Premium Payback Period Model and its Application in Stock Investment

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Abstract

A simple and effective investment strategy has always been the pursuit of both academicians and practitioners. This thesis introduces for the first time the concept of Premium Payback Period (PPP), the time required to earn back the premium paid for an asset. PPP is a powerful stock valuation model, which takes into account the company's current accounting information and future earning ability. In the stock market, a stock's PPP can be computed from its PB and ROE. In the real economy, a company's PPP can be observed from the date of establishment to IPO. As a rule of thumb, stocks with PPP < 5 years are undervalued and stocks with PPP > 9.5 years are overvalued, where the threshold PPP is obtained from observation in real economy.

PPP is proved to be an effective investment strategy in terms of stock selection as well as market timing. A pilot empirical study in Chapter 2 shows that a portfolio of stocks with PPP lower than 5 years can achieve excess return. In Chapter 3, I attempt to demonstrate the power of PPP model in selecting undervalued stocks. The size effect and PPP effect are incorporated in one framework and investigates both bull and bear market conditions. Investment recommendation is to invest in firms with small size and low PPP. When the indicators conflict, PPP criterion is the priority in the bear market and size criterion is the priority in the bull market. In Chapter 4, I endeavor to extend the application of PPP model to market timing. Both Treynor and Mazuy Model and Henriksson and Merton Model confirm the poor market timing performance of 10 Chinese equity-type funds. PPP model can help improve market timing significantly by adjusting position in stock market in line with PPP value of stock index. This research thus provides strong evidence that the PPP model performs as an effective investment strategy by selecting undervalued stocks and entering or exiting the stock market at appropriate timing.

Key Words:

Premium Payback Period, Stock Investment Strategy, Stock Selection, Market Timing

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Declaration

No part of this thesis has been submitted elsewhere for any other degree or qualification in this or any other university. It is all my own work unless referenced to the contrary in the text.

Statements of Copyright

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Dedication

To my beloved wife and three daughters.

Chapter 1 Introduction

Every day, millions of stock investors, no matter individual or institutional, have to face a common but often perplexing question: is the stock worth investing now? Finding the intrinsic value of a stock is always an endless effort for investors. However, despite the advancement in computation models and improvement in market environment, still no one can answer the above question with full confidence.

1.1 Research Background

The optimal investment strategy in the financial market, inter alia stock market, has consumed the wisdom of several generations of financial theorists and practitioners. The existence of such a strategy is a conundrum in itself. The milestone Efficient Market Hypothesis (EMH) proposed in a seminal paper by Eugene Fama (1970), ruled out such possibilities. However, efficient market is valid only under very rigorous conditions, one of which is investor's rationality. In a well functioning stock market with rational investors, it is impossible to yield excessive return and the discussion in this field comes to deadlock. Obviously these presumptions are far away from reality and it is widely noted on the investor's irrational behaviour and relevant market anomalies.

One possible but not exclusive cause of investor irrationality is the lack of education and training. But even those financial elites with MBA or PhD degrees in finance are still vulnerable to madness and emotions. Again and again, it is discovered that

educational level plays a negligible part in irrational behaviour, e.g. herding behaviour. In the book of *Investment Madness* (Nofsinger, 2001), such emotions are systematically summarized, and disposition effect is among the most significant phenomena. The disposition effect takes its root in the human psychology of seeking pride and avoiding regret. Such is human nature that investors are bounded to various personal limitations and their investment decisions are very likely to deviate from optimum.

According to *Standards for Classification of Stock Investors* issued by China Securities Regulatory Commission (CSRC), stock investors can be classified as individuals, institutions and corporations. Institutional investors mainly refer to funds, security companies, insurance companies, trust companies, QFII, social security fund, etc. Corporation shareholders refer to the business entities other than institutional investors. Corporation shareholders are usually original shareholders or strategic investors before IPO or by means of directed additional issuance or acquisition. Usually corporation shareholders trade infrequently despite the large proportion of market value they hold. According to the *Shanghai Stock Exchange Statistics Annual 2016*, individuals, institutions and corporations held respectively 25%, 15% and 60% of total market value. The three classes of investors contributed to 86.91%, 10.47% and 2.06% of the trading volume in the year of 2015. In conclusion, individual investors are an important active player in China's stock market.

It is acceptable that individual investors are irrational because of their lack of

expertise and experience as well as the so-called human weakness. Surprisingly, however, such irrationality is also prevalent among experienced and mature investors, best represented by investment managers in the institutions.

The major difference between normal individual investors and institutional investors is the latter's specialized knowledge and access to in-depth information and resources. According to China Securities Depository and Clearing Corporation Limited, the majority (69.11%) of Chinese individual investors are under the age of 40 years by the end of 2016, and only a small proportion (25.3%) of the individual investors have a bachelor's degree or above.

Table 1-1: Distribution of Individual Investors by Age as of 2015

Age	Under 30	30-40	40-50	50-60	Up 60
Percentage	37.64%	31.47%	19.05%	7.79%	4.06%

Data Source: China Securities Depository and Clearing Corporation Limited (CSDC)

Table 1-2: Distribution of Individual Investors by Academic Background as of 2015

Academic	Under Middle Education	Middle Education	Higher Education	Bachelor	Master or above
Percentage	23.59%	24.24%	26.87%	21.47%	3.83%

Data Source: China Securities Depository and Clearing Corporation Limited (CSDC)

On the contrary, people who are in charge institutional investors have more investment experience and better educational background. The best examples of these people are the managers of the public offered funds. According to the survey released by China Business Press Release Newswire in January 2014, the average age of the

fund managers is 38.2 years old. Out of the fund managers, 81.15% have a master degree, 13.66% have doctoral degree, 4.92% have a bachelor degree, and more than 50% of them graduate from China's top 4 universities. In addition, 72% are Chartered Financial Analyst (CFA), 15% have certification of Financial Risk Management (FRM) and 15% are Certified Public Accountant (CPA) in China. Besides the personal experiences and qualifications, fund managers have another dominant advantage over the individual investors. They have a strong research team who can provide intellectual support in macroeconomic analysis, industrial analysis, company-level analysis, etc. Another advantage of fund managers is that they are in charge of much more capital than individual investors so they are more able to diversify the allocation of capital and reduce systematic risks.

From observations in China's stock market in the past few years, it is found that even some fund managers enter in bull market (up to 6000 points) and exit in bear market (down to 1600). This phenomenon is somewhat inexplicable in the sense that fund managers or institutional investors are rational compared with individual investors. Institutional investors, including some security companies, are supposed to formulate decisions based on scientific forecast. However, it has been repeatedly tested that their forecast is often incorrect. Ostensibly, the security companies make predictions after a fundamental analysis of the economy, however, as one of the practitioners, I can reveal that a considerable proportion of the prediction is based on the status quo and trend on the prediction date, therefore the forecast is poorly grounded.

According to an investigation on Researcher Forecast Accuracy in China's Security Companies in 2009 conducted by *Investor China* (Issue 11, 12 March, 2010), more than half of the researcher recommendations are proved to be unsuccessful. The investigation covers 21,300 reports written by 1,042 researchers from 42 China's security companies from 1 July 2008 to 30 June 2009 and compares the recommended securities with the market index. It is astonishing to find that only 47% of the researchers are able to provide relatively accurate recommendations. More sarcastically, the bigger the brand of the security company is, the poorer its recommendation is, with China International Capital Corporation Limited (China's top investment bank) ranking lowest.

The change in position of stock represents a specific investment strategy. If the change in stock position is in advance of the changes in the stock index, such investment strategy is successful. To be more specific, if one investor increases stock position at time t and the market index rises at t+1, such a change in position brings profit. If one investor decreases stock position at time t and the market index drops at t+1, such a change in position avoids loss. If the position changes is opposite of the market index, such investment is a failure. Observations from the second half of the year 2009 identify a decline in positions of two types of funds: Open-end Fund (from 86.36% to 81.38%) and Close-end Fund (from 76.55% to 72.67%) during the third quarter of 2009 (Hu and Gao, 2009). However, the market index turned out to witness a growth from 2779.47 to 3039.86 in the fourth quarter. The negative correlation between fund's stock position and market index serves as evidence that fund

managers and institutional investors are not smart during the chosen period.

In such a stock market with both irrational individual and institutional investors, there must be full of opportunities for excess returns. Specifically, considering that China' stock market is still immature, traditional financial theories almost fail. China's stock market has two significant characteristics which set apart from mature markets, where the tradition financial theories are developed. A fundamental of a company cannot be reflected in the price of its stock.

The first characteristic is that state-owned enterprises (SOEs) play an important role in China's stock market. SOEs account for 35% of China's A-share listed company in terms of number and 48% in terms of market value as of 2015. On one hand, SOEs which have a very complicated decision making process, have relatively low operational efficiency and thus poor performance. On the other, SOEs have a good control of resources, specifically in industries with limited competition. These two aspects inter-link with each other. Despite the low efficiency and poor performance, SOEs are able to reshape its fundamental by restructure, merger & acquisition, or change of business scope, resulting in the considerable change in its stock price. Therefore, investors have to pay more attention to the "information" than the fundamental factors of the company.

The other characteristic of China's stock market is its sensitive to policies, e.g. macroeconomic policy, monetary policy, IPO policy, etc. It also occurs in other markets. The difference is that when the stock market is in an abnormal condition,

Chinese investors expect for a special policy and the regulator's action reinforces the investors' expectation. After hitting a historical high of 1558 points in February 1993, the Shanghai Security Composite Index (SSCI) slumped to 333 points in July 1994. The index was almost 80% off within one and half years. The market was expecting a so-called "save-the-market" policy. As expected, on 30 July 1994 China Securities Regulatory Commission (CSRC) put into effect three major policies to stabilize the stock market: (1) provisional suspension of IPO, (2) strict control of right offering for listed companies, (3) expansion of allowed capital for stock investment. Market intervention has also occurred later in different market conditions and indeed exerted an influential impact on the stock market. More interestingly, China's stock market is easily affected by editorials in *People' Daily*.

