining more earnings than the market average return, the $LOSER_{10}$ portfolio (the lowest return model) had a probability of 27.3% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ portfolio (the momentum model) had a probability of 40.9% of obtaining more earnings than the market average return.

Comparing the results in the Chinese stock market and the European stock market, in the normal market, whether Chinese stock market or the European stock market, the $WINNER_{10}$ portfolio had the largest possibility to be profitable portfolio.

As an effective financial market, European stock market had self-regulation and self-recovery ability. The $WINNER_{10}$ portfolio even performed better than in bull market. For the Chinese stock market, the $WINNER_{10}$ portfolio and the $WINNER_{10}$ + $LOSER_{10}$ portfolio had a similar

performance. The $LOSER_{10}$ portfolio, in normal market, had a high possibility that the fallen stock prices aversely rise later, so to choose the $WINNER_{10}$ portfolio was more secure than to select the $WINNER_{10}$ + $LOSER_{10}$ portfolio.

3.2.3.4 Daily Momentum Model

From the last experiment of the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model" and the "highest return rate of last 30 days (1 month) with holding period of 10 days model" in bull/bear/normal market, we discussed their prediction capacity of future stock price. Wong and Xiao (Ng, P. Wong, W. & Xiao, Z., 2017) proved that there was no arbitrage opportunity between the bear and bull markets by applying the NASDAQ 100 and S&P 500 indices. They believed that markets were inefficient and risk averters were better off investing in the bull rather than the bear market. Recent studies suggested that momentum returns were conditioned by market states, but people (Cheema, M. & Nartea, G., 2017) found that China is different. The absence of momentum returns following UP markets in China could not be explained by market dynamics, unlike in the U.S. Vo and Phan (Vo, X. & Phan, D. 2017) used daily, weekly and monthly data of Vietnam stock market from 2005 to 2015 and indicated that existed herding over the whole period studied. Moreover, they spited the data into three sub-periods including pre-crisis, during crisis and post-crisis. In the next experiment, we combined the efficient market theory with the concept of risk arbitrage in order to find out the arbitrage opportunity in the small time scale, we introduced the daily data to momentum portfolios.

For the Chinese stock market (non-effective market) and the European markets (efficient market), we designed three model portfolios, $WINNER_{10}$ portfolio, $LOSER_{10}$ portfolio and $WINNER_{10}$ + $LOSER_{10}$ portfolio. But this time, our investment horizon was set in daily period. We calculated the daily average return of stocks, so these three models could be called as, daily $WINNER_{10}$ portfolio, daily $LOSER_{10}$ portfolio and daily $WINNER_{10}$ + $LOSER_{10}$ portfolio.

But before this step, we testified if the daily expected return was more persuasive than the monthly-expected return. The following formula is used:

$$\textbf{Dif} = \sum_{1}^{T}\left[\frac{\sum_{1}^{n}\left(\mathrm{Re}\, i_{t} - \mathrm{Re}\, i_{t-1}\right)}{\frac{n(n-1)}{2}}\right] - \frac{\sum_{1}^{n}\left(\mathrm{Re}\, i_{T} - \mathrm{Re}\, i_{T-1}\right)}{\frac{n(n-1)}{2}}$$

Where

Re_i: expected return of individual stock

n: numbers of stock

t: actual day

t-1: the previous day

T: numbers of day of actual month

T-1: numbers of day of previous month

2006 - 2007 bull market

In the bull market of 2006 and 2007, for the Chinese stock market, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 69.8% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 25.1% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 60.5% of obtaining more earnings than the market average return. Meanwhile, for the European stock market, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 35.2% of obtaining more earnings than the market average return, the daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 16.1% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 28.9% of obtaining more earnings than the market average return.

Comparing the results in the Chinese stock market and the European stock market, in the bull market, the daily $WINNER_{10}$ portfolio had the largest possibility to be profitable portfolios in the Chinese stock market and the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio performed well too. On contrary, either the daily $WINNER_{10}$ portfolio or the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio were not significantly useful in the European stock market. The daily $LOSER_{10}$ portfolio's performance was the worst in both of these two markets. The stock prices generally showed a rising trend in daily $WINNER_{10}$ portfolio, its early high yield stocks became later high yield stocks. In summary, we would better use the daily $WINNER_{10}$ portfolio in the Chinese bull stock market.

2008 - 2009 bear market

In the bear market of 2008 and 2009, for the Chinese stock market, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 69.8% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 34.5% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 58.4% of obtaining more earnings than the market average return. Meanwhile, for the European stock market, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 0% of obtaining more earnings than the market average return, the daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 38.4% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 34.3% of obtaining more earnings than the market average return.

Comparing the results in the Chinese stock market and the European stock market, in the bull market, the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio had the largest possibility to be profitable portfolio in the Chinese stock market and the daily $WINNER_{10}$ portfolio performed well too. On contrary, either the daily $WINNER_{10}$ portfolio or the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio was not significantly useful in the European stock market. There existed something deserved thinking about, the daily $LOSER_{10}$ portfolio's performance was the worst in both of these two markets. In a bear market, the stock prices generally showed a decreasing trend in daily $LOSER_{10}$ portfolio and daily $WINNER_{10}$ + $LOSER_{10}$ portfolio, but its early low yield stocks may start to increase to high return. In summary, we would better use the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio in a bear market, not the daily $LOSER_{10}$ portfolio.

2013 - 2014 normal market

In the normal market of 2013 and 2014, for the Chinese stock market, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 57.7% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 41.4% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 56.6% of obtaining more earnings than the market average return. Meanwhile, for the European stock market, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 39.5% of obtaining more earnings than the market average return, the daily $LOSER_{10}$ (the lowest return model) portfolio

had a probability of 20.1% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 37.1% of obtaining more earnings than the market average return.

Comparing the results in the Chinese stock market and the European stock market, in the bull market, the daily $WINNER_{10}$ portfolio had the largest possibility to be profitable portfolio in the Chinese stock market and the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio performed well too. On contrary, either the daily $WINNER_{10}$ portfolio or the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio was not significantly useful in the European stock market. The daily $LOSER_{10}$ portfolio's performance was the worst in both of these two markets. The stock prices generally showed a rising trend in daily $WINNER_{10}$ portfolio, its early high yield stocks became later high yield stocks. In summary, we would better use the daily $WINNER_{10}$ portfolio in the Chinese normal stock market.

In the experiment of daily momentum model, we found out that, no matter for bull market, bear market or normal market, the daily $WINNER_{10}$ portfolio always performs best and the daily $LOSER_{10}$ portfolio performed worst. At the same stage, in order to find out short-term arbitrage opportunity in Chinese stock market as irrational market, we designed a the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio for the Chinese bear market, a daily $WINNER_{10}$ portfolio for the Chinese bull market and normal market. However, the European stock market was an efficient market, neither the daily $WINNER_{10}$ portfolio, the daily $LOSER_{10}$ portfolio or the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio could be applied in European market. It made us to think over, why in a very short-term, the daily investment portfolio applied better in Chinese stock market rather than in European stock market?

In this chapter, we had design investment models with different investment periods, in bull, bear and normal market, for the Chinese and European stock markets. The results showed that, in bear market, the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio (58.4%) was the best model for the Chinese stock market, in bull and normal market, the daily $WINNER_{10}$ portfolio (69.8%) was the best model for the Chinese stock market. As an inefficient market, when we invested in the Chinese stock market, we only needed a very short observation period to analyze the stock price volatility, then applied short term arbitrage momentum model to obtain more return than the market average level. On contrary, the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" was more suitable for the European stock market, its average yield was almost completely defeated the average market return over the same period.

When we invested in the European stock market, we needed a medium observation period to analyze the market fluctuation, then held the portfolio for a certain period in order to obtain stable income. We concluded that with respect to the European stock market, the Chinese stock market had a strong trend in a very short period. Once the investment period extended to mid-term or long-term, due to the dynamic fluctuation of Chinese stock market, it was difficult to use the highest return rate model, the lowest return model or momentum model to predict its future earnings. Although the European stock market was stable in short term, but in a very short term, there was a non-directional price fluctuation, its market efficiency had not been clearly demonstrated in a daily period.

3.2.3.5 The stock price volatility of companies with different market value in different stock market cycles

After study the applicable investment portfolios for the Chinese and European stock market, we did a further research of the daily investment model in the Chinese stock market and the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. In this stage, we introduced a new factor - company fundamental value (Fernández, P., 2007) and designed three investment portfolios. Among all the listed companies of our research, we ranked their book value with descending order, the company of the top 33% book value was called high market value company, the company of range 34%-66% was called medium market value company, the company of range 67%-100% was called low market value company. The main purpose of this experiment was to consider the relationship between the company's economic strength and its stock price volatility. Under different market conditions (bull and bear and normal market), whether there was a significant difference in stock price volatility between the high value company and a low value company, or there was no significant difference between the book value of the company and its stock price changes?

Here we introduced three factors in the momentum investment model, Investment market factor (the Chinese/European stock market), investment market conditions factor (bull/bear/normal market) and investment companies market value factor (high / medium/low).

The following model was a refinement of momentum models, at this stage, we started to introduce different factors into momentum investment model, which goal was to make this model more predictable of future earnings or losses in different situations.

$$\mathbf{RE = a_{j,k,l} * MODEL_{RE}}$$

$$\mathbf{= a_{1,1,1/2} * Winner_{10} + a_{1,1,3,} * Loser_{10} + a_{1,2/3,1/2/3} * Loser_{10}}$$

$$\mathbf{+ a_{2,\,1,1/2,} * Winner_{10} + a_{2,1,3} * Loser_{10} + a_{2,2,1/2/3} * (Winner_{10} + Loser_{10})}$$

$$\mathbf{+ a_{2,3,1} * Winner_{10} + a_{2,3,2} * (Winner_{10} + Loser_{10}) + a_{2,3,3} * Winner_{10}}$$

$$\textbf{Highest return model - Winner}_{10} = \left| \sum_{1}^{winner10} \left(\mathrm{Re}\, i_t - \mathrm{Re}\, i_{t-1} \right)_{T-1} - \left(\mathrm{Re}\, MAT_T - \mathrm{Re}\, MAT_{T-1} \right) \right|$$

$$\textbf{Lowest return model- Loser}_{10} = -\left| \sum_{1}^{loser10} \left(\mathrm{Re}\, j_t - \mathrm{Re}\, j_{t-1} \right)_{T-1} - \left(\mathrm{Re}\, MAT_T - \mathrm{Re}\, MAT_{T-1} \right) \right|$$

$$\textbf{Momentum model - Winner}_{10} \textbf{ + Loser}_{10} =$$

$$\left| \sum_{1}^{winner10} \left(\mathrm{Re}\, i_t - \mathrm{Re}\, i_{t-1} \right)_{T-1} - \left(\mathrm{Re}\, MAT_T - \mathrm{Re}\, MAT_{T-1} \right) \right| +$$

$$\left\{ -\left| \sum_{1}^{loser10} \left(\mathrm{Re}\, j_t - \mathrm{Re}\, j_{t-1} \right)_{T-1} - \left(\mathrm{Re}\, MAT_T - \mathrm{Re}\, MAT_{T-1} \right) \right| \right\}$$

a_j :Investment market factor (Chinese/European stock market)

a_k : Investment market conditions factor (bull/bear/normal market)

a_l : Investment companies market value factor (high/medium/low)

High market value company

In the bull market of 2006 and 2007, we applied the daily investment model in the Chinese stock market. For high market value companies, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 60.0% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio has a probability of 57.1% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 44.8% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the high market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 60.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 48.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 56.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, the prediction capacity of their the $WINNER_{10}$ (the highest return model) portfolio was similar, the daily $LOSER_{10}$ (the momentum model) portfolio of Chinese stock market performed similarly as the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of European market, the daily

$WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of Chinese stock market performed similarly as the $LOSER_{10}$ (the momentum model) portfolio of European market. To sum up, in a bull market, the highest return model was suitable for the company with high market value in the Chinese stock market and the European stock market.

In the bear market of 2008 and 2009, we applied the daily investment model in the Chinese stock market. For the high market value company, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 46.9% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 54.7% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 44.9% of obtaining more earnings than the market average return. Meanwhile, apply the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the high market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 75.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 80.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 80.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, the daily $LOSER_{10}$ (the momentum model) portfolio was suitable for Chinese stock market. In European stock market, the three models had outstanding performance, which explained that, in a bear market, the European high market value companies had strong anti-risk capability and more stable stock price volatility. In stock investment, the European high market value companies had a high investment value.

In the normal market of 2013 and 2014, we applied the daily investment model in the Chinese stock market. For high market value companies, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 42.6% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 57.1% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 48.9% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the high market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 52.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 64.0% of obtaining more earnings than the market average return, the

$WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 48.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, the daily $LOSER_{10}$ (the momentum model) portfolio of the Chinese stock market performs similarly as the $LOSER_{10}$ (the momentum model) portfolio of the European market, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of the Chinese stock market performed similarly as the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of the European market.

In these circumstances, comparing with the daily investment model, the new model of high market value company had no advantage in the Chinese stock market. However, "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" of the European stock market, the high market value companies had significant differences in bull, bear and normal market. In a bear market, they revealed a high stability, which was significantly better than the Chinese portfolios. In the bull market and normal market, the high market value company portfolio performed similar to the Chinese models.

Medium market value company

In the bull market of 2006 and 2007, we applied the daily investment model in the Chinese stock market. For the medium market value company, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 56.1% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 51.1% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 36.9% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the medium market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 65.4% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 50.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 53.8% of obtaining more earnings than the market average return. Comparing the results of these two markets, the prediction capacity of their the $WINNER_{10}$ (the highest return model) portfolio was similar, the prediction capacity of their the $LOSER_{10}$ (the lowest return model) portfolio was similar, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of the European stock market performs better than the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of the Chinese stock market.

In the bear market of 2008 and 2009, we applied the daily investment model in the Chinese stock market. For the medium market value company, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 47.5% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 58.6% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 43.0% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the medium market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 55.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 80.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 80.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, the daily $LOSER_{10}$ (the momentum model) portfolio was suitable for the Chinese stock market. In European stock market, the $LOSER_{10}$ (the momentum model) portfolio and the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had outstanding performance, which explains that, in a bear market, the European medium market value companies had strong anti-risk capability and more stable stock price volatility. In stock investment, the European medium market value companies had a high investment value.

In the normal market of 2013 and 2014, we applied the daily investment model in the Chinese stock market. For the medium market value company, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 42.6% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 48.7% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 42.2% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the medium market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 76.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 64.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 68.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, all the portfolios of European stock market perform better than the Chinese stock

market.

To be summary, comparing with the daily investment model, the daily investment model of medium market value company did not performs well. Therefore, comparing with the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model", the medium market value company obtained stable returns. In the bear market, the medium market value company performed well, especially better than the Chinese daily portfolios. But in the bull or the normal market, the portfolio of European market did not have more advantage.

Low market value company

In the bull market of 2006 and 2007, we applied the daily investment model in the Chinese stock market. For the low market value company, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 52.2% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 53.0% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 39.7% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the low market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 80.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 68.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 56.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, the prediction capacity of their the $LOSER_{10}$ (the lowest return model) portfolio was similar, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of European stock market performed better than the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of the Chinese stock market, the $WINNER_{10}$ (the highest return model) portfolio of the European stock market performs much better than the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio of the Chinese stock market. In the bull market, the highest return model was suitable for both the Chinese and the European stock markets, especially for the European stock market.

In the bear market of 2008 and 2009, we applied the daily investment model in the Chinese stock market. For the low market value company, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 47.0% of obtaining more earnings than the market average return,

daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 56.7% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 43.3% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the low market value company, the $WINNER_{10}$ (the highest return model) portfolio had a probability of 75.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 85.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 85.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, the daily $LOSER_{10}$ (the momentum model) portfolio was suitable for Chinese stock market. In European stock market, all these three models had outstanding performance, which explained that, in a bear market, the European medium market value companies had strong anti-risk capability and more stable stock price volatility. In stock investment, the European low market value companies had a high investment value.

In the normal market of 2013 and 2014, we applied the daily investment model in Chinese stock market. For the low market value company, the daily $WINNER_{10}$ (the highest return model) portfolio had a probability of 42.4% of obtaining more earnings than the market average return, daily $LOSER_{10}$ (the lowest return model) portfolio had a probability of 51.3% of obtaining more earnings than the market average return, the daily $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 41.0% of obtaining more earnings than the market average return. Meanwhile, by applying the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" in the European stock market. For the low market value company, the $WINNER_{10}$ (the highest return model) portfolio has a probability of 68.0% of obtaining more earnings than the market average return, the $LOSER_{10}$ (the lowest return model) portfolio had a probability of 60.0% of obtaining more earnings than the market average return, the $WINNER_{10}$+ $LOSER_{10}$ (the momentum model) portfolio had a probability of 56.0% of obtaining more earnings than the market average return. Comparing the results of these two markets, all the portfolios of European stock market performed better than the Chinese stock market.

To be summary, comparing with the daily investment model, the daily investment model of low market value company did not perform well. Therefore, comparing with the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model", the low market value company obtained stable returns. In the bear market, the medium market value company

performed well, especially better than the Chinese daily portfolio. But in the bull or the normal market, the portfolio of European market did not have many advantages.

At this stage, we analyzed the correlation between the company fundamentals value and its stock price fluctuation. We found out that in bull, bear and normal markets, there was no significant difference of returns among high, medium and low market values. The daily investment model was based on divided book value of company that could neither predict better the investment risk nor the future return. Different from the Chinese stock market, the European company market value investment model in a bull market, bear market, and normal market, had a significant difference. In the bull market, its forecasting and profitability was similar to the Chinese investment model; in the normal market, it was slightly better than the Chinese investment model; in bear market, it forecasting and profitability was significantly better than the Chinese investment model. Among them, the lower market value company could gain more profits with its momentum model and the lowest return model, which indicated that the company with low book value was less profitable, in the bear market, its stock price declined with the market tendency obviously and kept falling for a period. In contrast, in the Chinese stock market, the daily highest return model always wan the market, which showed than in daily unit investment period, the most profitable model was the former highest return model. We could try to weaken the influence of stock market trend and the company's market value in the investment.

3.2.3.6 . The latent variable of momentum model

Example of latent variable - interest rate adjustment

Many factors can affect stock returns like stock market crashes, times of policy-related uncertainty, world wars, and financial crises (Manela, A. & Moreira, A., 2017). Latent variable (Bollen, K., 2002) is a comprehensive variable that cannot be directly observed its feature. It is not observable, or with hidden appearance, but comprehensive essence. When we study latent variables, usually display its variable measure that these variables are external manifestations is determined by the latent variables, so we can take advantage of the relationship between the

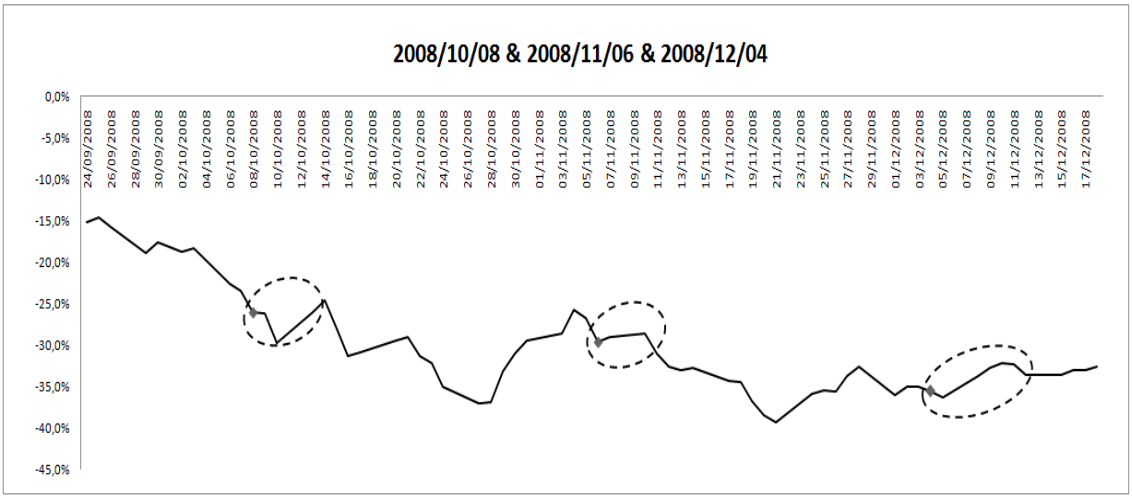
measures variables and the latent variables. Implicit Variable Analysis (Houswer, J. & Mocigemba, S., 2009) (Latent Variable Analysis) is probably the application of the fastest growing branch within the field of statistics in recent dozens years, due to its great practicality, in psychology, sociology, and later almost is used in all subjects. We refer to the concept of latent variables to optimize our momentum models. The changes of momentum strategy indicators are from a range of environmental factors, as exchange rate, interest rate...Because of that the influence of latent variable is various and some latent variables are difficult to be quantified. These latent variables cannot be accurately determined, we represent them by $I_{n+1.}$ Based on this assumption, Latent variable can be defined as:

$$\mathbf{V_{n+1} = V_n + I_{n+1}}$$

I_{n+1}: The n+1 time point that financial products can be affected by latent variable.
V_n and V_{n+1} : The trend of stock price volatility.