Based on the above discussions, investors do not have to care about the fundamentals of the companies. What really concerns is an easier access to the policy or information from the government, which can produce considerable speculative return rather than investment return.

Shanghai Securities Composite index has experienced rollercoaster-style movement in the past 10 years and is still very volatile recently in the aftermath of global financial crisis and gloomy domestic economic expectation. The deviation of the stock price and stock index from their fundamental as a result of irrational investors makes it possible for genius investors to identify undervalued stocks. The correct prediction on the index is also crucial to a successful investment strategy.

There are two major schools of investment philosophy, namely value investment and technical investment. Both investors believe in the imperfection of stock market so that they have the potential to beat the market and achieve excess return after doing their own homework. This is also the basic premise for this thesis otherwise all arguments are in vain. A value investor determines the intrinsic value of a stock by looking at the strength of the business, its financial status and the operating environment including macroeconomic factors. A value investor sticks to the firm belief that efficient market hypothesis works in the long term so that his endevours to seek for undervalued stocks will finally pay off in the future. Technical investors argue that fundamental elements of the stocks have already been completely priced. In the short run, the driving force to pull stock price away from fundamental level is the psychological aspect or the trading behaviour of the investors, which is exhibited from past movements of the stock price. Technical investors attempt to predict future movement from the observation of past movements. Technicians are usually more short-term traders by nature, contrasting with the long-term view fundamentalists generally take. Yet even experienced investors cannot reach consensus on which type of analysis can generate higher returns.

More scholarly speaking, value investment seems to have a more theoretical ground than technical investment. Therefore, a well-educated investor tends to apply the value investment; however the fact is that in many cases technical analysis does provide better return, especially in the short run. Both academicians and practitioners endeavor to find better investment strategies.

1.2 Relevant Literatures and Research Gap

Generally speaking, there are two schools of stock valuation models, i.e. absolute valuation models and relative valuation models. Absolute valuation is targeted at the intrinsic value of one stock by analyzing its fundamentals and estimating its future financial performance. Relative valuation, in contrast, examines the value of a stock by comparing with its competitors.

Absolute valuation models attempt to determine a stock's intrinsic worth based on its projected cash flows. The most well-known absolute valuations models are Discount Dividend Model (DDM) and Discount Cash Flow Model (DCF). DDM was first proposed by William (1938), viewing that the value of a stock is equivalent to the present value of all future dividends. DDM has several variants in terms of different assumptions of dividend payments, e.g. zero-growth model and constant growth model (Gordon, 1962). The three stage growth model (Molodovsky et al, 1965) takes into account different dividend growth rates for a more accurate estimation. The limitation of DDM is the assumption of a stable or predictable dividend payment policy. In reality, few companies pay out dividends in the manner defined in existent models.

DDM implies that dividend is the only yield for shareholders. DCF relaxes the assumption and emphasizes on the free cash flow available. DCF is a model with solid theoretical foundation because it incorporates all future cash flows related to the company. The free cash flow can either be free cash flow to the firm (FCFF) or free

cash flow to the equity (FCFE), discounted on correspondent rate. DCF model also requires analysts to have a clear understanding of the company's future financial performance. Predicting future cash flow is relatively easier for companies in a stable stage than fast growing companies.

Both DDM and DCF models neglect two important issues. The first one is that these two models neglect the cost of equity capital, in another word, opportunity cost for investors. The other one is that these two models neglect the current accounting information e.g. book value of equity. Edward and Bell (1961) proposed the first generation of Residual Income Model (hereafter RIM) to solve the problems. Residual income is the income generated by a firm after accounting for the cost of equity capital. Residual income is an economic income rather than an accounting income. A firm's value can thus expressed as the sum of its equity's book value and discounted future residual income. Different treatments of residual income lead to different specifications of RIM, e.g. Economic Value Added (EVA) model (Steward, 1991), Ohlson Model (Ohlson, 1995) and Feltham-Ohlson model (Feltham and Ohlson, 1995), etc. Feltham-Ohlson model is one of the milestones in valuation models. Feltham-Ohlson model perceives a company's value as the aggregate of its book value of equity and future profitability, highlighting the importance of accounting information in valuation. Bernard (1995) declares that Feltham-Ohlson model is "getting off to the right start" and his empirical study shows that valuation by Feltham-Ohlson model can explain 0.68-0.8 of stock price but traditional DCF models can only explain for 0.29. Penman and Sougiannis (1998) compared DDM, DCF and

Feltham-Ohlson models using data from 1973 to 1992, finding that Feltham-Ohlson model is superior to the other two.

Although absolute valuations models, which are based on the future cash flow or economic profit, have a logical grounding, they are not frequently used in investment practice due to the difficulty in precise prediction of future. It would require tremendous amount of financial information for a reliable forecast and the result is dependent on analysts' subjective selection of model parameters including cash flows and discount rate. The Morgan Stanley's survey entitled "*How We Value Stocks*" was published in 1999. The survey investigated the valuation methods most widely used by Morgan Stanley Dean Witter's analysts for valuing European companies. Surprisingly, fewer than 20% analysts use DCF model, which only ranks fifth, behind multiples such as PE Ratio, EV/EBITDA and EV/EG.

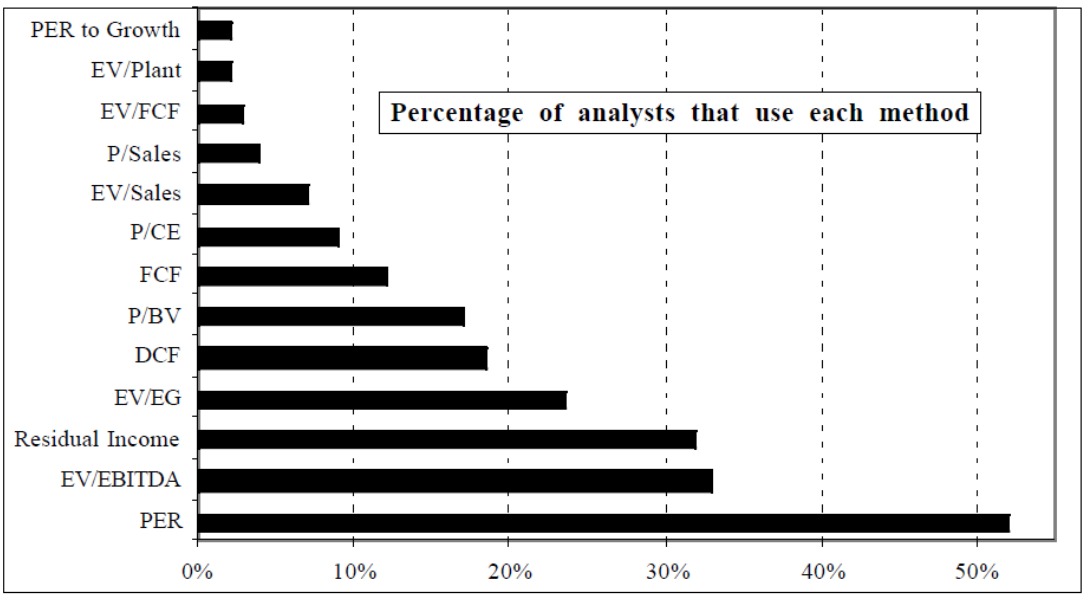

Figure 1-1: Most Widely Used Valuation Methods

Source: Morgan Stanley Dean Witter Research

Note: Weighted by the market capitalization of the industry in which it is applied.

The percentage falls below 15% in China according to China's WIND Data. The majority of security analysts prefer the other school of valuation, i.e. relative valuation, also called valuation using multiples. It refers to the notion of comparing the price of a stock to the market value of similar asset. Absolute valuation can judge whether a stock is worth investing or not, whereas relative valuation can justify which stock is a better target.

Relative valuation employs a series of ratios for a group of similar stocks and the stock with a below average ratio is deemed to be undervalued and worth investing. The most commonly adopted multiples fall into two categories, respectively based on market value and firm value. Market value based multiples include price to earnings (PE), price to book value (PB), price to sale (PS), price to cash flow (PCF). Firm value based multiples include EV/EBITDA, EV/sales and Tobin's Q (Tobin, 1969). Generally speaking, a lower ratio is "better" (cheaper) and a higher ratio is "worse" (more expensive). Basu (1977) found it true for PE and Senchack and Martin (1987) proved the case for PS.

Different ratios observe firm value from different perspectives and have their specific limitations. Earning in PE ratio is an accounting element which can be controlled by managers using a accounting policy at their advantage. Book value in PB ratio is the original price of asset minus depreciation and amortization, but it does not account for inflation and technological progress. PS ratio does not take into consideration of profitability whereas EV/EBITDA does not take into consideration of growth.

Sometimes two ratios have contradicting indications for valuation. Therefore it is recommended to use at least 2 ratios to leave less room for errors. For instance, the PEG ratio (price/earnings to growth ratio) first introduced by Frina (1969) and later popularized by Peter Lynch (1989) is a valuation metric for determining the relative trade-off between the price of a stock, the earnings generated per share (EPS), and the company's expected growth. Lynch proposes that a fairly valued company will have its PEG equal to 1. Stock with PEG <1 is undervalued and PEG>1 is overvalued.

Wilcox (1984) brought forward a framework which incorporates PB and ROE and proved the linear relationship between log (PB) and ROE. If the actual PB is higher (lower) than the one indicated by the linear relationship, the stock is overvalued (undervalued).

Tobin’s Q model provides a new horizon to valuation. Tobin’s Q is the ratio between a physical asset's market value (numerator) and its replacement cost (denominator). If the market value reflected solely the recorded assets of a company, Tobin's Q should be 1. If Tobin’s Q is larger than 1, the market value is greater than the value of the company's recorded assets, so that investors are encouraged to invest in physical assets rather than buy the stock. If Tobin’s Q is smaller than 1, the asset is undervalued in the stock market than in the real economy. Therefore, the ratio serves as the nexus between financial markets and markets for goods and services. Another application for Tobin’s Q is to determine the valuation of the whole market in ratio to the aggregate corporate assets. Tobin’s Q model has two shortcomings. The first one

is that it only addresses the physical asset and does not include intangible asset such as technology know-how and human capital. The second one is that the replacement cost, which is a lagging and inaccurate measure is too difficult to estimate because it is influenced by many factors. Different economic environments, for instance high inflation, will skew the metric substantially.

Stock valuation is a complex process and it is quite impossible that one single model can solve all the problems. Every model has its own advantages and disadvantages. DCF models have a strong theoretical grounding and simple expression, but future cash flows are not readily available and the models do not take into consideration of current accounting information. The determination of future cash flow and discount rate is subject to the analyst's experience and preference, which can lead to totally different results. So the application of DCF models in practice is not often. On the other hand, the multiples in the relative valuation models are very easy to obtain but each multiple is only applicable for a particular group of stocks and is vulnerable to external factors. The crosscheck by more than two multiples may help reduce the chance of misjudgment, but in some occasions, two relative ratios contradict each other. Even the Noble Prize winner Tobin's Q theory has many flaws despite its perfect economic interpretation. In conclusion, there is plenty of room for improvement in the valuation models. This research endeavors to provide a new valuation model which share the advantages of existent models and eliminate the disadvantages with my best effort.

1.3 Research Objective and Approach

The objective of this research is to present one of my own investment strategies which have been practiced for more than a decade. The full name of the model is called "Premium Payback Period" model (hereafter PPP model), which literally means the model to compute the required period to claim back the premium paid for an asset. The premium refers to the gap between price and book value. The comparison between the model-based data and the benchmark indicates whether the stock is overvalued or undervalued. PPP model also takes a value investment perspective. In this thesis, I attempt to show that PPP model is not only a good theory but also a powerful tool in investment practice. More importantly, the effective result of PPP model can indicate that value investment is viable in China's stock market. An investment strategy involves two dimensions. The first one is identification of stocks worth investing, i.e. stock selection. The second one, also equally important is to decide when to buy and when to sell, i.e. market timing. I also attempt to demonstrate PPP model's capacity in both dimensions.

To achieve the research objectives stated above, four other chapters are arranged to fully discuss the relevant topics. In Chapter 2, I will present PPP model and explain how it is constructed and I will also show how to apply PPP model in investment practice. In Chapter 3, I attempt to show how to apply PPP in selection of stocks under different market conditions and test whether the stocks selected can generate excess return. In Chapter 4, I will extend the application of PPP model in another

dimension, market timing and show that PPP model can improve investor's ability in market timing. Chapter 5 is the conclusion of this thesis. The details of the following four chapters are arranged as below.

In Chapter 2 "Premium Payback Period Model: A new method for stock valuation", I show how PPP model is constructed and the mathematical and economic indication of the model. PPP model belongs to the family of value investment which is based on the stock valuation. Tradition views are that the stock value is solely dependent on its future cash flow but more and more researchers point out that the current accounting information is equally important. In Chapter 2, I attempt to develop a framework to count for both current book value of asset and future earning ability in determining stock value. The concept of premium payback period is proposed to measure how long it takes the premium paid in purchasing stocks to be rewarded by company earnings. Stocks with low PPPs are safer and profitable investment. In this chapter, I also provide an easy method to calculate PPP in stock investment and how to determine the benchmark criteria for PPP index. The benchmark is obtained from observation in real market by the measure of time required for a firm from establishment to IPO in Growth Enterprise Market Board. A pilot empirical study is then conducted, indicating that normally stocks with PPP shorter than 5 years can be viewed as value stocks and can generate excess return.

In Chapter 3 "Practice of PPP in Stock Investment: A Perspective in Stock Selection", I demonstrate the PPP model's ability to identify undervalued stocks in an effort to

achieve excess return. A stock's excess return is its actual return over what can be justified by Capital Asset Pricing Model. Excess return is not only a practical issue but also of theoretical interest. In this Chapter, excess return is explained and achieved by means of size effect and PPP effect. Size effect refers to the fact that small size stocks generate higher returns than large size stocks. PPP effect refers to the fact that stocks with low PPP can generate higher return than those with high PPP. Both size effect and PPP effect are proved to be influential to stock returns, and one effect may be more influential than the other in different market conditions. A sample bear market and a sample bull market are both investigated respectively, demonstrating how the application of PPP method combined with size selection method can help pick stocks and construct well performing portfolios. Investment recommendations are provided for the two market conditions. Generally speaking, it is recommended to buy stocks with small capitalization and low PPP and sell stocks with large capitalization and high PPP. In bear market, PPP effect is more dominant whereas in bull market size effect is more dominant.

In Chapter 4 "Practice of PPP in Stock Investment: A Perspective in Market Timing", I demonstrate the PPP model's ability to identify investment opportunities, i.e. when to buy and when to sell. Excess return for an equity investment portfolio depends on the investor's decision of stock selection and market timing. Fund managers are supposed to have both stock selectivity and market timing abilities because of their expertise and experience. However, empirical studies in China as well as in foreign countries exhibit no convincing evidence that fund managers have either of these

abilities. In this chapter, I will adopt the traditional Trenyor and Mazuy Model (TM model) as well as Henriksson and Merton Model (HM model) to investigate the period from 2007 to 2013 using weekly data. The empirical result shows no significant market timing ability and in some certain period even negative market timing. Premium Payback Period Model, which is developed for valuation of individual stocks, is adjusted for the overall market to assess whether the overall stock market is overvalued or undervalued. The application of PPP for the overall stock market is demonstrated by case study across China's stock market history. PPP is found to be effective in predicting market trend and is proved to be good investment tool for market timing. The introduction of PPP can assist in adjusting the stock position of investment and exhibit better market timing ability for both funds and individual stocks.

In Chapter 5, I will draw the conclusions that PPP model excels in stock selection as well as market timing and provides the inherit logic behind the model. Then this chapter delivers a clear and systematic summary on how to employ PPP in stock investment for practical guidance. Despite the excellent performance of PPP model in stock selection and market timing, I also point out the underlying limitations of the model, the presumption of stable ROE and the negligence of investors' psychology, which can be explored by further research to improve PPP model.

1.4 Significance of Research and Contributions

This research is contributive in both theory and practice.

First and foremost, this research proposes a new model and criterion, named "Premium Payback Period" for stock investment. PPP model is such a model that takes into accounts both current accounting information and future earnings, that has a solid theoretical grounding and easy application, that can evaluate a single stock as well as the entire market. The analytical framework of PPP includes the two important elements of investment concern, price to book value (PB) and return on equity (ROE). Although this research is not the first attempt to combine PB and ROE in a single framework, it does attempt to provide a unified analysis of PB and ROE to generate a single indicator for investment guidance. The argument that stocks with lower PPP values are more favorable to those with higher PPP values unveils a potential connection between real economy and fictitious economy. Such a nexus has been addressed in the Tobin's Q theory, but Tobin's Q theory only analyses it in a static manner. PPP model employs a dynamic view on how real economy and fictitious economy is linked. This research also perceives the time duration from a company's establishment to initial public offering in Growth Enterprise Market (GEM) of China's stock market or Second-board Market in other countries as the benchmark PPP in the real economy. A stock with a lower PPP than the benchmark is undervalued and is worth investing. This is how PPP model serves as a bridge between real economy and fictitious economy.

As a DBA thesis, practical value is equally important and desirable. The most direct impact of this research is to conclude an investment strategy on what to invest and when to invest. The question of what to investment is no longer a big problem. The

classic portfolio theory and risk diversification have offered guidelines for stock selection and capital allocation. But the theories remain well-structured theories and perform poorly in real practice. In this research PPP model is proved to a good investment strategy with numerous advantages. First of all, it is easy to apply by merely retrieving basis financial data of the company and conducting easy calculation. Second, unlike technical analysis, the PPP strategy has a solid theoretical foundation. Thirdly, PPP can be used both in absolute valuation and relative valuation, by comparing it with the PPP in the real economy or with PPP values of other stocks. Finally and equally importantly, unlike other value investment strategies, PPP model can be used to select undervalued stocks as well as to indentify investment timing.

It is widely recognized that when to invest has been pestering both individual and institutional investors. Disposition effect refers to the selling of winners and buying of losers. As far as timing is concerned, the disposition effect also applies to holding losers too long and selling winners too soon. Holding losers too long indicates that the stocks with dropping price will continue its poor performance and will not rebound as much as wished; selling a winner too soon implies that it would have continued its favorable momentum if the selling is postponed. PPP model is meant to pinpoint the exact timing for buy and sell, or in other words enter or exit the stock market. The solution of timing problem will definitely increase investment performance and efficiency.

In conclusion, this study contributes both to theory and practice with the new model

of PPP. It inherits the new advancement in valuation by means of current accounting information and future earning ability and provides a unified way to evaluate both individual stocks and the entire stock market. The advantages of PPP model are its easy application, solid theoretical logic, linkage between real and fictitious economy as well as its application in both stock selection and market timing. Last but not least, the above contributions are based on the author's willingness and effort to make public the investment strategy which would otherwise be merely an investment secret.