If we know the effect of latent variable, the changes of momentum indicators will be predictable, then we can describe the trends of stock price volatility and future volatility of stock price. $\mathbf{V_{n+1}}$ expresses the combination between the momentum change and the actual impact factors. We believe that the momentum change is caused by a series of latent variables, incomplete and unknowable information lead an accurate momentum model that is assumed as random interference. The relationship between two adjacent observation periods of momentum indicators $\mathbf{V_n}$ and $\mathbf{V_{n+1}}$ are include the further stock price changes, so we can calculate their correlation for a theoretical prediction of future price.

In order to study the effect of latent variables in momentum strategy, we applied a complete momentum investment model, the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model". Since the financial crisis of 2008, European central bank had implemented several times of interest rate cut, so we defined the interest rate cut as the latent variable. In this experiment, we choose three interest rate cut of 2008 as experimental time point. They were On October 8, 2008; November 6 and December 4, 2008. Our preference stock price was the price of January 1, 2008, then we observe the stock price volatility in ten days after the interest rate cut.



(fig. 5)

From the chart (fig.5) we saw that the interest rate cut policy could adjust the stock price change. On October 8th, 2008, the European Central Bank announced that its benchmark interest rate decreased by 50 basis points to 3.75%, The average return of all listed companies of Europe EUROSTAXX 600 index stopped appearing downward trend, and kept a 6 days increased trend. In October 14 went back to its downtrend. On November 6th, 2008, the ECB announced that it would cut its benchmark interest rate by 150 basis points to 3.25%, the European market showed a stable trend about 7 days, and then resume the downward trend in November 13th. On December 4, 2008, the ECB announced that it would cut its benchmark interest rate by 100 basis points to 2.50%, the average return of European market started an upward trend, and it reached its peak 9 days after in December 12th. By analyzing the three time points of rate cut, stock price movement and purpose of the European Central Bank cut interest rates, latent variable could indeed cut interest rates can stimulate the stock market in the short term, which caused the stock price rising or preventing continuous declining in stock prices. However, the latent variable as rate cut can actually impact the stock price changes? As what it is assumed that, if there is no latent variables influence, the stock price change trend should remain unchanged? If the stock price changes by the impact of latent variables, the original stock price movement trend will appear abnormal movement. For example, the relation between shareholder payout and company abnormal leverage showed the internal capital market inefficiencies (Beyer, B. Downes, J. Rapley, E., 2017). Beltratti and Caccavaio (Beltratti, A. Bortolotti, B. & Caccavaio, M., 2016) discovered that there existed positive abnormal returns in the Chinese stock market, before the information leakage, the market trading increased for a few days. This abnormal change, that is, why we discuss the impact of latent variables on momentum investment model.

We used the existing historical stock price of all listed companies of European EUROSTAXX 600 index. During October to December of 2008 there were three times cut interest rate behaviors. We calculated the expected return including and excluding the impact of latent variable for "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model". The momentum model contained hidden variables is calculated as follow:

$$\mathbf{Re_{EU,Bear}} = \left\{\frac{\sum_{i=0}^{30n}(\mathbf{P_{i+30}} - \mathbf{P_i})}{\mathbf{P_i}} - \left[\frac{\sum_{i=0}^{30n}(\mathbf{Q_{i+30}} - \mathbf{Q_i})}{\mathbf{Q_i}}\right]\right\} + \left[\frac{\mathbf{I_{i+30}}}{\mathbf{P_i}} - \frac{\mathbf{I_{i+30}}}{\mathbf{Q_i}}\right]$$

P_i : The stock price of $Winner_{10}$ portfolio

Q_i : The stock price of - $Looser_{10}$ portfolio

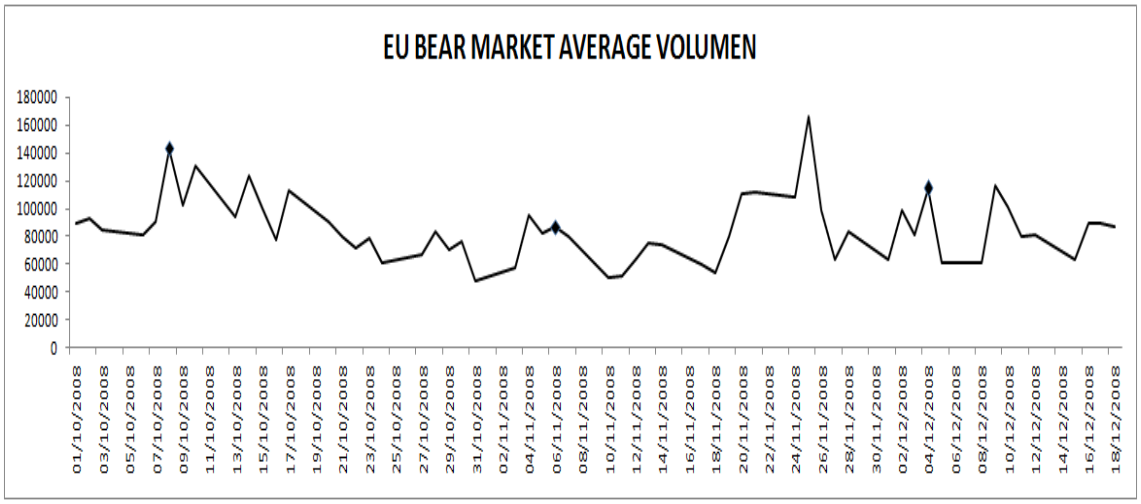
i : The end of 90 days of observation period, the beginning of 30 days of holding period

I_i : The impact of latent variable

To prove the impact of latent variable on stock price, we determined the last day when the interest rate cut made effect on stock price change as the last day (October 4th, 2008; November 6th, 2008; December 4th, 2008) of our holding period of momentum model ($Winner_{10}$- $Loser_{10}$) as Model A, and defined a compared model as Model B (without the impact of latent variable) with the day that announced the interest rate cut policy as the last day of our holding period of momentum model ($Winner_{10}$- $Loser_{10}$). By comparing the return rate of these two models, we could estimate the impact of interest rate cut on stock price change. On October 4th, the momentum model A (stock price of October 12th) had a return rate of -18.4%, the compared momentum model B had a return fate of -19.8%, so this interest rate cut reduced a loss of 1.4% for our momentum model ($Winner_{10}$- $Loser_{10}$). On November 6th, the momentum model A (stock price of November 12th) had a return rate of 4.9%, the compared momentum model B had a return fate of 4.4%, so this interest rate cut increased 0.5% more earnings for our momentum model ($Winner_{10}$- $Loser_{10}$). On November 6th, the momentum model A (stock price of December 12th) had a return rate of 3.0%, the compared momentum model B had a return fate of -0.5%, so this interest rate cut increased 3.5% more earnings for our momentum model ($Winner_{10}$- $Loser_{10}$). The impact of last interest rate cut kept a longer time, so it brought more benefits for the momentum investment portfolio.

Implicit factor of latent variable - market factors

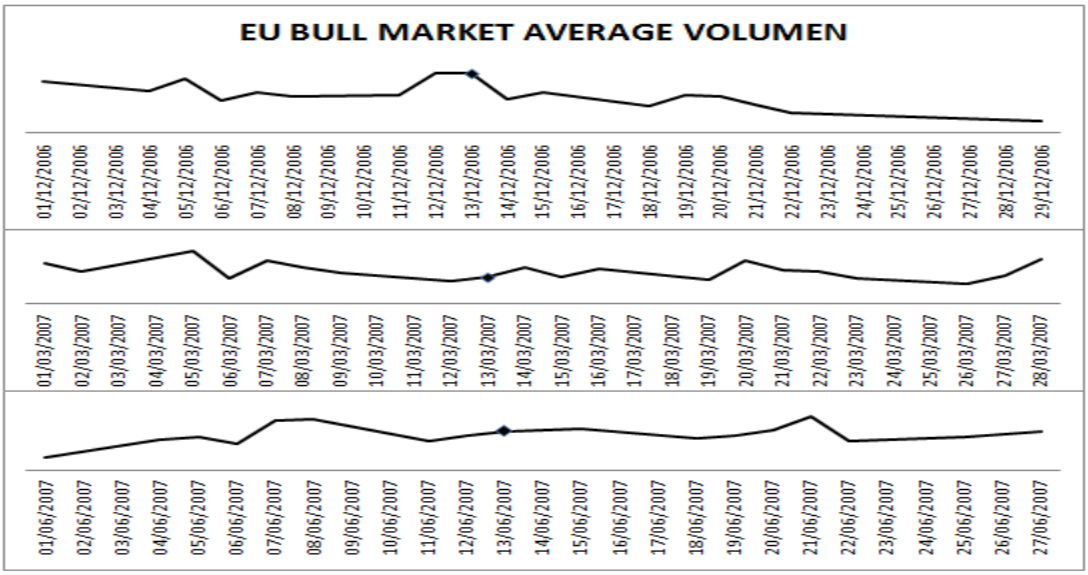
After studying the impact of interest rate cut on stock price change, combining the experimental results of the three factors momentums, investment market factor (Chinese/ European stock market), investment market conditions factor (bull/bear/normal market) and investment companies market value factor (high/medium/low). Panzone and Cohen (Panzone, L. Hilton, D. Sale, L. & Cohen, D., 2016) applied econometric modelling to showed how explicit and implicit factors influenced the consumer decision making behaviour. Stafylas and Uddin (Stafylas, D. Anderson, K. & Uddin, M., 2016) also proved that implicit factors and statistical factors models were able to explain the hedge fund return process, so we believed that if the same latent variable makes the same effect on stock price in different situations. In the next part, we studied the impact of interest rate adjustment on the Chinese stock market and the European stock market in both of the bull market and the bear market.



(fig. 6)

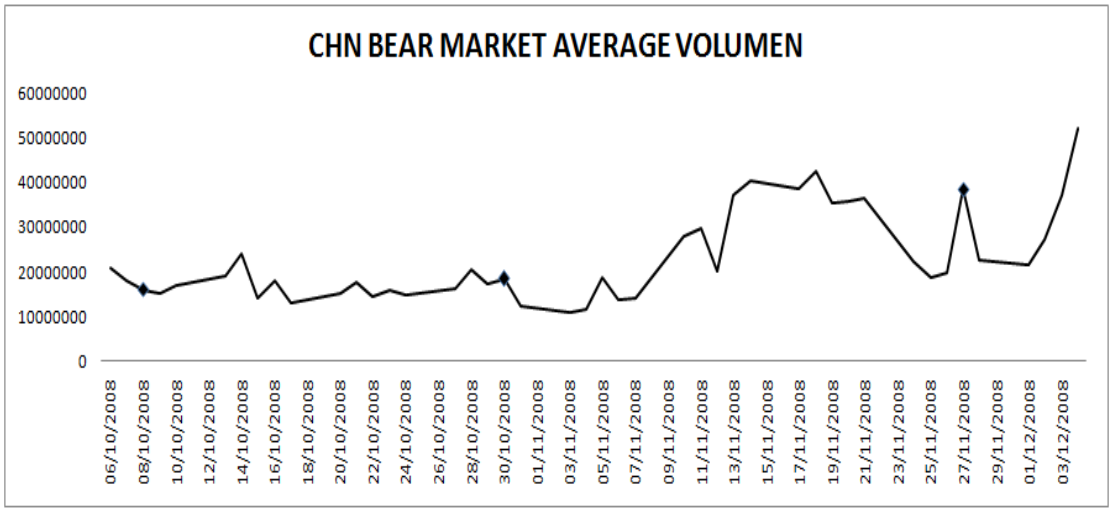
The figure.6 was the average return of all listed companies of EUROSTAXX 600 Index during the three interest rate cut (October 2008 to December 2008). Around the interest rate cut of October 4th, 2008, November 6th,2008 and December 4th, 2008, the trading volume appeared different degree of declining. Despite the changes in the average market share price was affected by the rate cut, interest rate policy itself did not stimulate investment behavior, in addition the cut interest rate of 8th October 2008, the stock turnover transient increased in short term and the other two interest rate cut did not let the stock market turnover increased. The main reason was the bear market, investors showed a strong risk aversion losses due to their loss of falling stock. Even the European Central Bank issued a positive message, still not increased the confidence of investors in the stock market, so investors would buy or sell stocks. It also illustrated why the good news of the interest rate cut did not affect the stock price movement in a long term. As in

the stock market there was a certain amount of capital, if there was no new capital that was added in, the stock price was difficult to stop falling in a long time.



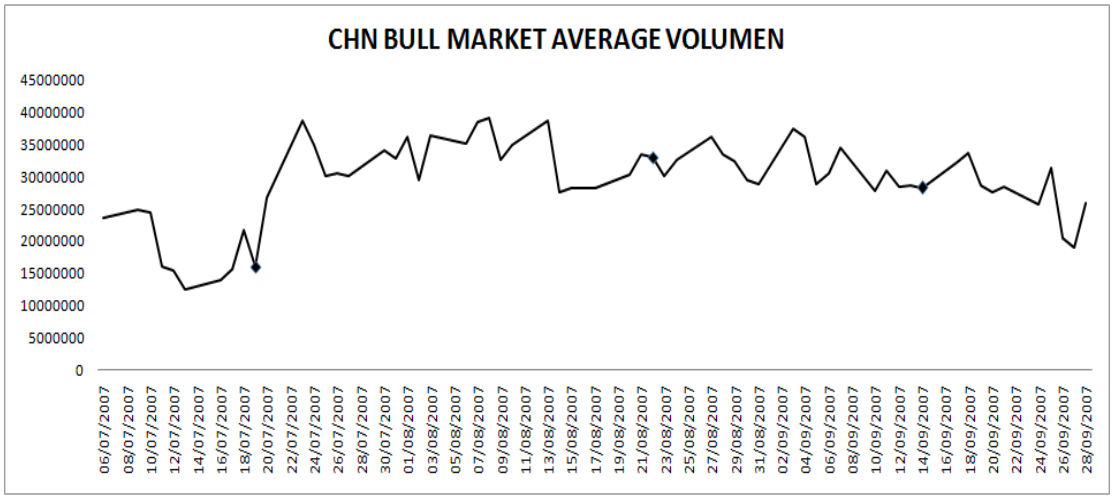
(fig. 7)

The figure.7 was the average return of all listed companies of EUROSTAXX 600 Index during the three interest rate raised (December 2006 to June 2007). On December 13th, 2006, the European Central Bank announced that its benchmark interest rate raised 25 basis points to 2.5%. On March 13th, 2007, the benchmark interest rate raised 25 basis points to 2.75%. On June 13th, 2007, the benchmark interest rate raised 25 basis points to 3.0%. Around the time point of these three interest rates, the interest rate increasing on December 13th, 2006 introduced a short term falling of the stock turnover, but the stock market boom had calmed down quickly. After the interest rate rising of March 13th, 2007 and June 13th, 2007, the stock trading volume started to increase. To compare with the relatively bearish interest rate cut policy, the raising interest rates policy in the bull market had longer impact. On one side, since the bull market, investors were much more confident of the stock market, so the bad news effectively could stimulate the investment behavior of investors. On the other side, investor herding was relatively obvious in bull market, investors followed the trend to buy or sell stocks as others, so raised interest rates policy in the bull market had intensified the trading behavior of investors.



(fig. 8)

The figure.8 was the average return of all listed companies of HUSHEN 300 Index during the three interest rate cut (October 2008 to November 2008). On October 8th, 2008, the People's Bank of China announced that its benchmark interest rate cut 27 basis points to 6.93%. On October 30th, 2008, the benchmark interest rate cut 27 basis points to 6.66%. On November 27th, 2008, the benchmark interest rate cut 108 basis points to 5.58%. After the interest rate cut of October 8th, the stock trading volume started to increase; after October 30th, the stock market turnover began to show a downward trend; after November 27th, the trading volume appeared a sudden jump on the same day, then continued to keeping upward tendency. Un liking the European bear market, when European investors faced to good news, they did not show a positive response. But on the contrary, when the central bank published bad news, despite in the bear market, the Chinese investors were still affected by bad news and began to trade more stocks. It indicated that, comparing with the European investors, the Chinese investors risk aversion of bear market was weaker, because they were more irrational.



(fig. 9)

The figure.9 was the average return of all listed companies of HUSHEN 300 Index during the three interest rate rised (July 2007 to September 2007). On July 21th, 2007, the People's Bank of China announced that its benchmark interest rate raised 27 basis points to 6.84%. On August 22th, 2008, the benchmark interest rate raised 18 basis points to 7.02%. On September 15th, 2008, the benchmark interest rate raised 27 basis points to 7.29%. After interest rates rise of July 21th, 2007, stock trading volume showed a substantial increasing. After interest rates raised of August 22th, 2008 and September 15th, 2008 the stock turnover increased smoothly. In the bull market, different from the European market, the central bank's bad news could not affect the Chinese investors behavior in long-term. Chinese investors were more confident than European investors when they heard bad news, so they still believed that their investment had higher profitability. It showed that in the bull market, the Chinese investors were less likely to be influenced by other factors than the European investors. They preferred to insist on their investment decision for obtaining more future profits with their investment portfolios.

The Table 23 and Table 24 were the list of one year interest rate changes that we selected for the Chinese market (CHN) and the European market (EU), which contained the following information: one-year interest rate change date (Date), the change of the interest rate (Δ 1 year interest rate%), listed companies of different capital scales (company capital scale small/medium/big) ARIMA model factor (C , AR (p), ...), the significant difference level (P-value<0.05) under the F test (F-statistic) and the difference (ΔRe= Estimated expected return - real market average return) between the estimated expected return of the AR model and the market average return 10 days after the one year interest rate change. As Rounaghi and Zdeh (Rounaghi, M. Zadeh, F., 2016) said that the complex financial markets could not be described with linear models easily, so they chosen ARMA model to apply multifractal analysis into market

efficiency study.

For the Chinese stock market, 70.4% of all the 27 AR models were significant (P-value<0.05), the difference between the average return of these models and the real market average return was -6.3%; 77.8% of the 9 AR models of big capital scale companies were significant (P-value<0.05), the difference between the average return of these models and the real market average return was -6.6%; 66.7% of the 9 AR models of big capital scale companies were significant (P-value<0.05), the difference between the average return of these models and the real market average return was -9.1%; 66.7% of the 9 AR models of small capital scale companies were significant (P-value<0.05), the difference between the average return of these models and the real market average return was -3.3%. For the European stock market, 44.4% of all the 27 AR models were significant (P-value<0.05), the difference between the average return of these models and the real market average return was -0.9%; 44.4% of the 9 AR models of big capital scale companies were significant (P-value<0.05), the difference between the average return of these models and the real market average return was -0.1%; 44.4% of the 9 AR models of big capital scale companies were significant (P-value<0.05), the difference between the average return of these models and the real average market return was -2.1%; 44.4% of the 9 AR models of small capital scale companies were significant (P-value<0.05), the difference between the average return of these models and the real market average return was -0.5%.

The above results showed that the AR model is more predictable in the Chinese stock market (70.4%) than in the European stock market (44.4%). For the Chinese stock market, the AR model had the highest applicability for big capital scale companies (77.8%). The Table 25 showed us the impact of one year interest change on expected return. The change of one year interest rates had a great impact on medium capital scale companies (-9.1%). For the European stock market, the AR model had no difference in applicability for companies with different capital scales. The change in one year interest rates had a great impact on medium capital scale companies (-2.1%). Thus, we believed that the latent variable like an interest rate change had a certain impact on future stock prices, especially in a short term investment liked a 10 day holding period (Chinese stock market), so this impact could not be ignored.

By studying the effect of interest rate cut to the stock price volatility, we verified the effect of latent variables really existed, and it had different degrees of impact on the stock price. Although at this stage of the experiment, we only selected the interest rate adjustment as the latent variables, the experiment results proved that the latent variables could not be ignored in the stock

price volatility. Whether latent variables of short-term, or latent variables of long-term could bring a certain gains or losses. When we designed the momentum investment model, especially the short term or very short-term momentum model, It is necessary to consider the latent variable. As long as take advantage of the impact of latent variables, we can optimize the momentum investment model, while maximizing expected return of momentum investment model. Since the form of latent variables have been varied, for example, exchange rate change, stock dividend, major political events. After comparing the bull and bear market, the Chinese stock market and the European stock market had difference of responding interest rate adjustment. We found out that in different markets and different market conditions, interest rate adjustment as a latent variable could influent the stock price changes with different degrees. Not only the latent variable could affect the stock price, but also had many factors that could affect the latent variable, such as market condition, investor behavior, etc. Therefore, the study of latent variables is complex. However, as an attractive investment opportunity, latent variables is very valuable for future research.