Chapter 2 Premium Payback Period Model: A New Method for Stock Valuation

2.1 Introduction

Chinese stock market was reactivated in December 1990 and since then the total value of Shanghai and Shenzhen stock markets have grown rapidly to over 10 trillion USD in June 2015, almost equal to China's GDP in the previous year. The development of Chinese stock market is strengthened by the participation of first mutual fund in 1997. Since then the Chinese stock market should have been more mature and stable. Unfortunately, the market behavior is not significantly different from before when there were only individual investors in the market. The dynamics of the stock market in China has been equally volatile and unpredictable. After several years of bear market till 2006, China's stock market bounced from 998 to 2245 points. The Shanghais Security Composite Index even reached a historical peak above 6000 in 2007. Many professional investors were taken aback by the extreme bull market, attracting more new investors to enter the market. As a result the number of active stock account hit 100 million in 2007. To the investors' great disappointment, the bull market does not exist for long and soon the stock index dived to half of the peak around 3000 points. Many investors have entered the stock market when the index was above 5000, concluding from the recent trend and believing that the stock market can provide easy money. The unsuccessful investment is resulted from the overconfidence of technical analysis and trend investment. The recent turmoil in

China's stock market again reshuffles investors' opinion about it. It took a few months for the index to rise from below 3000 points to over 5000 points and it took even fewer weeks for the index to fall dramatically from above 5000 points to below 3000 points.

It is common knowledge that when the stock price goes too high above its intrinsic value, it is doomed to go down. However, these irrational investors turn blind to the common relative valuation indicators such as PE and PB and only believe that the market can rise as long as possible. Therefore it is necessary to restate the concept of value investment for three reasons.

Firstly, China's stock market enters a new stage and entails value investment which is a mature idea and has been practiced for decades in foreign stock markets. This idea attracted investors' attention in 2003 when outdated investment ideas were heavily criticized. At the initial stage of China's stock market from 1992 to 1997, the movement of stock price was irrelevant to fundamental factors and speculation was universal. Such conditions changed afterwards with more institutional investors and experienced individual investors. The completion of share structure reform exerted a powerful influence on the stock market and neglecting fundamental factors could be disastrous.

Secondly, on the demand side, Chinese stock investors are learning to be more rational and value investment is more welcome. After Chinese stock investors experienced the huge upside movement in 2007 and huge downside movement in

2008, they started to reflect on their investment philosophies and value investment was reinforced. Even if the lesson is not serious enough, the recent movement of stock index like a rollercoaster reminds investors of value investment. Still many other investors doubt the validity of value investment in China and argue that value investment is air in the attic for China's stock market and the investment environment is not suitable for value investment. To test the suitability of value investment in China is urgent and is one of the research aims.

Value investment was first brought forward by Benjamin Graham and David Dodd (1934) in their masterpiece *Security Analysis*. They advocate that investors pay more attention to the value of companies per se than the fluctuations of stock market. This old and simple philosophy is enriched and practiced by Glenn Greenberg, Warren Buffett, Peter Lynch among others and leads to considerable investment reward.

The idea of value investment is merely to compare intrinsic value and market price of stocks, so simple that not many investors take it seriously. Value investment is founded on two basic presumptions: (1) market price always deviates from intrinsic value, and (2) market price always tends to revert to intrinsic value. The discrepancy between stock value and price consists as an investment risk. Value investors buy stocks whose prices are sufficiently below their values. The gap is the so-called margin of safety, an important concept for value investment. The greater a stock price deviates below the intrinsic value, the safer the investment is.

Value investors are extreme risk averters, who buy stocks as cautiously as if they buy out the whole company. Margin of safety is their weapon to fight against risks due to limited investment ability, stock market fluctuation and company development uncertainty. Margin of safety can help to buffer investor's loss against these adverse factors.

Margin of safety makes profitable investment possible, which sets itself apart from modern investment theories. First and foremost, value investment disagrees *Market Efficiency Hypothesis* and argues that the phenomenon of unmatched stock price and value is normal and key to the success of value investment. According to modern finance theories, return is positively related to risk; in contrast, value investment advocates that high return can always be accompanied by low risk, because of margin of safety.

Value investment emphasizes the intrinsic value of an asset and attempts to compare it with its price. If the price is lower than the intrinsic value, it is worth to buy, otherwise the stock is regarded as overvalued and not worth to buy. Both theorists and practitioners have developed many valuation methods to decide the intrinsic value of the stock so that the value and the price are comparable in one framework. The intrinsic value of a stock is dependent on a series of factors including macro economy, industrial cycles and company-specific elements. Value investors pay great attention to the margin of safety. When the price of a value investment product goes too high, it is no longer safe and loses its value. The perception of margin of safety is quite

different from momentum investment. When the price continues to climb, the margin of safety is undermined and investment is not recommended. However, momentum traders believe with no concrete economic ground that the trend is sustainable. A rational investor should be a value investor. De Bondt and Thaler (1985) investigated the monthly cumulated excess return and proposed the over-reaction hypothesis, concluding that the average return of losers portfolio (value stocks) is 19.6% higher than market return while the average return of winners portfolio is 5% lower than market return.

How safe is a stock investment? To what extent is the stock price or index low enough? These questions have been frequently asked by value investors. Many scholars have provided various models for this purpose. The direct way is to calculate the intrinsic value of the stock from such models as discounted dividend model, discounted cash flow model, etc. The calculated value of the stock is compared with its current price. This is what we call absolute valuation, focusing on the stock itself. The other school of valuation is relative valuation such as price to earnings (PE) and price to book value (PB). For instance, investors can compare PE of one stock with its peers in the same industry so that the stock with lower PE seems to have better investment value.

No matter which valuation method is applied, the investor should always take into consideration the accounting value of the stock and its potential earning ability. The purpose of this study is to provide a new scope to evaluate the safety of an investment and to determine whether a stock is undervalued or overvalued. The intuition of the

research idea is simple and has been routinely applied in project investment decision making. In a project investment, a prudent investor who fears future uncertainty prefers that the investment is rewarded as early as possible. The concept of payback period is employed to measure the velocity of investment reward. Stock investment is comparable to project investment in that all investors are alike to require cash inflow to compensate initial outflow.

The rest of the chapter is arranged as follows. Section 2.2 conducts a review of related literature of valuation models and value investment theories. Section 2.3 provides the theoretical foundation of premium payback period and derives the formula for computation. Section 2.4 exhibits the practice of premium payback period in stock investment and performs a pilot empirical test for PPP method. Section 2.5 is the conclusion for this chapter.

2.2 Literature Review

The focus of this study is to develop a model to decide whether a stock is worth investing. The majority of the related literature is about value investment and stock valuation. An ideal stock valuation model should have three features. First, it should be simple and understandable. Secondly, it is able to be tested and refined against historical data and precise in explaining current prices based on these data. Finally, it is open to incorporate related ideas about financial variables and newly observed facts.

This literature review starts from the traditional Discount Dividend Model and Discount Cash Flow Model and then discusses about modern models including Residual Income Model, PB-ROE Model, etc.

2.2.1 Discounted Cash Flow Models

Generally speaking, the value of an investment is the present value of all future cash flows. Fisher in his works *Theory of Interest* points out that the value of an asset is determined by the profit which the asset can generate in the future. It is common knowledge that the stock value is the discounted future income or cash flow.

The formula of Discount Cash Flow is demonstrated in equation 2-1,

$$V = \sum_{i=1}^{\infty} \frac{CF_i}{(1+r)^i} \tag{2-1}$$

where V stands for value of the asset,

CF_i stands for future cash flow at time i,

r stands for discounted rate.

Different measurements of cash flow leads to different forms of DCF models.

2.2.1.1 Discounted Dividend Model

The cash flows to a stock investor consist of the dividends paid during the holding period and the stock selling price at final time. Considering that the final price of the stock is dependent on future dividends, current stock value can be expressed as the sum of all discounted dividends in infinite periods. The typical model of this category

is the Discounted Dividend Model (DDM). William (1938) proposed the early form of this model as Present Value of Dividend Model, which considers that the reasonable value of a stock equals to the present value of all future dividends and the discount ratio is the risk-adjusted required return. The formula is represented in equation 2-2.

$$V = \sum_{t=1}^{\infty} \frac{d_t}{(1+r)^t} \tag{2-2}$$

where d_t refers to the dividends paid in time t and the other parameters are the same as in equation (2-1).

There are various types of DDM according to different assumptions about the dividend growth. Gordon (1962) developed DDM into Gordon Growth Model. Gordon assumes that the dividend grows at a constant rate g ($g<r$)，so that the DDM formula can be rewritten as:

$$V = \frac{d_1}{r-g} \tag{2-3}$$

Gordon Model exerts a simple assumption on the growth of future dividends. The growth rate is dependent on the development stage of the company. Gordon model is suitable for a steadily growing company with a fixed growth rate of sales or profits. The fixed growth rate of dividends is often challenged by both researchers and investors. As a matter of fact, the growth rate of dividend varies from time to time and the variance of Gordon model leads to two stage model and three stage model among others (Molodovsky, 1965; Fuller and Hsia, 1984).

In practice, the application of DDM is subject to the dividend payout policy. The preposition for DDM is that the company pays out dividends with stable and predictable dividend policies. Many companies with diversified stock holders in mature capital markets have well-established dividend policies, which are helpful in forecasting future dividends. However, there are also many companies who pay dividends infrequently or irregularly, especially those companies extremely profitable or extremely unprofitable (Campbell and Shiller, 1988). Lee (1996) found that 25% of the NYSE listed companies never pay out dividends. In fact, many companies prefer to repurchase stock instead of dividend. Other companies who do pay out dividends only pay out dividends in the late development stage of the company. In some stock markets which are still on its early stage like China, stocks and investors are still not accustomed to pay or receive dividends.

2.2.1.2 Discounted Free Cash Flow Model

In order to solve this problem of irregular dividend payments, Free Cash Flow Model is invented. Free cash flow model replaces dividend with free cash flow and suggests that the value of a company equals to the present value of free cash flow available. Here it is important to distinguish the free cash flow to firm (FCFF) and free cash flow to equity (FCFE).