In this chapter, by using the Paired sample T - test and Pearson correlation test, we studied the efficiency of Chinese stock market and the European market and we proved that the Chinese stock market was inefficient, while the European stock market was an efficient market. Based on the result of market efficiency theory, we designed investment model with different observation period and holding period for these two markets. There were several models as highest return model, lowest return model and momentum model. The models we designed are: the "52-week highest stock price model", the "highest return rate of last 180 days (6 months) model", the "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model", the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model", the "highest return rate of last 30 days (1 month) with holding period of 30 days (1 month) model", the "highest return rate of last 30 days (1 month) with holding period of 10 days model" and the "highest return rate of last 30 days (1 month) with holding period of 5 days model". we find that short term investment model was very different with the midterm investment model. For the Chinese stock market, by reducing the holding period, the "highest return rate of last 30 days (1 month) with holding period of 10 days model" was more powerful in predicting future return and "highest return rate of last 90 days (3 months) with holding period of 60 days (2 months) model"(35.0%) was the most powerful model for the European stock market. At this stage of experiment, we fatherly validated the inefficiency and short term volatility of the Chinese stock market, at the same time, we verified the automatic adjustment ability of the European stock market in certain period, which was its important feature of an

efficient market. Since the Chinese stock market was inefficient, it was more suitable for short-term speculative investment model, while the European stock market was an effective market, it was more suitable for long-term investment model. In the part of daily investment model, the results showed that, in the bear market, the daily $WINNER_{10}$ + $LOSER_{10}$ portfolio (58.4%) was the best model for the Chinese stock market, in the bull market and the normal market, the daily $WINNER_{10}$ portfolio (69.8%) was the best model for Chinese stock market. On contrary, the "highest return rate of last 90 days (3 months) with holding period of 30 days (1 month) model" was more suitable for the European stock market, its average yield was almost completely defeated the average market return over the same period. We concluded that with respect to the European stock market, the Chinese stock market had a strong trend in a very short period. Once the investment period extends to mid-term or long-term, due to the dynamic fluctuation of the Chinese stock market, it was difficult to use the highest return rate model, the lowest return model or momentum model to predict its future earnings. In the step of investigation of company market value, we discovered that in the bull, bear and normal markets, there was no significant difference of returns among high, medium and low market values. In the bull market, its forecasting and profitability was similar to the Chinese investment model; in the normal market, it was slightly better than the Chinese investment model; in the bear market, its forecasting and profitability was significantly better than the Chinese investment model. Among them, the lower market value company could gain more profits with its momentum model and the lowest return model. At last, we had done a research of the effect of latent variable in the stock price volatility, we verified the effect of latent variables really existed, and it had different degrees of impact on the stock price. Whether latent variables of short-term, or latent variables of long-term could bring some a certain gains or losses. As long as taking advantage of the impact of latent variables, we can optimize the momentum investment model, while maximizing expected return of momentum investment model. Since the form of latent variables has been varied, for example, exchange rate change, stock dividend, major political events. After comparing the bull and the bear market, the Chinese stock market and the European stock market had difference of responding interest rate adjustment. We also found out that in different markets and different conditions, interest rate adjustment as a latent variable could influent the stock price changes to different degrees. Not only the latent variable can affect the stock price, but also have others factors that can affect the latent variable.

3.3. Mental Accounting

3.3.1 The concept of mental accounting

Mental accounting is our daily life accounting, for example, Black and Devereux (Black, S. & Devereux, P., 2017) found that financial investment behavior was highly correlated between parents and their children. Chang and Westerfield (Chang, T. Solomon, D. & Westerfield, M., 2016) said that investors realized past gains more that past losses because of the disposition effect. When investors sell one asset and quickly buy another ("reinvestment days"), their trades suggest the original mental account is not closed, but is instead rolled into the new asset (Frydman, C. Hartzmark, S. & Solomon, D., 2017). Fischbacher and Schudy (Fischbacher, U. Hoffmann, G. & Schudy, S., 2017) also investigated that investors could apply use stop-loss and take-gain options to sell assets automatically, but selling at loss reduced their disposition effect.

In 1980, Richard Thalar, a famous psychologist of the University of Chicago, mentioned the concept of "Mental Accounting" in his article "USING MENTAL ACCOUNTING IN A THEORY OF CONSUMER BEHAVIOR" (Richard Thalar, 1983) for the first time. In this article, he used mental accounting to analyze consumer behavior. In 1985, Thaler published an article in magazine Marketing Science that named "MENTAL ACCOUNTING AND CONSUMER CHOICE" (Richard Thalar, 1985) which was the first article about mental accounting theory. He analyzed the classification and character of mental accounting and mentioned how mental accounting would affect the decision making of consumers (investors). Nobel Laureates in economy of 2002, professor of psychology of Princeton University, Daniel Kahneman had used the concept of "PSYCHOLOGICAL ACCOUNT" to represent the process how people enter in account ledger, encode, evaluate and budget the results (especially economic results). Professor Kahneman and his colleague Amos Tversky created prospect theory was the basis of behavioral economy. They combined psychology and economy to investigate the market situation and considered about the limitation and complexity of human behavior, which indicated a new research area in the economic development.

Mental Accounting is a cognitive operating system of individual, family or organization how they concern about, encode and evaluate economic activities., or it can be considered as a cognitive form of bookkeeping that can used to track the record of incomes and costs. The essence of mental accounting is a kind of narrow framing, which allows people to utilize the

limited brain resource to control or manage all transactions more efficiently. Mental accounting is constructed by three main relative parts, the first part is about how subjects can cognitive consequences, make decisions and evaluate results; the second part is about how to assign different activities to specific accounts; the last part is about the frequency of mental accounting evaluation. The effect of mental accounting is derived from the deeply cognitive mechanisms of cognitive processes among these three parts. Mental accounting consists of three phases of psychological process. Firstly, saving the cognitive gains or losses in a mental account as a outcome frame; secondly, encoding, marking and analyzing these gains or loss; thirdly, settle and shut down this mental account. Richard Thalar believed that individual, family and organization all have clear or potential mental accounting system. In summary, mental accounting is kind of management that people manage their wealth in separated accounts unconsciously and psychologically, every mental account has its own booking methods and psychological arithmetic rules. Mental accounting has two essential futures, one is non fungibility, another is specific arithmetic rule which is not belong to economic. Because of these two fungibilities, the people's economic behavior are betray the traditional economic hypothesis - rationality, while people are irrational in real world. The value curve reveals why mental accounting can influence consumer making decisions. When people calculate value, they have to determine a reference point of value, different decision making trees result different reference points. Value changes between gains and losses relative to this reference point, while this change will make people feel different about value, even changes people's preferences. At the same time, people valuate profits and losses with different value curves: the value curve of profits is convex and the value curve of losses is concave, so this formed a S-shaped curve. While the loss curve slope is greater than the profit curve slope, the curve loss is more steeper than profit curve, so people are more emotional to losses than to profits. In addition, the psychological perception of gains and losses is related to the reference point, much closer to the difference of reference point, people will be more sensitive. In daily economic activity, how people control and manage mental accounting, how people evaluate their economic transactions experience? Thalar said that people calculate their gains or losses in each mental account as an evaluation of their decisions and choices. In this process, people do mental accounting arithmetic not to pursuit a rational maximization cognitive of utility, but to pursuit maximization of emotional satisfaction, emotional experience plays an important role in people's decision making process.

Imagine a case, if you have a plan to go to a concert, and you have paid 200 euro for the ticket. Before leaving home, you tried to find the ticket and it was lost. At this moment, if you insist on going to the concert, it means that you have to buy another ticket of 200 euro. Will you go and

buy another ticket? Let us think, if you just lost a prepaid phone card which is worth 200 euro, what will you do? According to the psychological experimental data, in the former case, most people answered no, but in the latter case, there are still a lot of people said that they would go. Obviously, both these two decisions exist irrational elements, because no matter is the ticket or the prepaid phone card, they have the same value of 200 euro. No matter if or not you will go to the concert, you have already lost 200 euro. Considering from the economic perspective, this 200 euro of ticket or phone card will be calculated as "sunk cost", which should not be included within the scope of the decision-making. But it is difficult to convince yourself psychologically. People always tend to categorize their money in different account, and are accustomed to sum the total cost of "past investment" and "current payment" before evaluating the result of decision in their mind. For them, the ticket and the phone card are from different mental accounts, so after losing the ticket of 200 euro, they instinctively concern the ticket cost as 400 euro in total.

Mental accounting led people to form their irreplaceable attitude about the money. We can use a simple word "can" to make a metaphor of mental accounts. Many behavioral biases as regret and herding are exploited by investors, so higher future returns is relative with reduced volatility (Clare, A. Seaton, J. Smith, P. & Thomas, S., 2016). Assume that we have a basis account system to manage different group of gains and costs, for example, one is for the cost of housing hold, one is for the cost of water and electricity, one is for food costs, one is for entertainment expense and one is for savings. We think that these cans are independent instead of a whole union. We classify each can to its level basic on our subjective rules and experience. At last, we optimize the cost of every can separately, we do not optimize the whole cost totally. The money in the entertainment can cannot move to the can of savings, which means that we believe the money in each can is irreplaceable. If occur an unexpected expense, we prefer to take money from the entertainment can or savings can, but not from the house holding can or food can, this choice comes from our mental disorder. The money of different sources does not mean the same to us. For using the money in the account of "hard working earning", we will make plans and spend it cautiously. But we will easily take off the money in "bonus" account even feel much more relax. We may have a luxury dinner, buy an expensive coat, listen to a long-awaited concert and so on. In addition, different method of money saving also can improve the form of mental accounts. Recently, it appears a popular concept of "classified financial plan" among the young people, they classify their income in different accounts, as "house holding funds", "car holding fund", "medical funds"... A young couple have saved 5000 euro for paying the first payment of a new house, they plan to save more money and buy a new house with loans. Although they would like to take the whole family to travel abroad, they had already decided to only use the annual bonus

for travel costs, while the saving of bonus is not enough to afford the trip, so they postpone the travel plan. In fact, if this couple is willing to travel, they can diverted some of their house holding funds to pay the trip temporarily, and save all the bonus of next three years to fill the lost part of house holding funds, it is also a possible choice. But people would not like to make this choice, the total wealth has not changed, the house holding funds decreased because of the travel costs, this make people experience distinct feeling and emotion, while it is the manifestation of mental accounting. Mental accounting can indicate behavior, so we believe that each account is irreplaceable. When we take off the money from every account, our intentions are not same. Logically, money should be able to replace, no matter where is it from or where it will go. Cash is replaceable, that means units with same value can be replaced freely between people or between accounts.

This interesting case makes us to think about what causes the form of mental accounting? Daniel Kahneman concluded the reason and driving force of mental accounting to three aspects:

Consumers need self-control(Haws, K. & Bearden, W., 2012). By using mental accounts, consumers divide demand and consumption into different types, then strictly control the budget costs of a certain category of products based on the design of mental accounts. The money of different accounts cannot be transferred. By controlling mental accounts, people can reduce excessive consumption.

Considering mental accounting as a framing device. Mental accounting uses prospect theory value function, evaluates gains and losses by a relative reference point, people get the most pleasure through the Integration and separation of gains and losses.

Mental accounting enables to simplify the complex decision making problems, help reduce the difficulty of decision making and fast the decision making.

Mental accounting has its own typical characters, for example, non-fungibility, hedonic editing, loss aversion and diminishing sensitivity.

non–fungibility

Non-fungibility (Thaler, R., 1990) is not only a specific way to produce mental accounts or is the most typical form of its expression, but it is also the core and most essential feature of mental

accounting. Das, Markowitz (2010) believed that every mental account could reflect the trade-off between expected return and the potential loss efficiently and could confirm whether the threshold limit level reaches the efficient frontier, because of this frontier, the money could not across this effective boundary and flew freely between various sub-accounts. Classical economics believes that money is "independent source", which means that the value of wealth is not dependent on its origin and cannot be labeled, so money is replaceable, while its fungibility also consists with rational person requirements. But the concept of mental accounting has overturned the traditional economics perspective of fungibility, because that the money in mental accounts is classified by cash flow origin, types of cost. In different mental accounts, people's risk propensity and using willingness are not the same, or said that the money in different accounts cannot be replaced by the money of other accounts.

We describe mental accounting as following, The source of funds that is from different accounts is irreplaceable. For example, Abeler and Marklein (2008) found out that, in the real life, with the same amount of money, if it was from the lottery, people tended to consume it for pleasure, but if it was from hard-working earned money, such as wages, people was more prudent when they spent it. Due to the different budget and establishment of mental accounts are non-alternative. When people spend too much money of a certain account, they will reduce the future capital expenditures of this account, or if they have identified the use of a particular fund, then the funds of this account will be immobilized. After that, people will not use this money for any temporary consumption. Bertaut (2009) found out that, even if in the United States households had sufficient funds to repay bank debt, they were reluctant to reduce credit card debt. Having a non-alternative objects between consumptions due to the non fungibility of different funds established by the purpose of each mental account. Different accounts have different consumed propensity, they will have different labels, therefore funds cannot achieve the free transfer between accounts.

Reference dependence point

According to the prospect theory value function concept of Kahneman (Value Function), Thaler summarized three basic characters of mental accounting. They are reference point dependence, loss aversion and diminishing sensitivity. In the real life, mental accounting theory assumes that people do not pursue rational maximization of their value choice utility, but pursue the maximization of satisfaction of their choice, so these three basic properties are referred to hedonism editing. Dependent reference point is the value function that is defined on a relative

point of gains or losses, which leads us to cognitive our attention on our wealth when the value of wealth changes, rather than on the absolute level of wealth, so the transaction is often conduct on an independent assessment and perception. Some scholars believe that the reference point is dependent on their own biological mechanisms, steady-state (homeostasis) and collaborative steady (allostasis) mechanism, these two mechanisms shows the basic function of adaptive evolution. Reference point is generally divided into the status quo reference point and non-status quo reference point. The status quo reference point is the current situation in which the current state, such as the current income, current expenditure, etc. The non status quo is the reference point that means no objective reference to the state, as expected income, expected expenditures and so on. Both of these reference points are common in the stock market. For a dropped stock, people generally prefer the status quo to be the reference point, which is the initial purchase price. But when people sell their stock with return, they tend to take the most recent price as a reference point.

Loss aversion

In general, more income will improve our survival prospect, and significant loss could cause the loss of life. From biological perspective, the greatest significance of loss aversion is to help people avoid harm and achieve continuation of life. For a biology, loss means much more than gain. For example, economists Samuelson had a bet with a colleague by flipping a coin to decide the outcome. If his colleague win, he can win $ 200, on the contrary, if the colleagues lost, he just lost $ 100, but at the end, his colleague rejected this bet. In most of cases, comparing with income, people react much sensitively to the loss. Kahneman thought the loss aversion reflects the people's attitude of losses and gains is significant asymmetry, this leads a different emotional perception and decision making. D'Olando and Sanfilippo (2010) believed that in economic activity, because of the fear of individual losses, mental accounting could produce strong debt aversion which could affect people's economic behavior. To the account has losses, people tended to delay the settlement and closure of the accounts. Mental accounting helps different investment funds to achieve their objectives. Everyone has his different risk tolerance to achieve their investment purposes. Goals are necessary. Decisions would be affected by the rules. These rules regulate the tax and duty-free accounts, affect future generations of contemporary and trust funds. Different mental accounts have different risk tolerances. Pikulina and Toble (Pikulina, E. Renneboog, L. & Tobler, P., 2017) found that the overconfidence of investors' financial knowledge and investment choice produced strong overconfidence results in excess investment.

We find out that people with high risk tolerance tend to be more overconfident, with high propensity for maximization and the relatively young are more risk tolerant than the relatively old. Women have relatively high propensity for regret but they have relatively low levels of overconfidence and low propensity for maximization. The ISO Personal Financial Planning Standards defines risk tolerance as "the extent to which a consumer is willing to risk experiencing a less favorable financial outcome in the pursuit of a more favorable financial outcome."

The optimal portfolio for people who are willing to accept a maximum reduction of 3% in their standard of living consists of 80% in Treasury bills, 13% in long term Treasury bonds, and 7% in stocks. This portfolio has 4.4% expected return with a 3.31% standard deviation. The optimal portfolio for people who are willing to accept a maximum 24% reduction in their standard of living is composed of no Treasury bills, 32% in long term Treasury bonds, and 68% in stocks. The optimal portfolio for people close to the average of our sample who are willing to accept a maximum 12% reduction in their standard of living is composed of 47% in Treasury bills, 27% in long term Treasury bonds, and 26% in stocks. Young people have relatively high risk tolerance toward jobs, but they also found that risk tolerance does not decline monotonically with age. People who are younger than 55 are more risk tolerant than people between the age of 55 and 70, but people who are older than 70 are more risk tolerant than people in the 55 to 70 group. Younger people have higher risk tolerance toward portfolios than toward jobs, while older people have greater risk tolerance toward jobs than toward portfolios. People between the age of 18 to 24 are willing to accept a 14.08% downside in a portfolio but only a 12.07% downside in a job. The difference is statistically significant. In contrast, people of the 55 and older age group are willing to accept a 10.65% downside in a portfolio but and 11.54% downside in a job.

Each investor has a multitude of risk tolerances. Probing for one global risk tolerance misses that multitude. Specifically, investors consider their portfolios as collections of mental accounts, each devoted to a goal. Goals might include retirement income, college education, or being rich enough to travel first class whenever and wherever desired. Investors' risk tolerance corresponds to their goals. For example, an investor might have low risk tolerance in a retirement mental account, populating it with bonds or Treasury bills, and at the same time have high risk tolerance in a "get-rich" mental account, populating it with aggressive growth funds or even lottery tickets. Investors risk tolerance varies by circumstances and associated emotions. A failure to recognize this nature of risk tolerance is likely to result in disappointment. Vividly high returns on asset classes, whether dot-com stocks in 1999 or gold more recently, induce exuberance, misleading

investors into the belief that these assets combine high future returns with low risk. Risk tolerance questions asked ager periods of high stock returns are likely to elicit answers tinted by exuberance, exaggerating investors' risk tolerance. Conversely, vividly low returns on asset classes, such as U.S. and international stocks in 2008, induce fear, herding investors into Treasury bonds misleading them into the belief that stocks combine low future returns with high risk. Risk tolerance questions asked following periods of low stock returns are likely to elicit answers underestimating investors risk tolerance.

Foresight is different from hindsight (Fischhoff, B., 1975), and the risk tolerance of investors, assessed in foresight, is likely different from their risk tolerance assessed in foresight, is likely different from their risk tolerance assessed in hindsight. Investors with low propensity for hindsight and regret might shrug their shoulders when they learn, in hindsight, that their investments delivered poor returns while other investments they could have chosen brought better returns. But investors with high propensity for hindsight and regret might fire their advisors or even file lawsuits, claiming that they have been induced to undertake unsuitable investments. Kahneman noted, "Advisor and advisee have a common interest: both want the relationship not to end in disappointment, and both want to reduce the potential for regret and for abrupt reversals." Moreover, some propensities are intricately associated with other propensities, and advisors must understand these relations and make appropriate adjustments. For example, investors with high propensity for overconfidence might exhibit high risk tolerance. But are such investors true risk tolerant or is their measured risk tolerance exaggerated by overconfidence? This is the confusion that we need to make it clear in the future investigation.

Whether losses or gains appear a decreased tendency of sensitivity, with the growing of losses and gains, the sensitivity of people's perception has gradually slowed down. Because of the diminishing of sensitivity, as we know in the stock market, people always sell stocks with losses at the same day, but sell stocks with gains on different days, because people use the law of diminishing sensitivity (Ido Erev & Eyal Ert, 2008) to reduce the negative perception and increase positive perception of decision making in the case of unconscious situation. In fact, losses or gains are relative. People will set a standard in their mental accounts, and judge their losses or gains in accordance with this standard. They are concerned about the relative level not the absolute level. For example, a gambler walked into casino, and he thought that if it only left half of his money, he would left the casino immediately. But if he had more than half of his money left, it meant that he did not lose. For this gambler, losing money did not mean failure, only losing more than half of money was failure. People change their sensitivity of losses and

gains by their own standard. More far from their standard, they will be less sensitive. As the example of gambler, the first time, he wan 10 euro, the second time, 20 euro, this made him feel good, because that he had win twice the second time with an increase of 10 euro. If this gambler wan 1000 euro firstly, and then win 1010 euro, he thought that 1000 euro and 1010 euro were the same, while he would not believe that he had earned mucho more than the first time. In mental accounting, the pain of losing 100 euro was the feeling more stronger than the happiness of earning 100 euro. Imagine that you worked on the weekend, the company paid you 500 euro as bonus, and you felt very happy. With spending this 500 euro easily, the happiness disappears quickly. But if you had to pay 500 euro for a traffic violation, the pain of this loss would last much longer. People always think that they deserve bonus, but they hate violation or loss, they do not want the loss appears, and they also believe that losses should not happen, so people will immerse in remorse in a longer period.

By analyzing the cases above, it is easy to find out that mental accounting has its own algorithm.

Algorithm of losses and gains

Thalar expounded the algorithm rules of mental accounting systematically in his paper "Mental accounts and consumer choice". He said that how to encode losses and gains depends on how the seller describes the deal. When we can merge economic results and when we have to calculate losses and gains separately. He borrowed the value function of prospect theory of Kahneman and draw the following arithmetic rules:

a. "gain + gain" : At this point the value function is concave, so the two gains have to be separated, perceived maximum utility.

b. "loss + loss": At this point the value function is convex, two loss should be consolidated.

c. "gain > loss": With one positive result and one negative result, but the overall result is positive, so it should be consolidated.

d. "loss > gain": With one negative result and one positive result, but the overall result is negative, it should be considered as two circumstances. If the loss is closer to the gain, the result should be consolidated, but if the loss is much more than the gain, the result should be calculated separately. This calculation is from the concept of hedonic editing. When people reorganize

information, they prefer the frame that can bring greatest happiness.