FCFE refers to all cash flows available to the equity or shareholders. FCFE can be viewed as the source for dividends. However, most of companies do not pay out all FCFE as dividends for the following three reasons. First companies prefer stable

dividends payment, but FCFE is much more volatile, so dividends are always only a small part of FCFE. Second, a proportion of FCFE is retained for future capital investment for continual growth. Thirdly, income tax for capital gain is very high, so retaining FCFE can avoid payment of dividend tax. Using dividends alone may underestimate the earning ability of the company.

Using FCFE, the value of equity can be calculated as:

$$V = \sum_{i=1}^{\infty} \frac{FCFE_i}{(1+r)^i} \tag{2-4}$$

where FCFE = Net income + Depreciation - Capex – Working Capital Investment - Repayment of Principal

r is the required rate of return as in DDM.

Unlike FCFE, FCFF includes all the cash flows available to the firm, including both shareholders and debt holders. One way to calculate FCFF is to sum up all the cash flows to different types of investors.

$$FCFF=FCFE+Interest\ rate\times(1\text{-}tax\ rate)+loan\ repayment+preferrd\ stocks\ dividend$$

Another way is to compute directly on the basis of EBIT:

$$FCFF=EBIT\times(1\text{-}tax\ rate)+depreciation–capital\ expenditure–working\ capital\ change$$

Since the free cash flow refers to the cash flow to both the owners of equity and debt, the discounted ratio is accordingly different using weighted average cost of capital. The value of the firm is expressed as:

$$V = \sum_{i=1}^{\infty} \frac{FCFF_i}{(1+WACC)^i} \tag{2-5}$$

where WACC is weighted average cost of capital.

Although FCF model solves the problem of dividend payout and is perfect in theory, it is still subject to various problems in practice. First of all, it requires a precise forecast of future cash flow, which is almost impossible. It is still feasible to forecast the figures in 3-5 years, and assume the situation remains the same afterwards. Secondly, discount ratio is the required return adjusted by risk and it is difficult to determine. Different people may have different risk preferences and it is not suitable to apply the same discount ratio for all investors. Quantifying risk preference seems good in theory but infeasible in practice. Thirdly, free cash flow is calculated from a series of adjustment to operating cash flow, including extracting long term capital. In this case for a grow company, free cash flow may stay negative for a long period.

Both DDM and FCF models are well-grounded in logic: the value of an asset is only relevant to future cash flow and discounted rate, and irrelevant to its current book value which is believed to be sunk cost. However, future cash flow is based on forecast but book value is definite and in this sense book value is more reliable than discounted cash flow. In stock valuation, it is improper to totally neglect the presence of the accounting value. Incorporating book value into discount cash flow model is a meaningful attempt. One of the major developments is the residual income model.

2.2.2 Residual Income Model

Although discounted cash flow models are a great progress compared with static

assessment of stock value by accounting measures, the significance of accounting information cannot be neglected. The discounted cash flow model bets all on the prediction of future. As the old saying goes, one bird in hand is better than two birds in the woods. Value investors do not hinge merely on the abstruse technique by forecasting futures. By more direct means, assessing the book value of a company's asset is helpful to better understand the intrinsic value of the firm. An ideal analysis is an integrated framework that incorporates both current accounting information and future earning information. The start of this marriage is Residual Income Model (RIM) brought forward by Edwards and Bell (1961) who turn the traditional discounted dividend model into discounted expected residual return model.

RIM model also starts from the tradition DDM in that the stock value is expressed by

$$V = \sum_{t=1}^{\infty} \frac{d_t}{(1+r)^t} \tag{2-6}$$

where V is stock value, d is dividend, r is cost of capital,

Impose the clean surplus relation, which contains accounting information,

$$B_t = B_{t-1} + E_t - d_t \tag{2-7}$$

where B is book value of equity and E is earning or net income, E/B=ROE

Using clean surplus relation (2.7) to replace d, the value of stock can be rewritten as

$$V_0 = B_0 + \sum_{t=1}^{\infty} \frac{RI_t}{(1+r)^t} \tag{2-8}$$

where $RI_t = E_t - rB_{t-1} = (ROE_t - r)B_{t-1}$, adjusts net income with cost of capital, so it is also viewed as economic return.

Suppose *ROE* is constant and apply Gordon model (2-3), the stock value can be further simplified as

$$V_0 = B_0 + \frac{ROE - r}{r - g} B_0 \tag{2-9}$$

This is the first time that intrinsic value is expressed by an integrated framework of book value of equity (current factor) and ROE (future factor). It should be well noted that this is derived from the tradition DDM model. RIM model reveals the relationship between the equity value of company and its accounting variables. This new idea attracts attention from both theoretical and practical field and has become one of the most heated topics for corporate finance and accounting.

Although residual income model and discounted cash flow model share equivalent theoretical basis, researchers often argue about which model is superior. Some finance literatures have argued in favour of the DCF approach for firm valuation since it is independent of the choice accounting methods (Copeland, Koller, & Murrin, 1990). However, Ohlson (1995) demonstrated that the residual income approach is insensitive to different accounting methods if clean surplus accounting is applied in the forecasted financial statements. More recent studies such as Penman and Sougiannis (1998) and Francis, Olsson, and Oswald (2000) examined empirically conclude that the residual income approach yields more accurate firm value estimates than the DCF approach.

RIM takes advantage of discounted cash flow model in its time value of money and risk-adjusted principle. The difference is that RIM perceives from value creation

(ROE) rather than redistribution (dividends). The business of a company is focused on how to create value and all business activities will be represented in the financial report. Miles (1977) pointed out as early as in 1977 that the value of a company is composed of two elements: asset value and growth opportunity. The intrinsic value of a stock equals to the aggregate of current net asset and net present value of future equity growth. The value of a stock can be viewed as an option on the equity. Since more and more companies tend to pay out little cash dividend, this model is getting popular.

Financial analysts are keen on the residual income model which has a profound accounting basis. The model indicates that only when a company can create more value than cost of equity, its intrinsic value can rise so that investors are willing to pay a price higher than its book value of net asset. Otherwise, the profitability of the company cannot cover equity cost and investors are reluctant to pay a premium. The difference between the stock price and the net asset value is determined by the company's ability to create residual income. Professor Penman argues that the biggest difference between residual income and discounted cash flow model is that the former highlights the value creation process in a company. The value for investment lies on whether a company can generate residual after counting its capital cost. Price to book ratio (PB) will increase with the company's ability to provide economic value added. In contrast, if a company's profit generating ability is poor, it is not strange to find its price below net asset value.

Traditional discounted cash flow model only cares the expected future cash flow and ignores the accounting information. In fact, how much accounting information is reflected in stock price is a key criterion for its price discovering function and capital market efficiency. The traditional discounted cash flow model does not utilize information from the financial report and the accounting information cannot play its role in stock pricing procedure. Residual income model digs out the accounting information and attempts to value a stock using data from balance sheet and profit loss sheet. Residual income model is firmly based on the accounting. Although many scholars have criticized the accounting information which is based on historical cost, empirical studies show that accounting information can account for a good portion of stock price movement. Using accounting information is a relatively direct way to make valuation and it avoids the translation of accounting figures into cash flow figures, therefore RIM is more practical. American Accounting Association recommends residual income model to be a more accurate model than discounted cash flow model. Lo and Lys (2000) noticed that since 1980s, analysts earning forecasts are readily available so that the application of RIM is easier. Plenborg (2002) makes an interesting comparison between the residual income and discounted cash flow approaches in equity valuation and suggest it is logical to estimate firm values based on concepts known from accrual accounting and financial statement analysis, i.e. the residual income approach.

The Residual Income Valuation is further developed by Peasnell (1982) and Ohlson (1995). Ohlson's work is a great leap in the development of residual income model

with the introduction of the linear information dynamics. The linear information dynamics tries to identify the mechanism of abnormal earnings and connects current information to future abnormal earnings, which makes possible the development of a valuation model of a firm. Since Ohlson (1995)'s seminal research, more empirical studies have been completed. Therefore the residual income model is also called EBO model. Empirical studies by Dechow et al. (1999), Myers (1999), and Callen and Morel (2001) and Morel (2003) provide extensive empirical evidence that the Ohlson (1995) model is of limited empirical validity. One possible reason is the restrictive assumption of the Ohlson model that accounting is unbiased, but as a matter of fact US GAAP is strongly biased towards conservatism. Feltham and Ohlson (1995) model differs from the Ohlson model by the inclusion of the expected growth of the firm's operating assets in the valuation equation, in addition to abnormal earnings and book values. Youseff et al (1996) found that earnings, book values of equity and dividends were important factor for stock valuation with multilagged information dynamic model. Dechow, Hutton and Sloan (1999) show that residual income is well described by the mean reverting process in Ohlson (1995). They made an interesting comparison between EBO model and pure earnings model or pure book value model. The empirical results indicate that EBO model excels in predicting and explaining future abnormal earnings, current stock prices and stock returns.

2.2.3 Relative Valuation Ratios

Although Residual Income Model is only a theoretical model and needs modification

in real practice, the conclusion is essential and contributive. The RIM recalls investors' attention to the margin of safety. The safety of a stock investment depends on the book value of equity and earning ability. These two factors can lead to two ratios, i.e. price to book value (PB) and price to earnings ratio (PE), as two most important indicators for relative valuation.

Absolute valuation compares the stock price with its intrinsic value and it can directly whether or not the stock is worth investing. Relative valuation mainly compares the price ratio of one stock with other stocks with similar characteristics, usually in the same industry. A relatively low price ratio indicates that the stock may be undervalued and is worth investment. The most common relative valuations are PE and PB.