Transaction Utility

Transaction utility theory (Thaler, R., 2008) assumes that the total consumer's utility in commodity trading process is the sum of acquisition utility and transaction utility. Acquisition utility is equal to the difference between earned utility and paid price; transaction utility is the pleasure of displeasure that comes from the consumer behavior. When the sum of the two utility increases, consumer purchase willingness will also increases, as the following formula:

Total utility = acquisition utility + transaction utility

According to Thaler and Kahneman, frame is decision maker perception of his action and relevant results are produced by his selection. Be contrary of the rational man hypothesis of the traditional economics, people are always likely to accept the result that makes them feel more pleasant.

Framing effect

Framing effect (Kahneman, D. & Thaler, R., 1991) is considered as one of the most important discovery in the decision making area which was first proposed by Kahneman and Tversky. They defined "frame" as "behavior associated with particular choice or result and the concept of contingency conditions that is formed in decision maker's mind". They indicated that forming the frame is from expression of problem and decision maker's personal features, as regulation, habits and others factors. In mental accounting, the perception of price is focus on absolute representation frame, relative representation frame, integrating price and separated price.

Mental accounting can only apply to absolute frame, not relative frame. In absolute frame, people tend to separate increased price and a small discount (losses > gains) or separate a big discount and a small increase of price (gains > losses). When we express price with a percentage frame, on betray of "gains > losses" frame, people are likely to separate a big discount and a small increase of price, but in the case of "losses > gains", people's willing will not be affect on representation frame. Moon found that relative promotion can affect the consumer's decision making more than absolute promotion, but when the absolute promotion accumulates to a certain value, the relative promotion will lose its function. At this moment, the absolute promotion will

decide the people's purchase behavior. The experiment of Kahneman is called "Calculator" experiment, when we change two unrelated products into two strongly related products, the relative promotion will no longer work, the absolute promotion will play a major role. Subimal Chatterjee (2000) studied the influence of the integration and separation of " gains > losses" frame and "losses > gains " frame in decision maker's cognitive needs, he proved that consumers with high cognitive needs evaluate the economic result separated to the price representation frame; low awareness consumer's evaluation of economic result will be affected by the price representation frame. When the price changes in absolute form, it follows the principle of wealth desire, but when the price changes represent in relative form (percentage), it do not follow the principle of wealth desire. Chinese scholar Li Aimei (2005) said: When absolute value is low, absolute promotion is obvious; when absolute value is high, absolute promotion is not obvious. The relative promotion and absolute promotion can be affected by original price, when original price is low, relative promotion is more obvious; when original price is high, absolute promotion is more obvious. For high-priced products, no matter the size of discount, the representation of discount cannot affect the cognitive of discount size or purchase desire. For low priced product, the size of discount and the representation of discount size are interactive. When the discount size is large, relative form make consumers feel more promoted than absolute form; when the discount size is small, the representation of discount makes no effect on the cognitive discount of consumers. Regardless of the discount size is large or small, different discount representation makes no difference on purchase desire of low priced product. It can be drawn a conclusion: when the price changes are expressed in absolute number and percentage, the same amount of price increases or price cuts can introduce different consumer's choices. It is because that people carry out information with performance of "cognitive stingy person", when price changes expresses as a percentage, many consumers do not have a precise calculation for economic outcomes. They use intuition to judge the price as a short cut and make purchase decision by a simple calculation with surface number.

Frame effect is commonly applied in sales, for example, the mystery of discount and " Get XX euro rebate for every XX euro purchase". There are many methods to stimulate consumption, but neither of them is able to compared with the effect of price. Obviously, price marketing policy is not a simple price cuts, but to use the price mechanism to break out the alert mechanism of consumers. Many people have this experience: There is a "one purchase, one gift" campaign of a brand in the supermarket, people buy a box of chocolate and take home a plastic cup as a gift that they may never use in the future. This product plus gift sales takes opportunity of people's "free mentality". There exists an experiment, the supermarket put on sale two kinds of chocolate,

the big bar of chocolate is 10 euro and the small piece of chocolate is 2 euro. Firstly, both of them have 50% discount, the big one sells 5 euro, the small one sells 1 euro. The big bar of chocolate was berserk (apparently to buy big chocolate can get more benefits). Then both of them have 1 more euro of discount, the big one sells 5 euro, the small one is free. This time the small piece of chocolate was berserk, and nobody cares about the big bar of chocolate. "Free" has a great lethality for consumers. Whether the gift only worth few euro or thousand euro, even if in some the introductions of product quality. "Zero Coca-Cola" is a typical example, "low sugar" or "sugar free" may have little difference in terms of the human body, but "sugar free" indicates absolutely without sugar (even if it is impossible in reality.) which is much better than others similar products of "low sugar". This change of expression is called "framing effect", which brings a totally different effect on consumer behavior. It shows the expression will affect the people's judgment, expression the same logic with different argument makes people experience different perception in order to make different even opposite decisions. For consumers, they tend to "obtain" frame. For example, a product of 2 euro plus a free gift is more attractive than a product of 2 euro with 50% discount.

Endowment effect

When someone own something, he needs more money than the price of this subject as compensation when he has to give it up, this phenomenon is known as "endowment effect." (Kahneman, D. & Thaler, R., 1990) In an experiment, the experimenter had a product as a coffee mug or a pen, when he was asked one question, as "how much he will sell this product?" And another experimenter was asked another question, as "how much he will pay for this product?" Most of the experimental results showed that the selling price is nearly twice more than the purchase price. They believed that endowment effect was produced by "reference dependency" and "loss aversion", after being tested, the reference point of experimenter was transferred to ownership of goods, so his pain of losing was greater than his happiness of obtaining. Thus the endowment effect and did not affect all transactions, whether or not the product had the endowment effect depended on the initial acquisition was for trading or personal using. The products for trading only existed endowment effect in the case of transactions with uncertain proportions and the endowment effect was not suitable for all goods, if the article evoked negative emotions, its endowment effect could be minimized or even disappear. Ranyard thought that the endowment effect only appear when goods bring joy and happiness. Through the study of the endowment effect in car trade transactions, we found that people who changed their old car to new car had stronger willingness to buy than people who only bought new car. In the case

of equal payment in absolute terms, the higher the discount of old merchandise was, the more pleasure would obtain the consumers. When people sold an old product, an account would be closed, while people expected a revenue when they closed the account, because the end with gain could offer greater pleasure to the people. Therefore, comparing with the purchase price of new products, people were more concerned about the selling price of old products.

Emotional account

Mental account not only represents "deposit", but also saves personal mental energy. Mental accounting has psychological synonym which is called "self-esteem" (Robins, R. & Orth, U., 2014). People with higher sense of self-worth, his sense of self-efficacy is also higher, while he has stronger mobility and makes decisions more confidently; people with lower sense of self-worth, his sense of self-efficacy is more weak, he always hesitates to make a decision and lacks of action. This lack of mobility leads to a lower sense of self-worth, thereby he may drop to a vicious cycle. This is a cycle: the sense of self-worth determines personal ability of making choice or making decisions. While the ability of making decisions can determines personal mobility - then the mobility determines personal sense of self-efficacy. "I can do it, so I can do it ". The result of each action directly determines people's sense of self worth, every action can increase the psychological account" deposit "or reduce this" deposit. " Whether it is increasing or decreasing, keeps the action and does not give up action, it can enrich mental accounts continuously. As feelings in certain specific conditions, angry, guilt, disappointment, etc. What is the difference between consumer's choices? People can use emotion account to manage their mood. The emotion impacts on economic and cultural environment. If people find cash in their pockets accidentally, they will show positive emotion, but if the money is picked up on the road, they may have negative emotion.

We give an example of an emotional account. Chinese lucky money is a kind of money that is traditionally given in red packages to young people during the Chinese New Year. These red envelopes of money are called "Hong Bao". Symbols of wealth and luck usually decorate the outside of the red money packages. Red envelopes are used for Chinese lucky money as the Chinese consider red the color of luck and happiness. Chinese lucky money may be given in the form of coins, bills or checks. The amount of Chinese lucky money are contained in the packages that depend on the finances of the giver, the occasion and the age of the recipient. The closeness of the relationship between the giver and the recipient of the Chinese lucky money also affect the amount of cash given. During the Chinese New Year, older children usually receive more lucky

money in their red envelopes than younger children. According to the traditional Chinese culture, every New Year's Eve, parents place red envelopes under their children's pillows as a New Year's gift. Thus, the Chinese electricity providers have developed an electronic red envelopes which are more and more popular in China. "Since have appeared the electronic red envelopes, Chinese people are very enjoy in grabbing or gifting electronic red envelope. The electronic red envelope has completely destroyed people's standards and values. If there was 1 yuan on ground, people even may not look at it. But now an electronic red envelope of more than 1 yuan, people will think it is a huge sum of money. If it is more than 5 yuan they would suffocate. This a perfect reflection of the money that comes from grabbing a electronic red envelope money is from another mental account. When people can grab a red envelope for regarding profit, and the average of profit has only a very small quantity, people's desired degree is not high. if people get more amount of red envelopes (for example a high quantity), it will bring a greater satisfaction to people who are willing to invest the time to this activity. Although people may only get few money, because of that grabbing a red envelope is a mental account means more than other mental accounts, people believe that 1 yuan of this account is higher than 1 yuan of others accounts.

People often divide their wealth into fixed accounts and temporary accounts. The money in fixed account is for predetermined expenses, people do not want to spend it on temporary use because of their self-control. In the design of bundling sales, providers consciously blur the boundaries between these two accounts and try to weaken consumers' awareness of self-control, then achieve their sales goals. For example, insurance companies and commercial banks strengthen their cooperation, the insurance of business as life insurance has been developing rapidly in bank sector. Consumers pay the premiums directly to the bank account, insurance companies extract the money directly from the bank. In this transaction, by the intermediary of bank with its specific security function, banks and insurance companies reach double win. People often separate their wage and annual dividend, separate their normal income and windfall, spend these money in different ways. For daily wage, people can predict the amount of income because this income is fixed. When they spend it, they make plans and use the income more carefully, so self-control makes an important role in this case. When people spend un expected income, they will save this windfall in another mental account, use it in different accounting methods and calculate it with psychological mental budgetary rules, so they often go beyond their daily consumption habits and spend it generously. In this case people is less or no self- control. Traditional finance is unable to distinguish the capital in this way. It considers that a family or a pension plan for all funds as a unified whole, seek a total wealth effectively that takes into account the risks, benefits

and investment strategy. It also takes into account the financial status when it is replaced (if the owner is the same person, then the funds in this account and the funds in another account are the same). In addition, it is also very important that traditional finance takes into account the relationship between the different responsibilities and objectives, in which may exist different investment accounts. Separated accounts and separated investment strategy for each individual account may ignore the relationship between these accounts, which may be the extensive inefficiency of applying mental accounts, therefore, people should be careful when they use mental accounting. People often divide their consumption into living expenses, entertainment expenses, transport expense and etc.. When people spend their money, they often think about their real situations, set up different mental limitations (internal commitment) for different consumer accounts. If the cost exceed the ceiling, people will use self-control to reduce the overall of utility effectiveness.

"Mental accounting" effects can be easily overlooked in real marketing strategy, because it often occurs. In bundling sales, providers may utilize the opportunity of holidays when people get dividends and bonuses to carry out the bundling sale of luxury goods, people tend to be generously at their moment of vacations, as Thanksgiving, Christmas and New Year, their spending may be accounted into an important proportion in the total sales, and become one of the vane of economic trends observation. Domestic providers aware the importance of holidays, and proposed a "holiday economy" concept that offers a big promotion in various festivals, so daily sales often can exceed its monthly sales. In addition, when the providers implement bundling sales, as the promotion of some non-commodity, they bundle commodity goods with these non commodity, we can call it complementary goods sales or non-related commodity bundling sales. These sells can bundle the price, by selling the goods with the original price or less than the original price, through the price incentives to inhibit consumer self-control, then to achieve their promotion of new products and development of new markets. As another example, many supermarkets and shopping malls like cooperating with enterprises to issue gift cards. The utility of shopping card is not to pay the convenience, but they are often based on quarterly bonuses, holiday benefits, customer relationship. They are placed in a relatively "bonus" of mental account so few people will be equivalent the gift card to the amount of their own wages, they will be more generous in the consumption of the card. This marketing strategy applies "mental accounting" effect, so it is important to distinguish the real money income and shopping card. Some shopping malls think from the customers point of view, so they increased shopping card exchange, prepaid deposit with bank card and other services. What they plan will blur the boundaries between gift mental account and "labor income" that is not conducive to stimulating

consumer consumption. Coupons are tangible alienation bills which denominations are not high, consumers will have to pay some extra fee to enjoy the total benefits of coupons generally, and it is precisely the purpose of providers. By splitting "money view" that comes from different mental accounts with different sources of income, it is also called "endowment effect". It refers to people's estimation of the value of a commodity that is not static. When people own their articles, they will evaluate them with the value much higher than when they have not own them. People who have coupons, always think they have the equivalent of coupons with denomination money, regardless of the necessary of coupons, they are reluctant to give up the opportunity to use them, so they pay more money for spending the coupons at last. In the study of the consumer behavior, not only the real price can decide the consumer purchase decision making , but also the consumer subjective judgment can affect purchase decisions. When consumer evaluate is the commodity price is attractive, they compare the real price with their internal price standard, while the result will affect their decision making and purchase behavior. Consumers prefer to hold commodity prices to purchase some of the internal standard that is called internal reference price (internal reference price) by scholars. Internal reference price is formed by many factors as experience, brand awareness and ect. that have existed in the minds of consumer. Different price reference points will make different decision trees and change people's utility of transactions and total utility value.

Anchoring Effect and Adjusting Effect

Anchoring effect and adjusting effect (Epley, N. & Gilovich, T., 2001) are also commonly applied in mental accounting. When people judge the number of uncertain things, they often choose a number that is available to get (sometimes this number is pure noise), as an estimated initial point (anchor) and then they adjust basic estimation on the initial point. Because of their information is asymmetry and is sufficient, their adjustment may be biased, so the final value is highly dependent on the initial point - the anchoring point. For example, manufacturers make a high original price as the standard reference price, so consumers will anchor a high price as an anchoring point and adjust the acceptable price based on this initial price. After this adjustment, a relative high reference price will increase their transaction utility, also will left the manufacturers a higher benefit margin. According to the study of Biswas and Blair (Biswas and Blair, 1991), by comparing of the price that leaded the internal reference price to move to the compared price. Manufacturers often made a compared price higher than the original reference price of consumers, so this movement would rise the consumer transaction utility.

"Anchoring effect" - the mystery of luxury

Customers always confuse about the price of products, those products with high price often can attract consumer's attention (even if they will not buy them). Do you have a similar experience: when you go shopping, you attract by a expensive camera, but its price is too high. Then the salesman tells you that they have another camera with similar performance but little less functions and its price is much more affordable. He also states that some features of the expensive camera that you like are not commonly used. So, you bought this more "affordable" camera by thinking that you have picked up a big bargain happily. As early as 1974, Tversky and Kahneman proposed a method called "anchoring effect" for human behavior, and later Kahneman won the Nobel Prize of 2002 in economics. According to their definition, anchoring effect refers to a initial number that people carried out estimating, an initial number that is given arbitrarily will lead biased estimation of this number. To be honestly, customers are not used to do true or false choice, they like making choice in the portfolio of customers. This anchoring effect is not simply due to people's occasional and irrational behavior, but also is inherent in human nature.

"Intertemporal choice" - the mystery of credit card

Since the birth of credit card, consumers began to fall into a black hole on payment behavior. The benefit of credit card is to consider the time value of money, because of that a prepaid consumption can utilize bank overdraft spread. However, only a few days of overdraft period can really bring so much benefit to consumers? In reality, the most obvious feeling is that spend 500 euro by credit card is easier than pay 500 euro in cash, even if the credit card is exposed brush monthly, people is difficult to feel painful of these costs. when people use credit card to pay, they are more likely to forget how much it had spent. In fact, credit card plays a role of "cut-off machine", it can separate the pleasure of shopping and the pain of payment completely. On one hand, it is to enjoy the satisfaction of current consumption, on the other hand, it is to delay the payment in the future, which will bring "intertemporal choice"(Thaler, R. & Loewenstein, G., 1989) psychological effect to people when they pay by credit card. It refers to the process that people discount and evaluate costs and income in different time scales, maybe they use interest rate in the discounting rarely, but they may experience different emotions. In general, people cannot resist the great temptation of current enjoyment (better than future enjoyment) and future suffering (more than current suffering), so they will fall into current satisfaction and overlook the long term expense. This psychological effect is not only appear in credit cards, but also in

smoking, eating junk food, alcohol and other addictive activities. Personal finance cannot avoid the consumers to drop into credit card debt, so it is important to have a possible mechanism for ending the intertemporal effect when the purchase behavior happens. Maybe a blocking system of credit card payment will work. Customers can preset a series standards of consumption for credit card, when the daily or monthly purchase is over the normal frequency, the credit card will control the next payment automatically. This technology is not complicate, but there is no bank wants to adopt it. On the contrary, the process of using credit card is more and more convenient, the overdraft limit is more and more higher. The purpose of bank is clear, they wish "intertamporary effect" occur more frequently. Recently, a popular method that is called "Credit Card freezing" is approach to curb the growing overdraft of credit card: pour a glass of water and put a credit card into the water, then freeze the glass into the refrigerator; when you ignite the desire to buy something with credit card, people must take the glass out of the refrigerator, and wait half an hour until the ice is completely melted. And this half an hour may help people be calm down to restore their sanity.

According to the theory of mental accounting, spending the same amount of money with different purposes can also be differentiated in our mental accounts. By setting up folders for different uses, classifying the money for different uses will help us manage personal mental accounts more efficiently. So how can we classify it more efficiently? People spend their money in three ways: consumption, investment and wasting. Consumption is refered to after spending 100 euro, 100 euro can get it utility value, as company office supplies, individual food and clothing expenses, they are equivalent exchanges. And investment is paid money but will not be rewarded immediately, and it will be harvested in the future. For example, enterprise staff training, individual learning and etc.. It also can be called delay exchange, but the delay value will not be measure just by past paid money. If you had spent 3,000 euro to learn English, then you get a promotion because English ability, the increase income is not just worth 3000 euro. If only exist consumption and wasting in your mental accounts, you at least will be satisfied in short period, the cost of investment is the money of real long term development. Therefore, the mental account preferences is an important issue in investment. For example, many investors may invest the funds are deposited in several accounts (mental and actual accounts). To Imagine a simple division of investment portfolio and speculative portfolio. The problem of this division is that is the investor holds a investment portfolio, the net asset value of this portfolio will remain unchanged. By dividing these two portfolios, investors may incline to reduce profitable projects of speculative account, and improve security account to a pre-determined psychological level.
Mental accounting in financial decision making has high frequency in the construction of

portfolios. According to the rational portfolio theory, investors should only care about the expected utility of their portfolios and not about the specific portfolio components (Neumann and Morgenstern, 1947 and Savage, 1954). In contrast, a tendency that investors prefer to split up their investments into a safe account, designed for securing the wealth level, and a risky account for speculation is often observed. In behavioral portfolio theory, investors apply “risk budgeting” to their portfolios and allocate the risk budget to the satellite layer. This is what investors do when they choose to take a LOT more risk with some of their money, namely the money in the satellite layer, rather than take a LITTLE more risk with ALL, their money, namely the overall money in both the core and satellite layers.

The Peculiar "mental accounts" effect is commonly applied in investment funds. The most important manifestation is "sell off loss" and "non sell off loss" in different mental accounts. Before selling the funds with loss, people only have book losses; but after selling the funds with loss, people will have real losses. Actually, there is no difference between these two situations, but people have defined strict boundaries for these two options in their mental accounts. From book loss to real loss, the latter makes people feel more real, so they also feel more painful. That is why many investors lose rationality after being hold up, then give up the trading operation. Another phenomenon of mental accounts in fund investment is to separate different investments in different mental accounts, for example, separate the earning of fund A and the loss of fund B strictly, account them independently. Normally, the pain of loss is more stronger than the happiness of same amount of benefits, so people feel more hurtful when they face the funds with loss. There is no doubt that this is an irrational decision to keep them. Holding the funds with loss till them relief from loss is the same to give a reward to these funds with bad performance. In many cases, fund investors cannot evaluate funds system correctly and completely. When people evaluate performance of funds, they have to pay attention to investment strategies and investment opportunities. Therefore an important factor of fund investment is to be rational.

Similarly, mental accounting, investors short sight and loss aversion can help us explain the persistence of the equity risk premium. In economics and decision theory, loss aversion refers to people's tendency to strongly prefer avoiding losses to acquiring gains. And short sight refers to decisions, considerations, pursuits are only focus on effect of short term, not of long term. Thaler and Benartzi believed that investors continuously hope that the account gets more "profit", which encouraged them to invest in safer and lower volatility assets (such as bonds). Investors often checked their accounts which leads excessive trading. This enabled them to see the results of their investment strategy in a short time (most investment analysis takes annually), and avoided

the pain caused by short-term losses of higher volatility assets (such as stocks), but these higher volatility assets may perform well in long-term. In short, if there are enough short-sighted investors and loss aversion investors, which can explain why more rational, more patient investors can obtain more returns from the long-term investment. The reason why investors cannot make rational decisions, then negative effects of mental accounting in play an important role. In investments, we can also see the impact of mental accounting on people's decision making. There is a famous experiment proved by Kahneman and Tversky: people were more sensitive to losses than to profits. Most people sold their funds with less loss or with low benefit to seek psychological comfort. They believed that they were still earning money from their investments. Mental accounting disturb investments to a great extent, that is why more researches of this area should be carried off.

3.2.2 The application of psychological account factors in personal venture capital

3.2.2.1 Risk tolerance of investors

Oliveira and Beyhaghi (Oliveira, M. Kadapakkam, P. & Beyhaghi, M., 2017) studied how financial distress of a significant customer impacts capital structure of suppliers by using a U.S. firms sample. At this stage, we will discuss the impact of mental account factors on personal risk investment, which tends to play an important role in personal finance. Before examining the correlation between individual mental accounts and their venture capital, we use a set of tests that is commonly used in financial institutions to assess the risk appetite and risk appetite of their client investor's investment risk preferences from the perspective of age, occupation, income, family status, home ownership, investment objectives, loss tolerance and profit preference. The results divide investors into five categories:

a. extraordinary conservative investor

Character: retired people, low-income families, big families and conservative investors who have low investment risk tolerance. The first object of their investment instrument is to protect capital , then is the pursuit of profit.

Financing advise: Low-risk, highly liquid investments. Therefore, the type of investors often choose bonds, deposits, financial products with guarantee, investment-linked insurance, bond

funds or others low-risk, low-yielding products.

b. moderate conservative investor

Character: this type of investors tend to be conservative. They concern about risks more than profits, so they prefer to the financial product with lower risk than with higher return. Most of them are middle-aged and elderly people.

Financial advice: investment with low or medium risk and profit. These investors often choose structured financial products with stable risk and profit.

c. steady investor

Character: Neither risk-averse nor risk-seeking. This type of investor is rational to any investment. They analyze the market, investment instrument and financial product carefully, and find out investment with moderate risk and return. They gain profit about market average level, while take on the average risk.

Financial advice: sustain above-average investment returns through long-term. They usually pay more attention to average earnings within decades or even longer period. Therefore, this type of investor often choose the property, funds or other similar investment.

d. moderate aggressive investor

Character: with certain economic strength, certain investment knowledge and higher risk tolerance. They take on certain risk to pursuit higher risk investment returns, but they are not like extraordinary aggressive investors who are excessively risky to invest on instruments with high risk.

Financial advice: investment products with moderate or high risk and return. This type of investor often choose equity funds or others products for long-term investment. Therefore, they can gain higher return with less risk.

e. extraordinary aggressive investor

Character: relatively young, with professional knowledge and skills, daring, with fewer social burden. They have higher risk tolerance and remain aggressive investment philosophy even face to high volatility of investment return. These investors take short-term investment return declining as a good opportunity to raise their investments.

Financial advice: flexible, risk and reward are high investment. These investors dare to invest on options, futures, foreign exchange, equities, artwork that have high-risk and high-yield products. They trade frequently, so need more accurate risk management and capital allocation.

In order to investigate how mental accounting affects the individuals to make investment decision, we know that personal financial service is designed by particular investment portfolio for different clients. Investment portfolios can be personalize， even unique, they are all dependent on the client demands. Therefore, in our experiment, for distinguishing the investors behavior effectively, we only divided investors into three types, type A - conservative investor, type B - steady investor and type C - aggressive investor. All the participants in our experiment are categorized to these three standard types. Similarly, in order to test the psychological change and behavior model of these three types of investors in real investment environment, we selected two simulated investment environments. The first simulated investment environment is from May, 1st, 2007 to May 14th, 2007 (10 days), and the second simulated investment environment is from September 2nd, 2008 to September 15th, 2008 (10 days). We defined the first simulated environment as bull market and the second simulated environment as bear market. We choose three stocks from each of the Shanghai and Shenzhen 300 Index and EUROSTAXX 600 Index, these six stocks had significant difference between the return rate and volatility and provided different risk portfolios for different investors based on their investment risk preferences (Table 1).

In the bull market simulated investment environment, we selected a portfolio of low yield (RE) and low risk (VAR) for conservative investor A, and a high-yield and high-risk portfolio for aggressive investor - C. As a comparative sample, we applied the same investment portfolio of investor C for the stable investor - B to observe the differences between the stable investors and the aggressive investors.

In the bear market (Table 2) simulated investment environment, we selected a portfolio of low

lost (RE) for conservative investor A, and a high lost portfolio for aggressive investor - C. As a comparative sample, we applied the same investment portfolio of investor C for the stable investor - B to observe the differences between the stable investors and the aggressive investors. In this step of experiment, there is a small difference between the portfolio with low lost rate (-1.06%) and the portfolio with high lost rate (-2.00%), but their risk volatility are conversed. It means that in a bear market, the lower is the lost , the higher the is the risk.

We divided our experiment into two stages - bull market and bear market. In the bull market stage, three types of investors had the same initial capital (10,000 euro). At the beginning, they could allocated the proportion fund among three stocks of their investment portfolio. In the total 10 days investment period, they could change the allocation of their investment at any time, for example, they were free to change the proportion of their investment funds or to end their investment experiment. In the bear market stage, the investors are announced that they were in a bear market, they had right to choose if or not invest their initial fund. Their initial fund could be 10,000 euro or 10,000 euro plus their earning in the bull market stage. The investment process was same to the bull market. By the reason of that the portfolio design can be personalized, instead of using an average level of a sample data as a reference, we only selected three investors of different types to make an example. In addition, choosing individual investors can facilitate us to record investors' true psychological thinking in each time of changing in investment decisions. The mental factor can cause different investment decisions, for example Moro and Mantovani (Moro, A. Wisniewski, T. & Mantovani, G., 2017) investigated that female-run firms were less likely to file a loan application than male-run firms. There exist a positive relation between divergence of sentiment and stock price volatility (Signanos, A. Vegenas-Nanos, E. & Verwijmeren, P., 2017). In the next paragraph, we will discuss the differences between these three types of investors psychological changes and behavior models in different simulated investment environments:

Bull market investment environment

The Table 3 is about the investment portfolio of the conservative investor A in a bull market. As the initial decision, investor A allocated his investment fund 10,000 euro in a portfolio of 25% - stock 1, 50% - stock 2 and 25% - stock 3. At the beginning, investor A tended to allocate his funds to the stock with higher return (stock 2). The next day, he thought: "I have earned a lot of money by making right decisions." The fourth day, he said "I lost money." Even if his portfolio was still profitable comparing with his initial position, but because of the stock price, he was

sensitive of the loss because of stock prices drop. On the fifth day, He sold 25% of Stock 2 and transferred this part of fund to invest in Stock 3 that was more stable. On the eighth day, he sold all his Stock 2 and sat out the funds to invest in Stock 1. This behavior showed that, after earning higher profits, the investor A tended to set out the profit and did not want to wait for higher profits of Stock 2, which meant that in his expectation, the Stock 2 had reached its upper limit increasing at this moment. He believed that the price of Stock 2 was possible fell down. On the tenth day, investor A finished his experiment of investing in the bull market and earned 27% of profits.

The Table 4 is about the investment portfolio of the stable investor B in a bull market. As the initial decision, investor B allocated his investment fund 10,000 euro in a portfolio of 35% - stock 1, 40% - stock 2 and 25% - stock 3. The third day, investor B was glad and said: "I have earned a lot of money." On the fifth day, investor B sold all Stock 1. Because of the price of Stock 1 had raised to the upper limit of his expectation and realized a leap in price at this moment, he believed that its price might fall, so he decided to sell all stock 1. On the sixth day, because of the price of Stock 1 had raised to the roof of his expectation and realized a leap of price at this moment, he believed that its price might fall, so he decided to sell all Stock 3. On the seventh day, investor B finished his experiment of investing in the bull market and earned 29.5% of profits. He felt very happy of his earning. When the portfolio profit exceeded his expectation, he felt enough psychological satisfaction, so he stopped to suffer more risk of future losses, and no longer looked forward to more future earnings, so he chosen to end his experiment in the simulated bull market before the whole experiment period (10 days).

The Table 5 is about the investment portfolio of the conservative investor C in a bull market. As the initial decision, investor A allocated his investment fund 10,000 euro in a portfolio of 25% - stock 1, 25% - stock 2 and 50% - stock 3. At the beginning, investor A tended to allocate his funds to the stock with low price (stock 3). The third day, he was excided: "I have earned a lot of money because I never invested in high price stock before." The fourth day, he thought that the price of Stock 2 had high volatility, so he believed that its price would continuously raised. He sold 15% of Stock 3 and invested its income to Stock 2. On the fifth day, the price of Stock 1 increased significantly and investor C earned a lot of benefits, he decided to sold all Stock 1. On the sixth day, he thought the Stock 2 was stable, so he invested all his income of Stock 1 to Stock 2. On the eighth day, he sold all his Stock 1 and Stock 2, only hold the Stock 2. When the portfolio profit reached his expectation, he preferred to invest his fund to stable stocks for obtaining stable future profits. On the tenth day, investor B finished his experiment of investing

in the bull market and earned 116% of profits.

Comparing among these three investors mental accounts and their behaviors, during the ten day experiment period, from investor A to investor C, conservative investor A changed 3 times his portfolio, stable investor B changed 4 times his portfolio and aggressive investor C changed 5 times his portfolio. Their frequency of adjusting investment portfolio increased. This result is in line with the results of their risk appétit test. The investor A, after gaining a certain amount of benefits, tended to hold a stable stock. For him, the profit is not the most important objective, but the loss prevention is most important. Although the investor B adjusted his portfolio several times, he was more inclined to stop investing after obtaining expected return. He got away from the investment activity to avoid future profits and losses totally. The investor C was the most aggressive investor who had the highest expectation of profits. On one hand, after gaining a higher return, he preferred to continue to hold a fraction of the high volatility stock, but did not sell all of them as investor B. He still expected to continuously get more future returns. On the other hand, investor C also had a rational behavior, after obtaining more high returns, he focused his investment funds on stable stock. On one hand, he tried avoid future risk, on the other hand, he was greed of more future profits. He determined a lower risk tolerance limit and modified his portfolio by this new limit.

Bear market investment environment

The Table 6 is about the investment portfolio of the conservative investor A in a beat market. He decided to save his profits that he earned from the bear market, only invested the 10,000 euro initial fund in the bear market. As the initial decision, investor A allocated his investment fund 10,000 euro in a portfolio of 25% - stock 1, 25% - stock 2 and 50% - stock 3. In the bear market, investor A took a prudent position, so he separated his previous income and initial fund into different mental accounts. This is a real example of mental accounting application. Because of afraid of loss, he only used the initial fund that was not his money to invest and he preferred to invest in low price stock (Stock 3). On the third day, investor A sold all stocks 1 and used its fund to invest in stocks 3, which indicated that he was inclined to invest stable stock. The fourth day, his said "my decision was really good, I only lost a little money." On the fifth day, investor A sold all stocks 2 and invested this part of fund to Stock 1, because he believed that Stock 1 still had probability of increasing. On the sixth day, he sold all Stock 1 and invested its income to stocks 3, after obtaining a few of profits, he tended to hold more stable stock. The seventh day, his thought "The price of stock 1 is still rising, but it is really fortunate that I sold the stock 2".

The ninth day, his said "It is really good, my stock 3 is earning benefits." It is easy to see that investor A has a strong risk aversion and he is very satisfied with his risk aversion behavior. On the tenth day, investor A finished his experiment of investing in the bear market and earned 13% of profits.

The Table 7 is about the investment portfolio of the stable investor B in a beat market. As the initial decision, investor B allocated his investment fund 10,000 euro in a portfolio of 30% - stock 1, 30% - stock 2 and 40% - stock 3. Unlike investor A, investor B was willing to reinvest the profits that he earned in the previous period, which showed that he did not separate earnings from initial investment capital , he put them together into the same mental account. The next day, he thought "I know that I am in a bear market. Even if I want to sell the stock, I prefer to keep them at this moment". It meant that investor B was not optimistic about the risk in a bear market, but he was still willing to take a certain risk and continued to wait for the stock price changes. On the third day, he sold all Stock 2, and invested these funds to the stock 1 and the stock 3 equally. Since the price of stock 2 was not used to change, but stock 1 and stock 3 kept increasing, so he decided to pursue higher profits, even if he knew that the risk existed. On the sixth day, he sold all his stocks, ending the bear market simulated environment investment experiment before the end of 10 day period and earned 44% of the profits.

The Table 8 is about the investment portfolio of the aggressive investor C in a beat market. As the initial decision, investor C allocated his investment fund 10,000 euro in a portfolio of 25% - stock 1, 55% - stock 2 and 25% - stock 3. Unlike investor A, investor C was willing to reinvest the profits that he earned in the previous period, which showed that he did not separate earnings from initial investment capital , he put them together into the same mental account. The same as in previous experiment, in the bear market, investor C still tended to allocate his funds to low price stock 2. On the fourth day, he sold all stock 3 and invested his income to Stock 1. When he suffered a loss, he immediately sold the declining stock and invested his fund to stable stock. This behavior indicated that the investor C had a keenness of risk aversion. On the seventh day, he sold all Stock 2 and invested its fund to Stock 1, which showed his attitude of seeking stability. On the ninth day, he sold all Stock 1 and used all his money to invest in stocks 3. This behavior reflected his strong speculation of Stock 3. Because of the high volatility of Stock 3, he believed that it had a great probability of rebound, the price of Stock 3 may rise. On the tenth day, investor C finished his experiment of investing in the bear market and got 49% of loss.

Comparing among these three investors mental accounts and their behaviors, during the ten day

experiment period, from investor A to investor C, conservative investor A changed 3 times his portfolio, stable investor B changed 2 times his portfolio and aggressive investor C changed 3 times his portfolio. Their frequency of adjusting investment portfolio was similar. In the process of investment adjustment, all of them showed the risk aversion behaviors. In the bear market, all of them were cautious and had a prudent attitude. They did not want to trade stock frequently. Only the investor took high investment risk. At the final stage of his investment, he took a desperate attitude and hope to reverse the situation in order to obtain profits of speculative behaviors. Regardless of the degree of risk appetite, these three investors had similar behaviors. In the bull market, their trading frequency was more than in the bear market, which indicated that they were risk aversion. However, it was worth to mention that the conservative investor A was more risk aversion, he divided the profit mental account and loss mental account more clearly. Meanwhile, he was less confident with his judgment. When he made wrong decisions, he tended to seek self-confidence. On contract, investor C was willing to take higher risks because he wished to get higher returns, even if he was aware of the high risk of stock prices drop. To pursue higher profits, he accepted to take higher risk and used it to validate their investment decisions. At the same time, aggressive investor C was overconfident of his ability of predicting future stock price. In summary, the stable investor maintained consistent attitude, as far as possible to obtain benefits while avoiding losses. Once profits reached his expectation, he immediately terminated the investment activity. He was not willing to take more risk and did not expect higher future returns. To sum up, when we design investment portfolio, we have to take into account the psychological factors on the impact of investment decisions, and design propitiated investment portfolio by investors risk appetite and their mental accounts.

3.2.3 Mental account cost and net income

After studying the risk appetites of different investors, before designing appropriate portfolio for different types of investors, we must consider an important factor of investment portfolio - the investment cost. When we calculate the portfolio returns, we have to reduce the cost from total income, while the net benefit will be the real and final investment returns. For obtaining benefits, we have to make sure the profit is higher than the cost. In recent years, electronic commutations networks (ECNs) have been created in many countries to match orders between buyers and sellers. With an ECN, investors can place orders on their computers that are then executed by the computer system and confirmed through the Internet to the investor. Thus, all parts of the trading process from the placement of the order to the confirmation that the transaction has been executed are conducted by computer. The ease with which such orders can occur, regardless of

the locations of the investor and the stock exchange, is sure to increase the volume of international stock transactions in the future. The impact of technological advances in telecommunications and information technology showed that the costs of surmounting natural impediments to international financial transactions have fallen sharply.

3.2.3.1 Chinese stock market investment costs

In Chinese stock market, stock trading fees include stamp duty, transfer fees, brokerage fees, custody fees and brokerage trading commissions.

a. Stamp Duty

All securities listed on the Exchange are subject to a stamp duty at a rate of 0.1% (rounded up to the nearest dollar) on the value of the transaction, for the seller. That is the transaction stamp duty of seller (or inheritance, or gift A share, B share) levy securities (stock), the buyer (the transferee) does not need to pay it. Stamp duty is imposed by the state, has nothing to do with the broker and bonds and funds can exempt from this tax.

b. transfer fees

Transfer fee is the equity registration fee entrusted to exchange stocks that the paid by the buyer and seller. It is income of the securities registration and settlement agency, with is collected by the broker. Transfer fee is only charged by the Shanghai Stock Exchange, the Shenzhen Stock Exchange does not charge it. This fee is charged at the price of 0.6 % of the par value of the shares (the face value of the circulating stock and the most part is 1 yuan per share).

c. brokerage fees

Brokerage fee is the transaction of stock exchange when the transaction is finished. Shanghai Stock Exchange and Shenzhen Stock Exchange trading (two-way) are based on turnover of 0.0696 ‰ of trading value.

d. custody fee

Custody fee is the administration fee of security transaction. It is 0.02‰ of trading value. The fees is charged by the broker after the exchange by the China Securities Regulatory Commission.

e. brokerage trading commissions

Brokerage trading commission is the commission that the custom pay to the broker when they trading their stocks. The maximum transactions are less than 3% and the lowest cost is 5 yuan. A single transaction commission should be less than 5 yuan. Normally, a general brokerage commission includes securities regulatory fees and securities trading fees, securities management fees and handling fees are also known as the transaction fees. Various brokerage fees are vary, people can consult it before trading their stocks. Brokerage commission is the only stock trading fee can be reduced. For example, online trading commission is even lower than 5‰. If one client has more than one account, he can open an account in different brokerages, comparing their costs to choose the best one.

The following example is an example of the investment cost in Chinese stock market:

We calculated the cost of Chinese stock market, the main costs may include: include stamp duty, transfer fees, brokerage fees, custody fees and brokerage trading commissions. Suppose we buy 10 thousand shares of a stock with the price of 10 yuan/share and brokerage commissions is 1 per thousand (including collection fees and handling fees). The cost of this transaction is 100,106 yuan. At what price we can sell the stock with profits? (purchase price + transaction fees) / (1- duty rate - commission rate) / number of shares = 100,106 / (1-0.001-0.001) / 10000 = 10.03 yuan, so when the expected return is higher than 0.3%, the selling is profitable.

3.2.3.2 European stock market investment costs

In order to predict better future stock returns, we need to calculate the investment costs and subtracting these costs from earnings to get the net investment return. Then, we calculated the cost of the European stock market that may include: administrative fee, for example 25 euro per order/0.5% of trade value. Custody fee is depended on number of holding, for example, 2 euro per holding ever quarter. The transferring paper certificate shares into electronic form is usually free. There may exist some costs of third party as exchange access fees, stamp duty taxes, settlement fees and cleaning fees. They can be a percentage of trade value or a flat fee. Due to

the diversified investment costs of European stock markets, investors can find out a lowest cost for their stock investment.

In the European stock market, people can choose the stock investment costs between a fixed rate and the ladder cost, certainly, different euro-zone countries may apply a fee that only fits this country.

In the euro zone countries, for a fixed cost, an unilateral commission is 0.10% of the transaction value. The minimum transaction cost is 10 euro per trade and the minimum transaction fee by phone is 25 euro per trade. For ladder cost, the higher is the trading value, the lower is the transaction cost. In the following table, we can see the list of ladder costs (Table 9).

And the following example is an example of the investment cost in European stock market:

We calculated the cost of European stock market. Suppose we buy 10 thousand shares of a stock with the price of 10 euro/share and fixed transaction cost is 0.10% and the ladder transaction cost is 0.08%. The fixed cost is 100 euro and the ladder cost is 81.25 euro. In what price we can sell the stock with profits? transaction fees / number of shares = 100.000 euro*0.08%+29 euro / 10.000 = 109 / 10.000 = 0.11%, so when the expected return is higher than 0.11%, the selling is profitable.

And the following example is an example of the investment cost in European stock market:

We calculated the cost of European stock market. Suppose we buy 10 thousand shares of a stock with the price of 10 euro / share and fixed transaction cost is 0.10% and the ladder transaction cost is 0.08%. The fixed cost is 100 euro and the ladder cost is 81.25 euro. In what price we can sell the stock with profits? transaction fees / number of shares = 100.000 euro*0.08%+29 euro / 10.000 = 109 / 10.000 = 0.11%, so when the expected return is higher than 0.11%, the selling is profitable.