In stock trading, the PE ratio of a stock (also simply called "multiple") is a measure of the price paid for a share relative to the annual Earnings per Share (EPS)

$$PE = \frac{Market\ Price\ per\ Share}{Annual\ Earnings\ per\ Share} \tag{2-10}$$

The PE ratio is a financial ratio used for valuation: a higher PE ratio means that investors are paying more for each unit of net income, so the stock is more expensive compared to one with a lower PE ratio. The PE ratio also shows current investor demand for a company share. The PE ratio can be seen as being expressed in years, in the sense that it shows the number of years of earnings which would be required to pay back purchase price, ignoring inflation.

The PB ratio is a financial ratio used to compare a company's current market price to its book value.

$$PB = \frac{Market\ Price\ per\ Share}{Book\ Value\ per\ Share} \tag{2-11}$$

Book value is an accounting term denoting the portion of the company held by the shareholders; in other words, the company's total tangible assets less its total liabilities. A higher PB ratio implies that investors expect management to create more value from a given set of assets, all else equal (and/or that the market value of the firm's assets is significantly higher than their accounting value). PB ratios do not, however, directly provide any information on the ability of the firm to generate profits or cash for shareholders.

Basu (1977)'s empirical results based on CAPM model show that low PE stocks can generate excess return compared with the whole market but high PE stocks cannot. Goodman and Peavy (1983) reached the same conclusion with industry PE ratios. Other relative valuation ratio includes the Price-to-Sales Ratio (P/S ratio). Senchack and Martin (1987) believe that low P/S portfolio beat market performance and that the excess return for low PE portfolio is more stable than low PS portfolio. Jacobs and Levy (1988)'s investigation of the period between 1978 and 1986 found that PS ratio is significantly related to the performance of portfolio return. Fama and French (1997) reviewed the return of the major markets from 1975 to 1995 and revealed that the return of value stocks are 5.56%-7.68% higher than growth stocks, and value stocks

beat growth stocks in 12 markets out of 13 sample markets. Lakonishok, Shlefer and Vishny (1994) confirmed the above findings using NYSE stock data.

Harsley (2001) points out that the residual income model also provides insight into the inferences that can be drawn from PB and PE ratios. Penman (1996) proves that PB is related to future residual income and the expected growth rate in the book value of equity.

Both indicators can be used to judge the safety of stock investment and a stock with lower values for both indicators is favorable. However, in some cases these two ratios give contradictory recommendations. PE takes into consideration the dynamic cash flow of stock earning but neglects the cost of the asset (book value). PB compares the market valuation and the accounting valuation of a stock but fails to describe its earning ability. High PB and high PE is a signal of overvalued stock whereas low PB and low PE is a signal of undervalued stock. It would be tricky to evaluate stocks with high PB but low PE or with low PB but high PE. Penman (1996) demonstrates and interprets different PB and PE combinations as in Table 2-1.

How to solve the dilemma when PB and PE show contradicting implications? An indicator that combines PE and PB can solve the problem. A firm's PE-PB combination reveals the market's expectation of future profitability relative to current profitability. PB can be viewed as price premium to buy a stock and PE can be viewed as the number of years of earnings which would be required to compensate the price for procurement. An ideal model should balance these two factors in one single

framework and the pioneering research in this regard is the PB-ROE model (Wilcox, 1984).

Table 2-1: Penman (1996)'s Exhibit of PB-PE Combinations

	High PB	Low PB
High PE	High-performing firms Expected positive residual income Increasing income (32.8%)	Improving firms Expected negative residual income Increasing income (16.7%)
Low PE	Declining firms Expected positive residual income Decreasing income (17.1%)	Poor-performing firms Expected negative residual income Decreasing income (33.4%)

Notes: This table summarizes Penman (1996)'s observation over the public data of listed companies in NYSE and AMEX from 1968 to 1985 for an average sample of 2574 firms per year. The firms are divided into two groups in each dimension of PB or PE. A firm with PE above (below) the cross-sectional median falls into the high (low) PE category. A firm with PB above (below) the cross-sectional median falls into the high (low) PB category. A firm can be included into one of the four cells according to its PE and PB values. Penman (1996) underlines the characteristics for all the four types of combinations in the corresponding box. The percentage of each category from the overall sample is shown in the bracket in each box. Stocks in the category of high PB and high PE are not recommended and stocks in the category of low PB and low PE are recommended. The stocks with high PE and low PB or with low PE and high PB require further examination for investment recommendations.

2.2.4 PB-ROE Model

Wilcox (1984)'s PB-ROE model considers PB and ROE in one framework. PB and ROE can be regarded as the extension of the PE and PB conflict, considering that ROE=E/B=PB/PE. The dilemma of PE and PB can be restated as that of PB and ROE: low PB and high ROE is favorable but the fact is that high PB is always associated with high ROE and low PB is always associated with low ROE. This indicates that high PB is caused by the expectation that the firm can achieve an abnormally high ROE. PB and ROE are positively related and such a relation can be theoretically derived as follows:

The model begins with the identity:

$$P = B \cdot (P / B) \tag{2-12}$$

Take difference on both sides of (2-12)

$$\Delta P = \Delta[B \cdot (P / B)] = \Delta B \cdot (P / B) + B \cdot \Delta(P / B) \tag{2-13}$$

Divide by P on both sides of (2-13)

$$\Delta P / P = \Delta B / B + \Delta(P / B) / (P / B) \tag{2-14}$$

Define capital return as the sum of price appreciation and dividend payout as:

$$r = \frac{\Delta P + D}{P} = \frac{D}{P} + \frac{\Delta P}{P} \tag{2-15}$$

Applying the differential identity:

$$r = \frac{D}{P} + g_B + \frac{\Delta(P / B)}{P / B} \tag{2-16}$$

where $g_B = \Delta B / B$ is the growth rate of book value of equity.

Rewrite (2-16) as

$$\Delta(P/B) = P/B(r - g_B) - D/B \tag{2-17}$$

Rewrite (2-17) into differential equation:

$$\frac{d(P/B)}{dt} = P/B(r - g_B) - D/B \tag{2-18}$$

The solution to the differential equation is

$$P/B = \frac{D/B}{r - g_B} + C \cdot e^{(g_B - r)T} \tag{2-19}$$

where C is a constant to be further derived by the two conditions:

(i) In the long run, PB tends to be 1, i.e. $\lim_{t\to\infty}(P/B) = 1$, so that $\frac{D/B}{r - g_B} + C = 1$;

(ii) Clean surplus relationship: $\Delta B = E - D$, so that $ROE = \frac{E}{B} = \frac{\Delta B + D}{B} = g_B + D/B$

Then the constant C is solved as:

$$C = 1 - \frac{D/B}{r - g_B} = \frac{r - g_B - D/B}{r - g_B} = \frac{r - ROE}{r - g_B} \tag{2-20}$$

and

$$P/B = \frac{D/B}{r - g_B} + (\frac{r - ROE}{r - g_B})e^{(g_B - r)T} \tag{2-21}$$

Suppose no dividend is paid out, i.e.D=0，

$$g_B = \frac{\Delta B}{B} = \frac{E - D}{B} = \frac{E}{B} = ROE \tag{2-22}$$

In the end, PB can be simplified as

$$P/B = e^{(ROE - r)T} \tag{2-23}$$

Take logarithm on both sides of (2-23)

$$\log(P/B) = (ROE - r)T \tag{2-24}$$

This is the PB-ROE model, which is a rigorous mathematical model depicting the relationship between PB and ROE. It is evident that from the theoretical point of view

that PB and ROE are positively related. This relationship can also be empirically determined by the regression model:

$$\log(P/B) = -rT + T \cdot ROE \tag{2-25}$$

The linear relationship between log (P/B) and ROE can be illustrated in a scatter plot in a two dimensional framework with log (P/B) on the vertical axis and ROE on the horizontal axis. Using cross-sectional data, every stock is matched with a pair of ROE and log (P/B) and the best fit line is the relationship between the two factors. The best fit line can be viewed as a benchmark for stock valuation. Stocks falling above the line have high PB but low ROE and thus are overvalued. Stocks falling below the line have low PB but high ROE and thus are undervalued. The tradeoff rate between log (P/B) and ROE is the slope T, which is only simply defined investment horizon by Wilcox. Wilcox does not define the concept of T and this is the research gap that this paper aims to fill.

The idea of combining PB and ROE is borrowed by Clubb and Naffi (2007), who actually uses book to market value and future ROE expectations. Their research shows strong evidence that a simple linear model combining the book-to-market ratio with expectations of future book-to-market and ROE explains a significant portion of the cross-sectional variation in future stock returns.

Other models including Estep's (1985) T-Model and Leibowitz's (1999) P/E-Orbit model are developed from Wilcox PB-ROE model, using similar logic. The PB-ROE

model differs from both in that its structure more readily invites empirical estimation of its parameters.

2.3 Premium Payback Period Model

Since the value of a stock is determined jointly by book value of equity (past and present) and the stock's earning ability (future), it is useful to determine the relationship between PB and ROE. Wilcox has provided one version but the slope *T* in the equation (2-24) is not well justified. In this part, the core model for this research Premium Payback Period model is discussed.

2.3.1 Introduction to PPP Model

Stock market price is always higher than the book value per share, so investors always pay a premium for the opportunity to gain capital return. Buying stocks is like waiting in a queue, you have to consider: (i) How long is the queue (how much premium to pay, PB), and (ii) How fast is the queue moving (how profitable is the firm, ROE). As shown in PB-ROE model, PB and ROE has a positive relation, meaning that the higher P over B, the bigger ROE is required to recover the premium.