3.2.4 Design investment portfolio basing on mental account

3.2.4.1 The relationship between risk preference and investment decision

In the previous phase, we learned that different investors may make different investment decisions even if with a same portfolio, as they have different investment risk preferences, so they may evaluate a same risk or a same return with different ways. Moreover, we also calculate and analyze the investment cost in the Chinese stock market and the European stock market. Therefore, we have a conclusion. Before designing a investment portfolio, we need to understand our investors risk appetite, and design a propitiated portfolio according to their investment hobby. This method can reduce investors to make irrational decisions during their investment period. Before modifying the investment portfolio, we have to know the real cost of this adjustment, so we will be able to set a time point of transaction and will be able to estimate the future expected return. In the previous experiment, we classify the investor's risk appetite to three types. Similarly, we can also divided into the investment risk to three levels, which are high risk, medium risk and low risk.

3.2.4.2 Valuate investment portfolio by return rate, risk coefficient and financial indicators

When investors make investment decisions, they always have a future expected return level, but there exists a gap between their expected return and the real return (Elton, E., 1999). The real return could be higher or lower than the expectation, even could be a loss or volatility rate. All these possibilities can be considered as the investment risk, in another word, we can call it uncertainty of investment income. For example, security investment risk can be divided into two kinds, systematic risk and non-systematic risk. The systemic risk refers to the price volatility that is caused by macro economy, market sensibility or others factors. In other words, it is the linkage between stocks and broader market. The higher the systemic risk is, the greater the linkage is. Non-systematic risk is also called non-market risk or decentralized risk. It refers to a kind of risk which is caused by a particular company or a particular stock. It is always caused by a special factor that is not connected to the market price or systemic risk, but is connected to the expected return of serious particular stocks. We can call it specific risk that is brought from a specific event like a strike by a company's workers, failure to develop new products, loss of important sales contracts, litigation failure, the discovery of new miners or signing an important contract.

For the assessment of systemic risk (Acemoglu, D. & Ozdaglar, A., 2015), we can explain its fluctuation that can be described by the concept of probability distribution and standard deviation

in mathematical statistics with the objective of estimating the possible price volatility and future expected return. So the evaluation of the non-systematic risk can convert to a calculation as mean or standard deviation of the probability distribution of the future returns of the stock reflects the total risk of the stock investment. For a non-systematic risk (Howard, M., 2006), by using the basic principle of the financial indicators evaluation is a more direct method. It is to use the information provided by the financial statements and company's market value of enterprises to compile or select a set of index system to reflect the business performance and the stock value which is issued by the enterprise. On this basis, a dynamic analysis can determine the investment risk by combining subjective judgment and objective factors. Financial indicators can be absolute indicators, such as indicators of the amount of stock returns or a relative amount of indicators, such as changes in the level of stock returns, the size of solvency ratio of various types and so on. People believe that the financial information as an important investment indicator. Kim and Sohn (Kim, D. & Sohn, W., 2017) found that the increment of company growth rate was positively associated with the level of company liquidity, but only for large companies. Fauver and Taboada (Fauver, L. Hung, M. Li, X. & Taboada, A., 2017) proved that the corporate board reforms had positive impact on increasing firm value. These impact factor can also affect the firm financing policy (Karpavičius, S. & Yu, F., 2017). As an example, Kim and Pereira (Kim, K. Patro, S. & Pereira, R., 2017) proved the effect of firm leverage raised from both the long-term and short-term components of debt and is significantly stronger during the financial crisis of 2007–2009. Dittmar and Lundbald (Dittmar, R. & Lundblad, C., 2017) also found that the firm characteristics and firm-level risk exposures had high relativity. In general, the using of financial indicators are included three categories: the first category is the stock profitability index, which includes earnings per share, dividend yield, dividend per share, price-earnings ratio and return on investment; the second category is the market price trend indicators, whose main indicator is the stock price index; the third category is the enterprise solvency index, including the liquidity ratio, quick ratio, cash ratio, accounts receivable turnover, inventory turnover ratio, the ratio of its own funds, debt ratio, the total equity ratio, liabilities to shareholders equity ratio and working capital ratio.

3.2.4.2.1 Systematic risk assessment - BETA coefficient

Markowitz, the founder of modern portfolio theory, first proposed the mean-variance model of portfolio in 1952, which became the classic research method in financial field and marked the beginning of modern portfolio of investment theory. The core of this model is to make the expected benefits of the portfolio investment risk in a smallest and certain risk, but its calculation

process is extremely complex. Twelve years later, economists William Sharp, Jan Lintner and Jan Mossin (William, S., 1966) put forward the Capital Asset Pricing Theory (CAPM), which has been continually improved of this theory in whole economic field.

Sharp's formula found out that the expected return of an individual stock or portfolio can be calculated:

$$\bar{\gamma}_{\mathbf{a}} = \gamma_f + \beta_\alpha * (\bar{\gamma}_m - \bar{\gamma}_f)$$

γ_f: (Risk free rate) is the riskless rate of return with pure monetary time value,
β_α: is the Beta coefficient of the security,
$\bar{\gamma}_m$: is the expected market return,
$(\bar{\gamma}_m - \bar{\gamma}_f)$: is the stock market premium.

A typical risk-free rate return is a 10-year government bond return. If the stock investor needs to take an additional risk, he will need to get a premium more than the risk-free rate of return. Then the equity market premium is equal to the market expected return minus the risk-free return. The security risk premium is the product of the stock market premium and a ß coefficient. The beta coefficient is a measure of systemic risk of security investment that measures the volatility of a security portfolio as an investment portfolio and it is relative to the overall market. In assessing stock market volatility risk and investment opportunities or risk. Beta coefficient is one of the most important indicators for measuring structural and systemic risk. The real meaning of this factor is measured their investment portfolios volatility of individual assets and compare them with overall market assets. It reflects the performance of an investment is relative to the broader market level.

Beta coefficient (Antony, C. & Jeevanand, S., 2007) is a measure of how individual assets' price can be affected by all the assets in the market, which is an important indicator uses the net return as an indicator to evaluate the company value. Assessors have to analyze all factors that may affect the beta coefficient to properly determine right estimation objects for the systemic risk. Beta coefficient reflects the individual stocks on the market (or market) changes in sensitivity, which means that individual stocks and the broader market have correlation or share characters. Hong and Sraer (Hong, H. & Sraer, D., 2016) proved that high-beta assets are prone to speculative overpricing. People can predict price trends by choosing a different beta for

securities according to market trend, which is more suitable for band operation. When people have great confidence to predict in a bull market or a broader market does not has a increased trend, they should choose stocks with high beta. Because that it will bring multiplied return than the average market return. It will bring you high returns. In situation of a bear market or a declining broad market, you should adjust your investment structure to protect against market risk and to avoid losses. The best way to do this is to select stocks with low beta coefficients. The larger the absolute value has β, the greater the magnitude of the change in returns that is relative to the broader market; the smaller the absolute value has β , the smaller the change in the magnitude of the change in returns that is relative to the broader market. If β is negative, it shows the trend of individual stock price is opposite of the trend of total broader market. When the tendency of market price is raised, its tendency is declined. It reflects the sensitivity of the individual stock price compared with the overall economic volatility, as a 1% change in the average market value, the change in assets' value in small percentage - or, more generally, how much is the impact of a 1% increment in broader market on individual stock price. In the calculation of beta coefficient, in addition to the stock performance data, we also need indicators that can reflect the performance of the broader market. If β is 1, the market average price rises 10%, the individual stock price rises 10%; the market average price drops 10%, the individual stock price falls 10% correspondingly. If β is 1.1, the individual stock price goes up 11% when the market average price goes up 10%, and the individual stock price goes down 11% when the market average price goes down 10%. If β is 0.9, the individual stock price goes up 9% when the market average price goes up 10% and the individual stock price goes down 9% when the market average price goes down 10%.

The systemic risk of individual asset is measured by β coefficient. By using the whole market as the reference, the risk return ratio of individual asset that is used to compare with the average risk return ratio of the whole market can be calculated as following formula:

$$\boldsymbol{\beta_a} = \frac{\boldsymbol{Cov(\gamma_a, \gamma_m)}}{\boldsymbol{\sigma_m^2}}$$

Cov (ra, rm): is the covariance between the individual stock returns and the market returns;
σ_m^2 : is the variance of market returns.

Because of that $\mathbf{Cov\ (r_a, r_m) = \rho_{am}\sigma_a\sigma_m}$, so β formula can be written as:

$$\beta_a = \frac{\sigma_a}{\sigma_m}$$

Where ρ_{am} is the correlation coefficient between individual stock and the whole stock market; σ_a is the standard deviation of stock a; σ_m is the standard deviation of market level .

According to this formula, the beta coefficient does not represent the direct relationship between stock price volatility and overall market volatility.

The value of β is defined as

◆ β = 1, which means that the risk-return ratio of the individual asset is the same as the market portfolio average risk-return ratio, and the risk of individual asset is consistent with the risk situation of the market portfolio;

◆ β > 1, indicating that the risk-return ratio of the individual asset is higher than the average market risk return, the risk of the individual asset is greater than the risk of the entire market portfolio;

◆ β < 1, indicating that the risk-to-return ratio of the individual asset is less than the average market risk return, the risk of the individual asset is less than the risk of the entire market portfolio.

The beta factor in the income approach can be the beta factor that represents the future price. But we can only use the calculation of β coefficient from historical data, so the period of historical data should be longer or shorter? How can we define this database? If this period is long, the variance of β coefficient will be reduced, its stability may be increased, but if the period is too long, the business circle, market situation, technological updates and market captivity will all change. Mergers and acquisitions factors and the changes of market characteristics are likely to affect the beta coefficient calculation results. In general, this period will be more optimal between 4-6 years. Calculating β coefficient by weekly return rate data is smaller than by monthly return rate. Most of the researchers believe that the β coefficient should be calculated by monthly return rate. If we use the daily return rate, even if we will be able to get more observations, it will cause several problems such as unsynchronized transactions. Corrado and Schatzberg (Corrado and Schatzberg, 1990) showed that β was calculated by using daily return data, because of that the yield distribution was broad-tailed with respect to a normal distribution, the multiplication method may be invalid. Therefore, the difference of data period would lead to different frequency of yield distribution, so that the calculation result of β coefficient was not the same for different periods.

3.2.4.2.2 Non - systematic risk assessment method - Total Return on Assets (TROA)

Chen and Zhang (Chen, T. Xie, L. & Zhang, Y.,2017) examined the impact of financial analysis on the efficiency of firms' investment decisions and discovered that a high quality analysis could increase the investment efficiency. And Holden and Kim (Holden, C. & Kim, D., 2017) applied a model with the companies' share information and found that the model efficiency was depended on future firm performance forecast. Total Return on Assets (TROA) is another useful ratio for analyzing the companies' profitability. It is another measure of corporate financial indicators. In assessing how the company to realize their profit objectives, investors are often concerned with the implementation of compensation-related effects of investment assets, and often combined with earnings per share (EPS) and return on equity (ROE) or other indicators to judge the company's financial situation. In fact, the total return on assets (TROA) is a more effective indicator (Heikal, M. & Ummah, A., 2014). The level of return on total assets directly reflects the companies' competitive strength and development capacity, it can determine whether the company is capable in debt management. In fact, the total return on assets is the best indicator to reflect the company's efficiency and profitability among all financial indicators. It is actually the total market turnover of assets and after-tax net profit for the calculation of the sales profit margin. It reflects the profitability of all the assets of a company. It also depends on the size of the sales profit margin and total asset turnover. Sales profit rate is the companies' operating income to the extent of the contribution of net profit, and total asset turnover is the total number of corporate assets turnover which reflects the efficiency of total assets. The total return on assets and the return on net assets (net profit / shareholders' equity × 100%) can be used to illustrate the extent of the risk of the companies' operations. For company with net assets remaining, The index value is relatively high, but it does not mean that their risk is low. The return on equity as one of the necessary conditions for issued rights is an important reference to adjust the companies' profits.

Return on Total Assets = Net Profit / Average Total Assets ((Total Assets at Year End + Total Assets at Year-end) / 2) × 100%

= Net Profit / Average Total Assets (Average Total Debt Ten Average Owners' Equity) × 100%

In this experiment, we have calculated stock return, Beta risk coefficients and total return on assets TROA of the listed companies, analyze the correlation between these three factors and use BETA and TROA as criteria of assessing the portfolio to obtain higher future returns.

We used the same historical data of the 300 listed companies of Shanghai and Shenzhen 300 index and 600 listed companies of the EUROSTAXX 600 index as database. In order to make sure of the financial stability of listed companies, we choose a short time window, which was observed from 2012 to 2014. We applied a rolling calculation a three year period average annual yield of each stock, the relative average return compared with market level during these 3 years and the TROA of each company over these three-year period by using their financial statements. We also applied a test period that was 2015, because we used the stock price of 2015 to test the conclusion that we obtained from the data during the period of 2012 to 2014 to see the difference between the expected result and the real result. At the same time, we sat up a control sample, which was set to 2014 as an observation period. The purpose of the control sample was to compare the efficiency of the 2012-2014 observation period on the forecasting results. Was the average return of 3 year period data significant of predicting the future return accurately, or was it more credible to use a data of recent period?

In the previous part of momentum model, we divided the portfolio into $WINNER_{10}$ portfolio and $LOSER_{10}$ portfolios, where we not only ranked the historical stock returns, but also ranked the stocks the relative factor of risk market BETA and total assets ratio TROA of listed companies. We selected the top 10 highest yield stocks and the 10 lowest yield stocks as WINNER and LOSER return portfolios, 10 stocks with lowest and highest BETA as WINNER and LOSER risk portfolios and 10 stocks with highest and lowest TROA as WINNER and LOSER performance portfolios. During the test period of 2015, we recalculated the annual average return of the top 10 highest yield stocks and the 10 lowest yield stocks as WINNER and LOSER return portfolios, 10 stocks with lowest and highest BETA as WINNER and LOSER risk portfolios and 10 stocks with highest and lowest TROA as WINNER and LOSER performance portfolios to observe how these three predicted indicator played a role in predicting the future returns.

3.2.4.2.3 RE, BETA and TROA

Before designing the investment portfolio and predicting future expected return, we did a

analysis of the correlation among historical return RE, risk factor BETA and the total return on assets TROA to find out their relationship. We analyze all the listed companies of Shanghai and Shenzhen 300 Index and EUROSTAXX 600 index.

In statistics probability theory, the correlation (or correlation coefficient) shows the strength and direction of a linear relationship between two random variables. The relevant meaning is used to measure the mutual distance of two relative variables. Whether a larger value means that one variable is associated with a larger value of another variable (positive correlation); or whether a smaller value of one variable is associated with a larger value of another variable (negative correlation); whether two variables (The correlation coefficient is approximately zero). Let (X, Y) us consider that a binary random variable as

$$\boldsymbol{\rho_{X,Y}} = \frac{\boldsymbol{cov(X,Y)}}{\boldsymbol{\sigma_X \sigma_Y}} = \frac{\boldsymbol{E\big((X-\mu_X)(Y-\mu_Y)\big)}}{\boldsymbol{\sigma_X \sigma_Y}}$$

$$\boldsymbol{\rho_{X,Y}} = \frac{\boldsymbol{E(XY) - E(X)E(Y)}}{\sqrt{\boldsymbol{E(X^2) - E^2(X)}} - \sqrt{\boldsymbol{E(Y^2) - E^2(Y)}}}$$

Where **ρ** is a numerical characteristic that measures the degree of linear correlation between random variables **X** and **Y**.

E is the mathematical expectation, **Cov** is the covariance, $\boldsymbol{\sigma_X}$ and $\boldsymbol{\sigma_Y}$ are the standard deviations. Therefore, the correlation formula can also be expressed as:

$$\boldsymbol{\rho_{X,Y}} = \frac{\boldsymbol{E(XY) - E(X)E(Y)}}{\sqrt{\boldsymbol{E(X^2) - E^2(X)}} - \sqrt{\boldsymbol{E(Y^2) - E^2(Y)}}}$$

In general, the correlation coefficient of two variables can be expressed by **γ**. When we calculate the correlation coefficient, it is assumed that the two variables are linear, and both of these two variables are random variables. The value of the correlation coefficient is between -1 and +1, i.e. $-1 \leq \gamma \leq +1$. When r> 0, that the two variables are positively related, when **γ** <0, said two variables for the negative correlation. When $|\gamma| = 1$, it means that the two variables are completely linear correlation, so they are totally correlative. When **γ** = 1, it is called full positive correlation, and when **γ** = -1, it is called the complete negative correlation. When **γ** = 0, which means that these two variables have non linear correlation. The higher is the absolute value of **γ**, the higher is the

degree of correlation. As a measure of the correlation between two variables, commonly we used a criteria, when $|\gamma| \geq 0.75$, it can be regarded as highly correlated; when $0.5 \leq |\gamma| < 0.8$, it can be regarded as moderate correlation; when $0.3 \leq |\gamma| < 0.5$, it is regarded as low correlation; when $|\gamma| < 0.3$, the correlation between the two variables is very weak.

The Chinese stock market: 2012 to 2014, the 3-year observed period of stock returns, BETA and TROA:

From the Table 10, according to the 3-year period data of Chinese stock market from 2012 to 2014, the total assets rate of return TROA and the average daily rate of return RE had moderately negative correlation, the total asset yield TROA and risk coefficient BETA had highly negative correlation and the daily average return RE and the same risk coefficient BETA was poorly correlated.

The Chinese stock market: 2014, the 1-year observed period of stock returns, BETA and total TROA:

From the Table 11, according to the 1-year period data of Chinese stock market of 2014, the total assets rate of return TROA and the average daily rate of return RE had moderately negative correlation, the total asset yield TROA and risk coefficient BETA had really poorly correlation and the daily average return RE and the same risk coefficient BETA was poorly correlated.

By observing the 3-year period and 1 year period data in the Chinese stock market, we found out that the correlation between daily average return and its risk coefficient was very weak. On one hand, this result was not consistent with the CAPM model, because the CAPM model said that portfolio returns are positively correlated with their risk factor BETA. On the other hand, the total return on assets TROA of listed companies had a negative correlation with the daily average rate of return, which meant that the stronger was the companies' profitability, the lower was its expected return. Obviously, it did not fit the rational investor's emphasize. Because of that rational investors tended to invest in profitable companies by analyzing the companies' financial situation, so this action could rise their stock prices.

The European stock market: 2012 to 2014, the 3-year observed period of stock returns, BETA and TROA:

From the Table 12, according to the 3-year period data of European stock market of 2014, the total assets rate of return TROA and the average daily rate of return RE had moderately negative correlation, the total asset yield TROA and risk coefficient BETA had really poorly correlation and the daily average return RE and the same risk coefficient BETA had moderately correlation.

The European stock market: 2014, the 1-year observed period of stock returns, BETA and total TROA:

From the Table 13, according to the 1-year period data of European stock market of 2014, the total assets rate of return TROA and the average daily rate of return RE had low negative correlation, the total asset yield TROA and risk coefficient BETA had moderately negative correlation and the daily average return RE and the same risk coefficient RE had moderately correlation .

By observing the 3-year period and 1 year period data in the European stock market, we found out that the total return on assets TROA of listed companies had a low correlation with the daily average return, which meant that the companies' profitability had weaken relationship with its expected return. Obviously, the daily average return had high correlation with the risk factor BETA, which meant that it proved the CAPM model that says the portfolio's expected return was negative relative with its investment risk.

Experimental results and portfolio design

At this stage of our experiment, we kept applying the concept of ranking performance of previous momentum investment strategy and used the information of all listed companies of the Shanghai and Shenzhen 300 Index and the EUROSTAXX 600 index, we calculated their daily expected return (RE), Risk Coefficient (BETA), total return on assets (TROA), named the top 10 winners as $Winner_{10}$ and the bottom 10 losers as $Loser_{10}$. We had three RE winner portfolios, three RE loser portfolios, which included: the $Winner_{RE10}$ and $Looser_{RE10}$ portfolios for expected return factor RE, the $Winner_{BETA10}$ and $Loser_{BETA10}$ portfolios for risk factor BETA, and the $Winner_{TROA10}$ and $Loser_{TROA10}$ portfolios for total return on assets TROA.

We assumed that the winner portfolio was of 10 listed companies with lowest risk factor BETA and the loser portfolio was of 10 listed companies with highest risk factor BETA. For the

$Winner_{BETA10}$, we took long position of buying in the future , for the $Loser_{BETA10,}$ we took short position of selling in the future. From a rational view of point, stock investment should be risk aversion, the higher is the investment risk, the more cautious should be investors. Therefore, we considered that the portfolio with low risk as the "winner portfolio" and the portfolio with high risk as the "loser portfolio".

With the growth of listed companies, for taking into account the change of total return on assets TROA, we selected a data set of resent years as the experimental data, because the listed companies could increase or decrease over time. We separated the experiment time interval to two periods, one 3-year period from 2012 to 2014 and another 1-year period of 2014. We identified all three types of winner and loser portfolios for each of these two periods. These two time periods were chosen as the experimental periods to study the impact of the length of observed period on investment decisions making. People always confuse about how to select the right observation period, whether a 3-year period data set is better than a 1-year period data set as the observation period to design investment portfolio or not? A 3-year period data set may give us a more stable conclusion with excluding the impact of temporary events, but a 1-year data set may be closer to reality. In the next phase, we applied both of these two periods, respectively, to find out their impact on our $Winner_{RE10}$, $Looser_{RE10,}$ $Winner_{BETA10}$, $Loser_{BETA10}$ $Winner_{TROA10}$ and $Loser_{TROA10}$.

After determining our winner portfolios, loser portfolios and observed periods, we took 2015 as a test period to calculate the daily accumulative expected return and investment risk VAR for all winner portfolios and loser portfolios with 3-year observed period/1-year observed period. By comparing their results with the market average daily accumulative expected return RE and average price volatility VAR of 2015. We could test the real performance of these historical winners or losers in a future period.

In the first step, we calculated the three indicators (RE, BETA, TROA) with 3-year period 2012-2014 data set of all listed companies of Shanghai and Shenzhen 300 index and EUROSTAXX600 index, ranked their rolling yearly expected return by descending, defined the top 10 as $WINNER_{RE10}$ and the bottom 10 as $LOSER_{RE10}$; ranked their yearly BETA by ascending, defined the top 10 as $WINNER_{RE10}$ and the bottom 10 as $LOSER_{RE10}$; ranked their yearly TROA by descending, defined the top 10 as $WINNER_{RE10}$ and the bottom 10 as $LOSER_{RE10}$.

At the same time, we calculated the three indicators (RE, BETA, TROA) with 1-year period 2014 data set of all listed companies of Shanghai and Shenzhen 300 index and EUROSTAXX600 index, ranked their rolling yearly expected return by descending, defined the top 10 as $WINNER_{RE10}$ and the bottom 10 as $LOSER_{RE10}$; ranked their yearly BETA by ascending, defined the top 10 as $WINNER_{RE10}$ and the bottom 10 as $LOSER_{RE10}$; ranked their yearly TROA by descending, defined the top 10 as $WINNER_{RE10}$ and the bottom 10 as $LOSER_{RE10}$.

In the second step, we calculated the average daily expected return and daily average price volatility (VAR) of all listed companies of Shanghai and Shenzhen 300 index and EUROSTAXX600 index by assuming these two variables as the average daily return and the average daily price volatility VAR of Chinese stock market and European stock market in 2015. The average daily return of Chinese stock market was 9.45%, the average daily price volatility was 0.0305; the average daily return of European stock market was 0.39%, the average daily price volatility is 0.0021. It was easy to discover that the stock price of Chinese stock market raised significantly higher than the European stock market in 2015, while its stock price volatility was also greater.

In the last step, we recalculated the net accumulative expected return (minus the investment cost in our previous assumption, Chinese stock market investment cost was 0.3% of total investment capital, European stock market investment cost was 0.11% of total investment capital) of three indicators (RE, BETA, TROA) with 3-year period 2012-2014 data set and 1-year period 2014 data set of all listed companies of Shanghai and Shenzhen 300 index and EUROSTAXX600 index. By comparing their net accumulative expected return with the market average daily expected return and daily average price volatility (VAR) of 2015, we could verify whether the past performance of these listed companies were able to effectively predict the their future stock price movements.

We used the net cumulative daily return to find out the time point that investors may modify their investment portfolio, when the investment income grew, especially it was much higher than the market average level, investors were most likely to adjust their investment portfolio, for example selling or buying actions. At the same time, we also identified the time point when investors may make an investment decision (the net expected return was higher than the market average return). Investors were used to compare the market average return with their own portfolio return and modified their portfolio to adapt the price trend of stock market. By combing with our investor

risk appetite test, investors may change their investment decision when they faced any profit or loss based on their own investment risk tolerance for investment. In order to facilitate the observation of the experimental results, we only discussed how profitability could change the investment decision-making, that was, when the portfolio net profit was above the market average return, investors were possible to choose to sell their portfolios and got their net income at any time. We calculated the average portfolio returns (AV.Net 2015) and the average holding time (% Pr.Transaction) for all our winner and loser portfolios at these possible decision-making time point (when net expected return was higher than the market average return).

RE Momentum portfolio

RE $Winner_{10}$ portfolio:

The Table 14 was the summary of the performance of two RE $Winner_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance included net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios have a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period or the 1-year observed period, the RE Winner10 portfolio return of Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. On one hand, the RE Winner10 portfolio with 3 -year observed period had the highest return rate (22.64%), but the 1-year observed period RE $Winner_{10}$ portfolio had a return rate 82.7% higher than the average market return over the same period, it was 1.64% lower than the portfolio with 3 -year observed period, while its stock price volatility was also 2% lower than the other. Therefore, we believed that 1-year observed period RE $Winner_{10}$ was more convenient than the 3-year observed period RE $Winner_{10}$ in evaluating risk and earning more benefits for Chinese stock market. On the other hand, the 3-year observed period RE $Winner_{10}$ portfolio of European stock market had a much higher return rate (1.67%), and the 3 -year observed period portfolio and the 1 -year observed period portfolio did not have significant difference of price volatility and profitability.

RE $Loser_{10}$ portfolio:

The Table 15 was the summary of the performance of two RE $Loser_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance included net daily

accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period or the 1-year observed period, the RE $Loser_{10}$ portfolio return of Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. On one hand, the RE $Loser_{10}$ portfolio with 1 -year observed period had the highest return rate (15.4%), and the 1-year observed period RE Winner10 portfolio had a probability (52.3%) of earning more much higher than the probability (16.9%) of 3-year observed period portfolio, it was 1.64% lower than the portfolio with 3 -year observed period, while its price volatility (0.0107) was also lower than the other (0.1100). Therefore, we believed that 1-year observed period RE $Loser_{10}$ was more convenient than the 3-year observed period RE $Loser_{10}$ in evaluating risk and earning more benefits for Chinese stock market. On the other hand, the 3-year observed period RE Winner10 portfolio of European stock market had a much higher return rate (1.56%), and the 3 -year observed period portfolio and the 1 -year observed period portfolio did not have significant difference of price volatility, but the 1 -year observed period RE $Loser_{10}$ portfolio had more profitability (45.4%).

RE $(Winner+Loser)_{10}$ portfolio:

The Table 16 was the summary of the performance of two RE $(Winner+Loser)_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance included net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period or the 1-year observed period, the RE $(Winner+Loser)_{10}$ portfolio return of the Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. On one hand, the RE $(Winner+Loser)_{10}$with 1-year observed period had the highest return rate (20.4%), and the 1-year observed period RE Winner10 portfolio had a probability (77.0%) of earning more much higher than the probability (19.3%) of 3-year observed period portfolio, it was 1.64% lower than the portfolio with 3-year observed period, while its price volatility (0.0140) was a little higher than the other (0.0071). Therefore, we believed that 1-year observed period RE $Loser_{10}$ was more convenient than the 3-year observed period RE $(Winner+Loser)_{10}$ in evaluating risk and earning more benefits for the Chinese stock market. On the other hand, the 3-year observed period RE Winner10 portfolio of the European stock market had a much higher

return rate (1.56%), and the 3-year observed period portfolio and the 1-year observed period portfolio did not have significant difference of price volatility and profitability, but the 3-year observed period RE (Winner+Loser)$_{10}$ portfolio had more profitability (41.7%).

By analyzing the RE Momentum portfolio, for different investment markets, the RE Winner$_{10}$ portfolio, the Loser$_{10}$ portfolio and the RE (Winner+Loser)$_{10}$ portfolio were all profitable in the Chinese stock market and the European stock market. The Chinese stock market had higher return rate and higher price volatility and the European stock market had lower return rate and lower price volatility. For different investors risk appetite, the Chinese stock market was more suit to aggressive investors and the European stock market was more suit to conserved investors. For different observed period, 1-year observed period portfolio had better performance in Chinese stock market and 3-year observed period portfolio had better performance in the European stock market. It meant that the European stock market was more stable than the Chinese stock market in long term, because its stock price volatility was low. For different combined factors, the 1-year observed period of RE (Winner+Loser)$_{10}$ had a return rate of 20.4%, with the price volatility of 0.0140 and a probability of 77.0% of earning more benefits than average market level. We considered it as the most optimized investment portfolio with higher return, lower risk and more transaction probability.

TROA Momentum portfolio

TROA Winner$_{10}$ portfolio:

The Table 17 was the summary of the performance of two the TROA Winner$_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance included net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period or the 1-year observed period, the TROA Winner$_{10}$ portfolio return of the Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. On one hand, the TROA Winner$_{10}$ portfolio with 3 -year observed period had the highest return rate (20.95%), but if we considered more investment factors. In the Chinese stock market, the TROA Winner$_{10}$ portfolio with 1-year observed period had 40.3% more probability of earning more return than the market average level, its return rate (17.25%) was a little lower than the 3-year period

portfolio and its price volatility was similar to the 3-year period portfolio. Therefore, we believed that 1-year observed period RE $Loser_{10}$ was more convenient than the 3-year observed period the TROA $Winner_{10}$ in evaluating risk and earning more benefits for the Chinese stock market. On the other hand, the 3 -year observed period TROA $Winner_{10}$ portfolio and the 1-year observed period portfolio did not have significant difference of price volatility and profitability in the European stock market.

TROA $Loser_{10}$ portfolio:

The Table 18 was the summary of the performance of two the TROA $Loser_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance included net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period or the 1-year observed period, the TROA $Loser_{10}$ portfolio return of the Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. No matter for the Chinese stock market or the European stock market, the 3-year observed period TROA $Loser_{10}$ portfolio had a little higher return than the 1-year observed period TROA $Loser_{10}$ portfolio, but the 1-year observed period TROA $Loser_{10}$ portfolio had more probability of earning higher return.

TROA $(Winner+Loser)_{10}$ portfolio:

The Table 19 was the summary of the performance of two the TROA $(Winner+ Loser)_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance includes net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period or the 1-year observed period, the TROA $(Winner+ Loser)_{10}$ return of the Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. On one hand, TROA $(Winner+ Loser)_{10}$ with 1-year observed period had the highest return rate (20.50%), at the same time, the TROA $(Winner+ Loser)_{10}$ with 1 -year observed period had a probability (77.0%) of earning more much higher than the probability (3.3%) of 3-year observed

period portfolio, while its price volatility (0.0140) was a little higher than the other (0.0043). Therefore, we believed that 1-year observed period RE $Loser_{10}$ was more convenient than the 3-year observed period the TROA $(Winner+ Loser)_{10}$ in evaluating risk and earning more benefits for Chinese stock market. On the other hand, the 3 -year observed period TROA $(Winner+ Loser)_{10}$ portfolio and the 1-year observed period portfolio did have significant difference of price volatility and profitability in European stock market.

By analyzing the TROA momentum portfolio, for different investment markets, the TROA $Winner_{10}$ portfolio, the $Loser_{10}$ portfolio and the TROA $(Winner+Loser)_{10}$ portfolio were all profitable in the Chinese stock market and European stock market. The Chinese stock market had higher return rate and higher price volatility and the European stock market had lower return rate and lower price volatility. For different investors risk appetite, all these three portfolios had a lower price volatility than the average market level in both of these two market, which meant that TROA was useful tool to predict future price tendency. TROA could be an indicator for conserved investors who pursuit more stable profits. For different observed period, 1-year observed period portfolio had better performance in Chinese stock market and 3-year observed period portfolio had better performance in European stock market. It meant that the European stock market was more relative to the Chinese stock market stable in long term, its stock price volatility was low. For different combined factors, the 1-year observed period of TROA $(Winner+Loser)_{10}$ had a return rate of 17.25%, price volatility of 0.0185 and a probability of 40.3% of earning more benefits than average market level. We considered it as the most optimized investment portfolio with higher return, lower risk and more transaction probability.

BETA Momentum portfolio

BETA $Winner_{10}$ portfolio:

The Table 20 was the summary of the performance of two the BETA $Winner_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance included net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period o the 1-year observed period, the BETA $Winner_{10}$ return of the Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. On one hand, the BETA

$Winner_{10}$ with 3-year observed period has the highest return rate (14.84%), while its price volatility (0.0108) was a higher than the other (0.0034). These two portfolios had similar probability of earning more benefits. Therefore, we could recommend the 1-year observed period BETA $Winner_{10}$ portfolio to conserved investors and recommend the 1-year observed period BETA $Winner_{10}$ portfolio to aggressive investors. On the other hand, the 3 -year observed period TROA $(Winner+ Loser)_{10}$ portfolio and the 1-year observed period portfolio did not have significant difference of price volatility and profitability in European stock market.

BETA $Loser_{10}$ portfolio:

The Table 21 was the summary of the performance of two the BETA $Loser_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance included net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period o the 1-year observed period, the BETA $Loser_{10}$ portfolio return of the Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. No matter for the Chinese stock market or European stock market, the 3-year observed period BETA $Loser_{10}$ portfolio and the 1-year observed period TROA $Loser_{10}$ portfolio did not have significant difference of price volatility and profitability.

BETA $(Winner+Loser)_{10}$ portfolio:

The Table 22 was the summary of the performance of two the BETA $(Winner+ Loser)_{10}$ portfolios (with 3-year observed data set and with 1-year observed data set) in 2015. The performance includes net daily accumulative return (AV.Net RE 2015), price volatility (VAR Trans. 2015) and the probability of investors making investment decisions (how many days their portfolios had a higher return than the average market return/their total investment period) (% Pr.Transaction). No matter for the 3-year observed period or the 1-year observed period, the BETA $(Winner+Loser)_{10}$ return of Chinese stock market was significantly higher than the European stock market, and its price volatility was also higher than the European stock market. On one hand, the BETA $(Winner+ Loser)_{10}$ with 1-year observed period had the highest return rate (20.50%), it had more probability of earning more benefits than the 3-year observed period portfolio, while its price volatility (0.0140) was higher than the other (0.0075). On the other hand, the 1-year observed period BETA $(Winner+Loser)_{10}$ portfolio of European stock market had

higher return (1.90%) and higher probability (43.8%) of earning more benefits than the 3-year observed period portfolio, they did not have significant difference of price volatility.

By analyzing the BETA Momentum portfolio, for different investment markets, the BETA $Winner_{10}$ portfolio, the BETA $Loser_{10}$ portfolio and the BETA $(Winner+Loser)_{10}$ portfolio were all profitable in the Chinese stock market and the European stock market. The Chinese stock market had higher return rate and higher price volatility and the European stock market had lower return rate and lower price volatility. For different investors risk appetite, all these three portfolios had a lower price volatility than the average market level in both of these two market, which meant that BETA was useful tool to predict investment risk. For different observed period, we could not get a clear conclusion of the best observed period. For different combined factors, the 1-year observed period of BETA $(Winner+Loser)_{10}$ had a return rate of 20.50%, price volatility of 0.0140 and a probability of 77.0% of earning more benefits than average market level . We considered it as the most optimized investment portfolio with higher return, lower risk and more transaction probability.

After evaluating the three factors (RE, TROA, BETA) of momentum model, we had a conclusion: from the observed period, the Chinese stock market was more suitable to 1-year observed period and the European stock market was more stable, so 1-year observed period portfolio and 3-year observed period portfolio had no difference in price volatility or profitability. For different indicators, in short term, the previous portfolio return could be a valuable reference to estimate future portfolio expected return. For different risk appetite of investors, as the information that we could easily get from listed company financial report, TROA could be understood by investors, so it could be an useful tool for evaluating investment risk. And form the experiment, a higher TROA indicator was not meant a higher profit rate for a listed company. A higher TROA meant a higher profit was an investors misunderstanding, a company had high ability of earning more net return does not mean that its stock price had a higher future increased margin. There was no absolute relationship between the companies' financial indicators with the future stock returns. As an effective tool of investment risk estimation, BETA could help investors find an investment portfolio with lower risk. At the same time, momentum investment strategy, based on a BETA indicator we can predict well the future investment risk of portfolio, the return and the risk was inversely. BETA $(Winner+Loser)_{10}$ was the best example of a combination of a portfolio with high risk, high return, low risk and low return. So in a market with high risk as the Chinese stock market, BETA momentum portfolio had a good performance. But evaluating from different momentum investment portfolios, Winner and (Winner+Loser) investment portfolios all had

good performance with a higher return than market average level, but Loser investment portfolio did not perform as well as others two portfolios. So if we only took a short position of selling with momentum strategy, we could not make sure our future earnings. From investors risk appetite, even if different investors had different risk and expected return appetites, only pursuit highest returns and lowest risk was not the best investment strategy. We should evaluate the investment return and investment risk rationally, so we would be able to obtain the expected return in the future.

In the part of mental accounting, we discussed how to apply mental account in investment portfolios. The application of mental accounting is based on the application of psychology. Investors have different risk appetite and they make investment decision according to their risk and profit appetites. In the experiment, we tested the investment risk appetite of our volunteers, separated them to three type of investors, aggressive investor, rational investor and conserved investor. In the stimulated bull market environment and bear market environment, with the same investment portfolio, they made different investment decisions because they had distinct risk appetites. Aggressive investors pursuit to highest return by modifying their investment portfolio frequently, and they were enjoyed in supporting high risk; Conserved investors pursuit to lowest investment risk, so they held stocks with low price volatility and gave up to pursuit high return; stable investors could adjust their investment portfolio rationally when they obtained expected return and made a right decisions of buying or selling their products. On one hand, this phenomenon demonstrated the importance of psychological factor in investment decision making; on other hand, to understand the investors thought was really important too. We have to design an investment portfolio that is suitable for our clients, help them make right investment decisions in a right moment and gave them investment advices according to their risk appetites. The fundamental investment rule is rational investment with a balance of higher return and lower risk.

After combing with the momentum strategy of last part, in this part of paper, we combined different investment indicators as expected return rate RE, risk factor BETA and net return in total assets TROA and designed three momentum investment portfolios, Winner portfolio, Loser portfolio and (Winner + Loser) portfolio for finding out a most optimized portfolio with higher return and lower risk. Before optimizing individual investment portfolios, we introduced the concept of investment market (the Chinese stock market and the European stock market) from momentum strategy. Based on these two investment markets, we designed different investment portfolios. Comparing with the European stock market, the Chinese stock market had more

volatility, so it also had a higher return by suffering this high risk. For the conserved investors who want more investment stability, the European stock market is better. On the contract, for aggressive investors who pursuit high return and accept to suffer high risk, the Chinese stock market is the best choice. We also adapted our investment portfolios to momentum portfolios. A RE momentum portfolio with short observed period data set predicted well future return, while TROA momentum portfolio and BETA momentum portfolio predicted well future risk. From the aspects of returns, net income and investment risk, we had a conclusion that neither conserved investors nor aggressive investors were classic example of rational investors. They were all rational investors, obviously, many investors were not rational. By combing the RE, TROA and BETA factors, we may be able to find out the balance of expected return and investment risk, to make a rational investment decision and design an optimized investment portfolio. It means that we can design an optimized Winner + Loser momentum portfolio with higher return, lower risk and more transaction probability. Mental accounting is a classic example of how to combine finance with psychology. Form the investors view of point, by using investment indicator as return rate RE, risk factor BETA and TROA..., we calculated these factors with historical data and design different investment portfolios. The most important thing is, by experimental proving, we discovered that momentum investment strategy could be an useful to help us find the balance between investor investment appetite and investment portfolio design, so we would be able to help investors to understand their investment appetite and help them get more possible returns with lower risk.

Chapter 4. Conclusion and Future Investment

4.1 Conclusion

In summary, this paper tried to explain the investors psychology by the perspective of behavior finance, analyzed the characters of the Chinese stock market and the European stock market, then designed optimized investment portfolios between profits and investment risks.

By using a 10 year period (2005-2015) data set of these two stock markets, we proved that the Chinese stock market was an inefficient market and the European stock market is a efficient market. Comparing with the European investors, the Chinese investors are less rational. The fundamental different of these two markets comes from their market characteristics. The market capitalization plays an important role in market efficiency (Sukpitak, J. & Hengpunya., 2016).

By investigating the Chinese firms, Xu and Yang (Cull, R. Xu, L. Yang, X. Zhou, L. & Zhu, T., 2017) found out that the government provision could improve market development and was positively associated with firm efficiency. The government control of the Chinese stock market is more strict, so its self-regulation is weaker; on the contrary, the European stock market is more transparent, so it has a stronger self- adjustment ability.

Based on the understanding of these two market, we separated the 10 year period to three business circles, bull market period, bear market period and normal market period, and designed multivariate momentum model with different investment periods. The results showed that the investment portfolios of both of these two markets had significant performs in different business circles, which meant that we should take in count this factor in portfolios designing.

Meanwhile, short term investment period is more suitable to the Chinese stock market and the middle investment period is more suitable to the European stock market. It also meant that the price volatility of the Chinese stock market is higher than the European stock market in a short period, which provided an arbitrage opportunity to investors of the Chinese stock market.

We discussed the impact of the book value of listed companies and found out that high value companies, middle value companies and low value companies has distinct price volatility and future returns. So when we designed momentum portfolios, the company basic value is also a worthwhile factor.

Finally, we analyzed how the implicit factor - interest rate could affect the price volatility. This stage of the experiment showed that the momentum model was not depend on single factor, it could be affected by a variety of factors, such as investment market, economic circle, company basic value or many implicit factors. In order to obtain the most optimized return, we should apply a multivariate momentum portfolio to replace a univariate momentum portfolio.