A discreet investor cares how fast his overpaid premium for the stock is compensated by the capital return, thus is the concept of Premium Payback Period

It is a common phenomenon that stock is sold at premium, i.e. the stock price is higher than its net book value per share. The investor buys the stock at price which is

higher than the book value of equity (P > B). It should be a stupid investment if P is consistently larger than B. However, the fact is that the asset is earning profit every year. Assume that no dividend is paid out so that all earning is retained to add to the book value of equity. Consequently, B is growing bigger. Since the market has the expectation that the asset is creating value during the period, the market endows the stock price with a premium over its book value. The premium is reduced with more profit added to the book value. The investor's major concern is the final stage when B levels with P and his investment is paid back. This is called premium payback period in the stock market. PPP is a good measure to decide how much premium is reasonable and it should be dependent on ROE.

The existence of premium in the fictitious economy coincides with the proposition raised in residual income model. Residual income model reveals that the intrinsic value of a stock equals to the book value of equity and the net present value of expected residual income. It is also equivalent to Miles' opinion that the market value of the company composes of the asset and growth opportunity. When an investor makes the investment decision of whether to buy the stock, the most crucial factor he has to consider is whether the premium is acceptable, which is further determined by the absolute value of the premium and the growth speed of the company's book value of equity. The increase in the company's book value of equity stems from its profit which is not distributed to shareholders but reinvested in the company. The growth speed of the increase can be measured by ROE. The safety of a stock investment is negatively related to premium and positively related to ROE. ROE is a figure which

can be derived from the financial report, so that the accounting information is important in stock investment decision.

In the stock market, the investor buys the fictitious asset at premium over its book value, in other words, the cost for new shareholders is higher than old shareholders. What does concern the investor is how soon the premium can be earned back. This is what called premium payback period is.

2.3.2 Model Construction

Premium payback period can be easily calculated by market data and accounting data. The key assumptions of PPP model is summarized as below.

Assumption 1: the stock market is inefficient.

Market inefficiency refers to the fact that the prices of stocks do not fully reflect all the information. Efficient market hypothesis rules out the possibility of an investment strategy which can generate excess return. Only in the condition of inefficient market, can an investor have the chance to beat the market with specific investment methods. In addition, efficient market is valid only under very rigorous conditions, one of which is investor's rationality.

Assumption 2: the investors are irrational.

Irrational investors refer to those who make their investment decisions not based on the fundamentals of the economy and the company, but on the search for the

unreleased information. Irrationally investors are easily influenced by the crowd of investors and cannot invest by their own judgment. Some investors are irrational because of their lack of education and experience. Other investors choose to be irrational, because the market provide profit margin for irrational investors and the traditional financial theories fail in Chinese stock market as discussed in Question 3.

Assumption 3: the ROE of the listed companies are stable.

A stable ROE is crucial for the PPP model which uses current ROE to forecast future ROE. It is not realistic to assume that future ROEs are equal to current ROE. But it can be found that companies with high ROE will continue to have high ROE in the future.

It should rigorously be noted that the ROE is the future earning ability and is not observable. What is observable is past ROE and current ROE. It is necessary to empirically investigate the relationship between current ROE and future ROEs. In this PPP formula, it is assumed that ROE is stable and predictable. A series of studies have concluded that current ROE is a good predictor for future ROEs. Chung and Jeong (2000) investigate HK listed stocks and rank all the companies ROE in the bench year and observe the median ROE in the following five years. They find: first high ROE will be followed by high ROE and low ROE will be followed by low ROE; secondly the sectional difference between high and low ROE is getting smaller (mean reverting). These two findings confirm that ROE is stable and predictable, which is consistent with the discoveries using US data (Beaver, 1970; Freeman, et al, 1982;

Penman, 1993).

I adopted Chung and Kim (2000)'s methodology to test the relationship between current ROE and future ROE using data from China's stock market. I investigated the ROEs of the Shanghai Shenzhen Composite 300 component stocks from 2005 to 2015. Not all 300 stocks have been staying in the composite from 2005 to 2015 and some stocks have experienced restructuring. Therefore, the 300 stocks are shortlisted into 180 qualified samples. I choose the year 2005 as a base year and rank all the stocks in term of their ROE. The 180 stocks are equally divided into 5 classes, where the first (fifth) class of stocks has the lowest (highest) ROE. The median ROE of each class of stocks are to be studied for every 2 following years, i.e. 2006-2007, 2008-2009, 2010-2011, 2012-2013, and 2014-2015. It is concluded from Table 2-2 that stocks with higher (lower) ROE tend to have higher (lower) ROE consistently in the future. This finding is consistent with the findings in other markets.

Table 2-2: Median ROE for Sample Stocks from 2005-2015

ROE Class	2005	2006-07	2008-09	2010-11	2012-13	2014-15
1	-6.44%	4.36%	5.34%	11.44%	9.31%	6.99%
2	4.34%	6.04%	7.74%	12.41%	8.49%	9.42%
3	8.54%	10.30%	11.37%	13.61%	11.54%	9.23%
4	14.02%	13.78%	12.54%	14.56%	11.62%	13.35%
5	19.44%	21.12%	12.62%	17.48%	13.72%	13.70%

Notes: Table 2-2 shows the evolution of median ROE for sample stocks from 2005 to 2015. The first class which has the lowest ROE in the base year 2005, also tends to have the lowest median ROE in the following years. The fifth class which has the highest ROE in the base year 2005 also

tends to have the highest median ROE in the following years.

Assumption 4: investors have limited investment opportunities

Limited opportunity for investment ensures that an investor has the only choices over either the stock or the real asset of the company. This assumption implies that the cost of capital, or required rate of return, or opportunity cost is equal to zero. Therefore my PPP model does not have to take into consideration the discount factor.

2.3.2.1 Single Interest Model

Suppose that interest is not compounded, and the premium payback period for a single stock equals to the paid premium divided by annual earnings per share. The result is obviously the number of years needed to recover purchase premium.

$$PPP = \frac{Price - Book\ Value\ per\ Share}{Earnings\ per\ Share} \tag{2-26}$$

Note that PE=Price/Earnings per share and ROE=E/B, PPP can be expressed in simple indicators as:

$$PPP = PE - \frac{1}{ROE} \tag{2-27}$$

The formulation is based on the fact that the price of a stock is higher than its book value, and the difference between market price and book value is denoted as the premium (equivalent to the stock price minus book value per share) in this study. The reason why the investor can accept the premium is that the stock can generate cash

flow in terms of earning. The major concern for investment is how long it takes the earning to compensate the premium. This is how the idea of premium payback period comes into being.

It is obvious that premium payback period is positively related to the absolute premium and negatively related to the earning ability. The investor has to make a tradeoff between premium and earning ability in making investment decisions and the equilibrium constructs the margin of safety. In the case of the same earning per share, a higher premium reflects bigger bubble and less desirable investment. In the case of equal premium, a smaller EPS will result in a longer premium payback period.

2.3.2.2 Compounded Interest Form

Suppose that the earning in each period is reinvested in the company and no dividend is paid out, thus the compounded interest form of PPP model. Still, the essential equation is the book value of equity grows up to the purchase price so that the investment is paid back.

$$P = B(1+ROE)^N \tag{2-28}$$

where P is the stock rice,

B is the book value of equity,

ROE is the return on equity,

N is premium payback period (PPP).

Reshape (2-28) in order to solve N:

$$N = \frac{\log(P/B)}{\log(1+ROE)} \tag{2-29}$$

Investors buy the stock with book value of B at the price of P > B and the premium is eroded with compounded growing book value of equity at the velocity of ROE. In the N^{th} year, the book value of equity is cumulated to *P*. *N* is called the premium payback period.

The above formula for PPP does not take into consideration the cost of capital or the required rate of return (opportunity cost) because the investor has no other investment opportunity other than buy the stock or invest on a new similar company. If the assumption is relaxed, suppose the cost of capital is r and r < ROE. In the N^{th} year, the initial outlay is as valuable as $P(1+r)^N$, which is equal to the book value of equity in year *N*, as shown in equation 2-30.

$$P(1+r)^N = B(1+ROE)^N \tag{2-30}$$

$$\log(P/B) = N(\log(1+ROE) - \log(1+r)) \tag{2-31}$$

Using approximation log (1+x)=x,

$$\log(P/B) = N(ROE - r) \tag{2-32}$$

$$N = \frac{\log(P/B)}{ROE - r} \tag{2-33}$$

Recall the Wilcox PB-ROE model (2-24)

$$\log(P/B) = (ROE - r)T \tag{2-34}$$

PB-ROE model and PPP model are two different models although they can have similar mathematical format. Firstly, these two models have different starting points. PB-ROE model aims at cross-sectional data and reveals the relationship between PB and ROE for a series of stocks at a specific time point. The variable T reflects the

relationship. PPP aims at an individual stock and is applied to see whether a stock is undervalued or overvalued. Secondly, the two models are achieved from different perspective. PB-ROE model is derived from rigorous mathematical modeling whereas PPP model is derived from financial instinct. The two differences lead to PPP model's superiority to PB-ROE model in the following aspects.

Firstly, the T variable in PB-ROE model is obtained from regression, which is a statistical concept but the PPP variable is computed for each individual stock, which is an economic concept. Secondly, in PB-ROE model, the T variable is fixed and each stock is plotted above or below the line to determine whether it is overvalued or undervalued. PPP varies for different stocks and its value is signal of overvaluation or undervaluation. Therefore PPP is a simpler method. Thirdly, PPP model serves as an important supplement to PB-ROE model in that Wilcox discusses little about the meaning of slope T and PPP model imposes a very concrete economic meaning for this variable, and builds a bridge between real and fictitious economies.

In the remaining part of this thesis, I adopt the simplified version of PPP model, where I assume the cost of capital r is equal to zero for the reason that there is very limited opportunity for investment that an investor has the only choices over either the stock or the real asset of the company. Even in the case of the opportunity for investment in risk free asset, I assume that the return of risk free asset (R_f) is so small compared with ROE that it can be neglected. Therefore, the discount factor is not considered.