After finding the momentum models that fitted these two markets, we introduced the concept of mental accounting, tried to add the investors psychological factors into investment portfolio. We firstly analyzed the investors risk appetite, and then found a suitable investment model according to their risk and profit profiles. At this stage, we introduced three investment standard investment indicator, the risk factor BETA, the historical yield RE and the net profitability ROTA of the listed company and designed momentum investment portfolios for each of these three indicators. Finally, we observed the price volatility and return rate of these momentum models in the next

year.

In this way, we found a momentum model that had more real return in the future, and got a more appropriate portfolio which was based on investor risk appetite and profits profile. We came to two conclusions, one was the Chinese market was more suitable for aggressive investors, while the European stock market was more suitable for conservative investors; another was these three standard investment indicators could be applied to optimize the income and risk tolerance of different types of investors.

In this work, we proved the impact of behavior finance in risk investments from many aspects as theory, data set analysis, modeling and psychological test. We provided a new perspective that could optimized the investment portfolio designing, proved that the investor psychological factors decided their decision making system, and then decided their investment profit or losses.

4.2 Limitation of investigation and future investment

The financial market is based on game theory (Turocy, T. & Stengel, B., 2001), so the great value of behavior finance is to correct the basic errors of the traditional finance theories. However, behavioral finance also has some methodological and fundamental flaws. At present, the behavioral finance is mainly to explore the common characteristics of human psychology, and uses these human basic psychological characteristics to analyze and explain economic phenomenon. Since a few years, behavioral finance has tested, summarized, discovered and summed up the human psychological characteristics, and also warns investors that some psychological characteristics are not conducive to investment. In general, behavioral finance is the statistics of psychological characteristics and then use it to explain some capital market phenomenon. It discovers problems of traditional theory but cannot solve these problems. It found out that the psychological characteristics of the people was the decisive reason for the price change in stock market, and found a series of specific human psychological characteristics, then explained how these specific psychological characteristics could affect the investors decision making, but it did not point out how investors could overcome these inherent psychological characteristics. In other words, behavioral finance found out and summed up the human psychological characteristics, also recognized their serious harm, but did not indicated people to avoid them, and did not find out how to solve these problems.

We have to improved several points in the future investment of behavior finance:

a. We need to establish a new basic theoretical framework. We believe that the new basic theory should be based on the premise of rational people, then we describe theory more closer to the reality of market.

b. We need to establish a unified and unique logic. The value of behavioral financial is to apply cognitive psychology theory to the analysis of investors behaviors, but it does not have a strict logic system. People can explain the same phenomena with different behavioral finance theories, but which one is fundamental, what is the connection between different factors, how does they make impact to each other, all these questions cannot be answered till today. It means that behavior finance has not yet established a strict logic framework, so its basic theory is not solid and standardized.

c. We need to establish a new behavior based model. Despite behavioral finance having rapid development, it is enable to challenge the traditional finance core theory because of lacking strong background supports such as own core theory frameworks or predictive models. For example, in the debate on the market efficiency, traditional finance has strict logic system and asset pricing theory which behavioral finance does not have, so behavioral finance cannot win in the debate.

d. We need to establish clear objective of investigation and research methods. The boundary between behavioral finance and traditional finance has not been determined, so behavioral finance has defined as a small branch of economy and psychology. psychology is the study of human psychology, and behavioral finance is based on the cognitive psychology of the decision-making under the uncertain conditions. But impact of human psychology on decision making is complicated., behavioral finance has to establish a new basic theory and analytical paradigm based on new hypothesis which requires it to innovate distinctive investment methodology.

In future researches, we should try to find more accurate experimental methods to confirm the specific behavioral finance philosophy. In order to provide a stronger proof of the conclusion, we should use more psychological experiments and practical data for more complex mathematical modeling, adding more direct variables and indirect variables to find the association. However, we believe that as a new discipline, behavioral finance society is constantly developing and improving, and finally recognized by the majority of scholars and widely used in real life.

Final Conclusion

From the point of view of behavioral finance, our thesis breaks through the framework of traditional investment concepts. We puts forward the multivariate momentum investment model with several comprehensive variables as economic environment, psychological and geographical factors.

First of all, we studies how investment environment can be an important factor by testing the market efficiency of the Chinese stock market and the European stock market and explains the importance of market characteristics in investment portfolio designing. Furthermore, by testing the investors' risk appetite, we proves that mental accounts can play a decisive role in the investment decision-making, which directly affect the investors' final investment profits. After identifying these two basic factors, we continuously explore other factors that may affect the investment returns, such as investment duration, company intrinsic value and others implicit variables. Finally, we find that the multivariable momentum investment models can optimize the investment risks and incomes better than traditional investment portfolios, they can effectively reduce investment risks meanwhile increasing investment profits.

The core idea of this thesis is to boldly apply the concept of behavioral finance and to integrate it into investment portfolio design. By improving the traditional momentum model into multivariable momentum model, adding investor mental accounting effect, we try to balance the investment risks and profits and to pursuit maximized income.

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Appendix 1

Table 1.

Bull Market	RE Equity 1	VAR Equity 1	RE Equity 2	VAR Equity 2	RE Equity 3	VAR Equity 3	**RE Portfolio**	**VAR Portfolio**
Investor A	2,90%	0,0027	1,60%	0,0020	0,10%	0,0004	0,60%	0,0014
Investor B	*14,10%*	*0,0760*	*0,90%*	*0,0020*	*0,30%*	*0,0000*	*5,12%*	*0,0283*
Investor C	14,10%	0,0760	0,90%	0,0020	0,30%	0,0000	5,12%	0,0283

Table 2.

Bear Market	RE Equity 1	VAR Equity 1	RE Equity 2	VAR Equity 2	RE Equity 3	VAR Equity 3	**RE Portfolio**	**VAR Portfolio**
Investor A	-5,60%	0,0598	1,40%	0,0011	1,10%	0,0002	-1,06%	0,0199
Investor B	*-5,60%*	*0,0598*	*1,40%*	*0,0011*	*1,10%*	*0,0002*	*-1,06%*	*0,0199*
Investor C	-5,60%	0,0260	-0,40%	0,0030	0,00%	0,0000	-2,00%	0,0096

Table 3.

Investor A	**Equity 1**	**Equity 2**	**Equity 3**
%Investment	**25%**	**50%**	**25%**
Day 1	11,5	23,4	11,2
Day 2	12,6	25,7	11,4
Day 3	13,6	27,2	11,4
Day 4	13,4	26,7	11,9
Day 5	12,9	25,7	11,9
%Investment	**25%**	**25%**	**50%**
Day 6	12,8	26,0	11,6
Day 7	12,0	27,3	11,6
Day 8	12,5	29,7	11,4
%Investment	**50%**	**0%**	**50%**
Day 9	13,2	30,2	11,4
Day 10	13,2	30,2	11,3

Table 4.

Investor B	**Equity 1**	**Equity 2**	**Equity 3**
%Investment	**35%**	**40%**	**25%**
Day 1	306,0	83,2	7,0
Day 2	309,8	84,0	9,3
Day 3	320,0	84,1	8,5
Day 4	334,0	85,1	9,5
Day 5	363,2	85,0	9,5
%Investment	**0%**	**40%**	**25%**
Day 6	331,3	85,0	12,8
%Investment	**0%**	**40%**	**0%**
Day 7	326,5	88,6	27,5
%Investment	**0%**	**0%**	**0%**

Table 5.

Investor C	Equity 1	Equity 2	Equity 3
%Investment	**25%**	**25%**	**50%**
Day 1	306,0	83,2	7,0
Day 2	309,8	84,0	9,3
Day 3	320,0	84,1	8,5
Day 4	334,0	85,1	9,5
%Investment	**25%**	**40%**	**35%**
Day 5	363,2	85,0	9,5
%Investment	**19%**	**30%**	**26%**
Day 6	331,3	85,0	12,8
%Investment	**19%**	**55%**	**26%**
Day 7	326,5	88,6	27,5
Day 8	322,3	89,8	28,3
%Investment	**0%**	**55%**	**0%**
Day 9	320,5	91,1	25,8
Day 10	314,8	90,3	25,0

Table 6.

Investor A	Equity 1	Equity 2	Equity 3
%Investment	**25%**	**25%**	**50%**
Day 1	14,1	19,3	4,7
Day 2	14,9	20,2	4,9
Day 3	15,3	20,2	5,0
%Investment	**0%**	**25%**	**75%**
Day 4	15,0	19,9	5,0
Day 5	14,8	20,2	5,0
%Investment	**25%**	**0%**	**75%**
Day 6	16,2	20,1	5,0
%Investment	**0%**	**0%**	**75%**
Day 7	16,7	19,7	5,1
Day 8	16,9	21,5	5,1
Day 9	8,4	21,6	5,2
Day 10	8,5	21,8	5,2

Table 7.

Investor B	Equity 1	Equity 2	Equity 3
%Investment	**30%**	**30%**	**40%**
Day 1	14,1	19,3	4,7
Day 2	14,9	20,2	4,9
Day 3	15,3	20,2	5,0
%Investment	**45%**	**0%**	**55%**
Day 4	15,0	19,9	5,0
Day 5	14,8	20,2	5,0
Day 6	16,2	20,1	5,0
%Investment	**0%**	**0%**	**0%**

Table 8.

Investor C	Equity 1	Equity 2	Equity 3
%Investment	**25%**	**50%**	**25%**
Day 1	71,7	5,8	192,8
Day 2	71,6	6,1	203,2
Day 3	71,6	5,8	198,0
Day 4	71,6	5,7	188,5
%Investment	**50%**	**50%**	**0%**
Day 5	71,5	3,6	183,3
Day 6	71,6	3,9	203,0
Day 7	71,7	3,8	206,8
%Investment	**100%**	**0%**	**0%**
Day 8	71,6	3,6	202,7
Day 9	71,6	3,3	195,1
%Investment	**0%**	**0%**	**100%**
Day 10	71,5	3,5	186,4

Table 9.

Transaction Value (EURO)	% Transaction Value	Minimun/Per trading (EURO)	Maximum/Per trading (EURO)
<= 1000,000,000	0.080%	1.25	29.00
1000,000,001 - 10,000,000,000	0.060%	1.25	29.00
10,000,000,001- 50,000,000,000	0.050%	1.25	29.00
50,000,000,001- 100,000,000,000	0.030%	1.25	29.00
100,000,000,001-500,000,000,000	0.020%	1.25	29.00
> 500,000,000,000	0.015%	1.25	29.00

Table 10.

CHN 3 year	Average ROTA	Average RE	Average BETA
Average ROTA	1		
Average RE	-0.05	1	
Average BETA	-0.08	0.01	1

Table 11.

CHN 1 year	Average ROTA	Average RE	Average BETA
Average ROTA	1		
Average RE	-0.07	1	
Average BETA	-0.02	-0.03	1

Table 12.

EU 3 year	Average ROTA	Average RE	Average BETA
Average ROTA	1		
Average RE	-0.04	1	
Average BETA	-0.05	0.61	1

Table 13.

EU 1 year	Average ROTA	Average RE	Average BETA
Average ROTA	1		
Average RE	-0.03	1	
Average BETA	-0.04	0.98	1

Table 14.

RE Winner10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	22.64%	21.00%	1.16%	0.87%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0446	0.0266	0.0001	0.0000
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*55.8%*	*82.7%*	*37.1%*	*31.2%*

Table 15.

RE Loser10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	4.95%	15.40%	1.56%	1.36%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.1100	0.0107	0.0002	0.0004
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*16.9%*	*52.3%*	*33.6%*	*45.4%*

Table 16.

RE (Winner+Loser)10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	12.02%	20.40%	1.58%	1.31%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0071	0.0140	0.0002	0.0005
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*19.3%*	*77.0%*	*41.7%*	*38.8%*

Table 17.

ROTA Winner10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	20.95%	17.25%	0.98%	0.93%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0159	0.0185	0.0001	0.0001
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*2.5%*	*40.3%*	*35.1%*	*30.8%*

Table 18.

ROTA Loser10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	7.33%	8.82%	1.31%	2.03%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0017	0.0036	0.0001	0.0006
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*27.6%*	*35.8%*	*35.1%*	*45.0%*

Table 19.

ROTA (Winner+Loser)10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	5.26%	20.50%	1.43%	1.90%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0043	0.0140	0.0003	0.0007
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*3.3%*	*77.0%*	*44.0%*	*43.8%*

Table 20.

BETA Winner10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	14.84%	10.96%	0.89%	0.66%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0108	0.0034	0.0001	0.0001
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*17.4%*	*21.0%*	*34.7%*	*34.6%*

Table 21.

BETA Loser10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	10.93%	10.97%	1.19%	-0.68%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0053	0.0047	0.0001	0.0001
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*35.4%*	*38.3%*	*41.3%*	*41.5%*

Table 22.

BETA (Winner+Loser)10	CHN		EU	
	2012-2014 Base Portfolio	2014 Base Portfolio	2012-2014 Base Portfolio	2014 Base Portfolio
AV.Net RE 2015	11.35%	20.50%	0.65%	1.90%
AV.Net Market RE 2015	9.45%	9.45%	0.39%	0.39%
VAR Trans. 2015	0.0075	0.0140	0.0000	0.0007
VAR Market 2015	0.0305	0.0305	0.0021	0.0021
%Pr. Transaction	*31.7%*	*77.0%*	*32.4%*	*43.8%*

Table 23.

CHN							
Date	**Δ 1 year interest rate(%)**	**Company capital scale**	**C**	**AR(1)**	**AR(2)**	**p-Value**	**ΔRe**
		big	-0,0580	0,8250	–	<0,0001	-1,5%
28/04/2006	5,58 - 5,85	mid	–	0,9247	–	<0,0001	-9,6%
		small	–	0,9555	–	<0,0001	-8,4%
		big	–	0,9658	–	<0,0001	-1,4%
18/08/2006	5,85 - 6,12	mid	–	0,9578	–	0,7294	-6,8%
		small	–	0,9371	–	0,6911	-6,8%
		big	0,5849	0,8028	–	<0,0001	-5,6%
18/03/2007	6,12 - 6,39	mid	0,6490	0,7935	–	<0,0001	-6,3%
		small	0,5451	0,7713	–	<0,0001	-5,1%
		big	0,9708	0,9168	–	<0,0001	3,4%
19/05/2007	6,39 - 6,57	mid	0,9960	0,9039	–	<0,0001	3,2%
		small	0,8048	0,8817	–	<0,0001	3,1%
		big	0,9824	0,8682	–	<0,0001	-17,9%
21/07/2007	6,57 - 6,84	mid	0,9828	0,8817	–	<0,0001	-16,7%
		small	0,7726	0,9150	–	<0,0001	-14,2%
		big	0,2594	0,8980	–	<0,0001	-17,2%
16/09/2008	7,47 - 7,2	mid	–	1,5360	-0,5478	<0,0001	-7,1%
		small	–	1,5072	-0,5282	<0,0001	-5,0%
		big	0,2845	0,8665	–	0,0418	-4,6%
08/10/2008	7,2 - 6,93	mid	0,2486	0,8856	–	0,7493	-1,1%
		small	–	0,9428	–	<0,0001	9,9%
		big	–	0,9729	–	0,3715	-8,7%
30/10/2008	6,93 - 6,66	mid	–	0,9661	–	0,2873	-5,3%
		small	–	0,9487	–	0,3677	-6,4%
		big	0,1765	0,9383	–	<0,0001	-5,9%
27/11/2008	6,66 - 6,58	mid	–	0,9658	–	<0,0001	-17,9%
		small	–	0,9441	–	0,4892	-22,0%

Table 24.

EU						
Date	**Δ 1 year interest rate(%)**	**Company capital scale**	**C**	**AR(1)**	**p-Value**	**ΔRe**
		big	0,1106	0,8193	0,2092	-0,7%
09/08/2006	1,75 - 2	mid	0,1692	0,7470	<0,0001	-2,6%
		small	0,1331	0,6835	0,0001	2,5%
		big	–	1,0097	<0,0001	4,9%
11/11/2006	2 - 2,25	mid	0,2506	0,7691	<0,0001	-1,1%
		small	0,1551	0,9208	<0,0001	-1,3%
		big	0,1556	0,8376	<0,0001	-1,9%
13/12/2006	2,25 - 2,5	mid	0,2708	0,4424	0,0052	-2,0%
		small	0,1624	0,7080	<0,0001	-0,7%
		big	0,1968	0,8011	<0,0001	-2,6%
14/03/2007	2,5 - 2,75	mid	0,3240	0,8015	<0,0001	-2,8%
		small	0,2002	0,6757	0,0001	-2,6%
		big	0,1920	0,5083	0,0046	-0,9%
13/06/2007	2,75 - 3	mid	–	–	0,6162	-1,3%
		small	–	–	0,4402	-1,2%
		big	-0,4400	0,8228	0,3974	7,8%
10/11/2008	3,25 - 2,75	mid	-0,1803	0,7795	0,6409	9,4%
		small	-0,2744	0,8696	0,2498	6,4%
		big	-0,4821	0,8399	0,2283	-2,5%
10/12/2008	2,75 - 2	mid	-0,2044	0,7992	0,2178	-1,0%
		small	-0,3062	0,8881	0,8961	-2,0%
		big	-0,4273	0,6783	0,1258	2,6%
09/11/2011	0,75 - 0,5	mid	0,1228	0,7686	0,4472	3,2%
		small	0,1246	0,8193	0,7021	2,7%
		big	-0,4485	0,7034	0,1096	-9,3%
14/12/2011	0,5 - 0,25	mid	0,1070	0,7497	0,1278	-47,0%
		small	0,1153	0,8133	0,3848	8,5%

Table 25.

	% Significant P-value	**Average ΔRe**
CHN big	77,8%	-6,6%
CHN mid	66,7%	-9,1%
CHN small	66,7%	-3,3%
CHN total	70,4%	-6,3%
EU Big	44,4%	-0,1%
EU mid	44,4%	-2,1%
EU small	44,4%	-0,5%
EU total	44,4%	-0,9%

Appendix 2

Test 1. Investment Risk Appetite Test

Standards：Choice **A** - 10 points, Choice **B** - 8 points, Choice **C** - 5 points, Choice **D** - 3 points, Choice **E** - 0 point.

1. Your age is：（ ）

A .< 30　B．30 - 40　C．40 - 50　D．50 - 60　E．>=60

2. The stability of your income：（ ）

A．very stable

B．stable

C．not very stable

D．not stable

E．Unemployed

3. The number of persons who is dependent on your income：（ ）

A．single/only yourself

B．married, your couple also works and without children

C. 1-2 persons

D．3-4 persons

E．>= 4 persons

4. Your real estate situation is：（ ）

A．have real estate investment

B．Private property for own use without debt

C．Private property for own use with debt

D．do not have private property, but renting a house

E．do not have private property, only renting one room

5. The range of your tolerance about your investment loss is：（ ）

A．0%

B．0-10%

C．10% - 15%

D．15% - 25%

E．>=25%

6. Your investment object is：（ ）

A．long term investment for high return

B．short term investment for earning difference of price

C．obtain certain annual return

D．investment return only for preventing inflation

7. If your investment suddenly loses 15%，what will you do：（ ）

A．buy more with this low price and wait for price rising

B．wait for price rebound

C．sell 50% of your investment

D．sell all your investment

E．preset a point-of-sale and sell your investment when it reaches this expected price

8. If your investment suddenly gains 15%，what will you do：（ ）

A．buy more

B．wait for more price rising

C．sell 50% of your investment

D．sell all your investment

E．preset a point-of-sale and sell your investment when it reaches this expected price

9.If you have the probability to win in a TV show, which one will you choose: ()

A．1000 euro

B．50% to earn 4000 euro

C．20% to earn 10,000 euro

D．5% to earn 100,000 euro

E．1% to earn 500,000 euro

10. The company where you work sell shares to employees for raising funds. The company will list in 5 years. You will able to sell your shares after it listing on the market. Once it listed on the market, it is possible that you will sell the shares with a price 10 times much higher than the original purchasing price. But you don't have sufficient money now, what will you do? ( )

A. give up this opportunity

B. sell your current investment that has profit

C. sell your current investment that has loss

D. use family funds (house purchasing or education)

E. borrow money from others

Research Process and Findings

Distance Research

- Polytechnic Institute of Viana do Castelo, Portugal, May 2017

Congress

- Spain Finance Forum 2015, Madrid, July 2015
Presented paper: *Behavioral Finance in Risk Management*

- World Finance Conference 2017, Sardinia, July 2017
Presented paper: *Multivariate Momentum Model in Risk Investment Management*

Articles

- INTERNATIONAL JOURNAL OF ECONOMICS AND FINANCIAL ISSUES, 2017, 7(3), ISSN:2146-4138, SCOPUS.
Paper: *How People Apply Mental Accounting Philosophy to Investment Risk?*

- Journal of the Asia Pacific Economy, sent in March 2017, waiting for respond, JCR.
Paper: *Behavioral Finance in Risk Investment Management*

- Academia Revista Latiamericana de Administración, on preparation, call for paper December 2017, JCR.
Paper: *Efficiency tests of the Chinese and the European Financial Markets*