PPP follows the logic of Tobin's Q in bridging the real and fictitious economies. The P value is defined as the ratio of PPP in fictitious economy over in real economy as follows:

$$P = \frac{PPP\ in\ Fictitious\ Economy}{PPP\ in\ Real\ Economy} \tag{2-35}$$

When P<1, it means the investment in fictitious economy is more favorable than real economy and capital will rush into the stock market so that the undervalued stock price will rise. Contrary, when P>1, investment in real economy is more attractive so that capital will flow out of stock market. The PPP in fictitious economy is calculated by my model and the PPP in the real economy is obtained from market observation. For the latter, the opportunity cost is also neglected, so there is no need to count for the opportunity cost of the former. The formula applied to compute PPP in this thesis is equation (2-29).

2.3.3 PPP in Real Economy and Selection of the Critical Value

Like the function of Tobin's Q in bridging real economy and fictitious economy, the PPP model can also make the bridge and the comparison between PPP and the critical value determines the direction of cash flow. Earning is equivalent in every invested vehicle, and the investor only cares the size of input and output and the speed to realize the profit.

When the PPP in the fictitious economy is longer than that in the real economy, it is

safer to invest in real economy; when the PPP in the fictitious economy is shorter than that in the real economy, capital investment will flow back to the stock market. PPP in the fictitious market can be calculated with the formula described previously. PPP in the real economy can only be observed from the market data available.

Market data shows that a stock's market price (P) is larger than its book value (B) of equity. The essence of PPP is the process of B overtaking P. Suppose an investor is faced with two choices, investing in fictitious economy or real economy. Let's examine these two scenarios respectively to see how PPP works.

Suppose the investor enters the fictitious economy and invests P in the stock whose book value is only B. However, considering the company is earning profit and the retained earnings is added to the book value of the equity. The accumulation of earnings increases B to P so that the investment is paid back. PPP for investment in fictitious economy is time needed to reclaim to nominal loss in a passive way.

Suppose the investor enters the real economy and he establishes a new company at the cost B. Such an asset is valued at P in the stock market. It seems that the entrepreneur can sell the company and obtain the quick and easy money (P-B). However, it is not that soon because it takes time for the company to be recognized by the market before it completes initial public offering (IPO). Once its value is observed by the market, it is listed in the stock market. The initial investment of B realizes its potential worthiness of P. This is also the process of B growing into P. PPP in real economy is different from that in the fictitious market in that the investor pays active effort to in

the management of the company, and the payback period is the time to realize the potential profit.

PPP in fictitious economy and real economy is comparable. The result of comparison leads to the decision of investment strategy. PPP in the stock market can be calculated by the formula 2-29. On the other side, PPP in the real economy can be summarized from fact observation. PPP in the real economy can be viewed as the timed needed for a company from establishment to being listed in stock market. I denote it as T.

I use the data from Second-board Market or Growth Enterprise Market (GEM) to calculate the threshold for PPP mainly because GEM can more accurately simulate the time required for a company to list in the capital market. China's GEM was officially launched in 2009. It was developed for companies which were not entirely suitable for the main board market. Stocks traded in GEM have the codes starting with 300. The total market value of GEM reached 55916RMB by the end of 2015.

Compared with main board market, GEM has more relaxed requirements for IPO, such as establishment date, capital size or long term financial performance. Thus the threshold for GEM is much lower than the main board market. Normally speaking, it is easier and takes less time for a company to be listed in GEM than in main board. Main board market has too many restrictions and the information from it may be distorted and misleading. So the data gathered from GEM is closer to the reality and better reflects the PPP value in real economy. This is why GEM stocks are used to compute the threshold of PPP in real economy.

My observation of the data for Growth Enterprise Market starts from 30 October 2009, when the first stock (code: 300001) in GEM was listed. The GEM data shows the time span of a company from establishment to IPO. Different companies spend different numbers of years to achieve the goal. When I first adopted this method, I considered the top 5% shortest (around 5 years) as a buy threshold, so a stock with a PPP shorter than 5 years can beat 95% of the companies in real economy in terms of premium payback period. I considered the median PPP (around 9.5 years) as a sell threshold, so a tock with a PPP of 9.5 years is beaten by half of the companies in real economy. This is how the rule of thumb 5 years and 9.5 years came to being. However, when data continues to accumulate, the threshold does not change much. For the sample from 2009 to 2015, 5 years ranks top 6% and 9.5 years rank top 44%. Therefore I stick to the rules of 5 and 9.5 years.

I select 5 years as an entry PPP threshold (buy signal) and 9.5 years as an exit PPP threshold (sell signal). For the stocks with a PPP < 5 years, they require less time to get back premium paid than most of firms and it is safe to invest in these stocks. For the stocks with a PPP > 9.5 years, they require more time to get back premium paid than nearly half of firms and it achieves average margin of safety.

A large sample of recent data can also justify the critical value established. I collected the T values for all the companies listed in China's stock market including Shanghai Security Exchange and Shenzhen Security Exchange from December 2010 to February 2016. The number of observations is 781 for the selected period. The max

and min Ts for the sample are 35.57 and 0.88, and the median and mean Ts are 11.39 and 11.8 years respectively. 7.17% of the observations have a T shorter than 5 years and 65% of the observations have a PPP longer than 9.5 years. Therefore, investment in stocks with PPP < 5 can have a better return than 93% firms in the real economy and have a satisfactory margin of safety. Stocks with PPP > 9.5 may perform more poorly than 35% firms in the real economy.

It should be reiterated that the selection of PPP critical values is not an absolute criterion. It is advised to invest in stocks with low PPP but no one can say how low PPP is low enough just as in the case of low PE and low PB. The difference between PPP and relative ratios is that PPP can find its counterpart in the real economy and the critical value can be reflected in the observations in the real economy. In different market conditions, the observations in the real economy may be different, for instance IPO approval process may take longer. In addition, if the PPP criterion is set to be too strict, it may rule out some potentially good investment targets, because the safest way to protect investment is to invest in nothing. Therefore the selection of PPP critical value is the balance between safety and opportunity. The observation in real economy offers insight for a relative accurate selection of PPP critical value. The buy signal of PPP < 5 and sell signal of PPP > 9.5 have been used in my own investment for many years and examined by my investment experience

2.3.4 Comparison of PPP and Tobin's Q

Different from traditional financial valuation models, the Tobin's Q theory provides a

macroeconomic perspective on the stock valuation. The Q ratio was first proposed by Tobin (1969) to analyze the relationship between stock price and investment expenditure. Tobin's Q stresses replacement cost rather than book value. Replacement value refers to the amount that a company would have to pay to replace an asset at the present time, according to its current worth. Replacement cost can be regarded as the present value of past cost. Tobin's Q is the ratio of a company's market value to its replacement cost. This is a ratio between two valuations. The nominator is how much the company is worth in the stock and bond market (fictitious economy). The denominator is how much the company cost if it is rebuilt with current economic resources (real economy).

$$Q\ Ratio = \frac{Total\ Market\ Value\ of\ \ Firm}{Total\ Asset\ Value\ of\ \ Firm} \tag{2-36}$$

If Q > 1, it is cheaper to build the company than to buy the share of an existing company, therefore the capital is invested in real economy.

If Q < 1, it is cheaper to directly buy the stock in financial market to have the control of a company, therefore cash flows into fictitious economy.

Tobin's Q is a perfect theory, but of little avail to real practice. In theory, Q should move around 1 but observation from the financial market evidently shows that Q is fluctuating around some value high above 1. One explanation of why Tobin's Q is consistently above 1 is that the denominator is underestimated because entrepreneurship cannot be fairly valued as an economic resource. Tobin's Q is the

static description of the relationship between financial capital and industrial capital, neglecting the earning ability. Therefore it is necessary to introduce a earning dynamics into Tobin's Q theory so that the theory is still workable when Q is consistently above 1.

PPP and Tobin's Q are comparable in that both theories can bridge between real and fictitious economies and serve as good guidance for investment practice. PPP follows the residual income model and stresses the value creation in the company business, while Tobin's Q only focuses the static replacement cost of the asset. PPP's value creation perspective is more realistic and true to fact, so it is more useful for investment practice.

The critical value is different for the two variables. The critical value for Tobin's Q is 1, and the comparison between Q and 1 decides the investment decision. The critical value for PPP is dependent on markets. The payback period may be country-specific. Comparing PPP and the critical value can also guide the cash flow. PPP is a better tool for practice.

2.4 Practice of PPP Model and a Pilot Empirical Study

2.4.1 Data Collection

The data used in this research to calculate PPP in fictitious economy is retrieved from the resource terminal of Shanghai Jushengyuan Data Service Co. The data includes all the listed companies traded in Shanghai Stock Exchange and Shenzhen Stock

Exchange. Daily data is collected ranging from 1 Jan 1991 to 14 Oct 2011. The Shanghai Stock Exchange and Shenzhen Stock Exchange were established in 1990 and 1991 respectively. Considering data availability, my sample is from 1 July 1992 to 14 Oct 2011. The data types include annual financial report and daily stock price and earning information.

The date used to calculate PPP in real economy (critical value) is retrieved from the Growth Enterprise Market in Shenzhen Stock Exchange. The prospectuses of all the listed companies in this market are reviewed.

According to the theoretical explanations in previous sections, I calculate the PPP for both fictitious economy and real economy respectively as follows.

2.4.2 PPP Model in Fictitious Economy

PPP can be used to judge whether or not an individual stock is safe as well as the overall stock market is safe. In this part, I define that the investment in stock market to hold all the listed companies. The weight of each stock in my portfolio equals to its weight in the stock market.

Define and compute:

Q: weighted average of PB ratio of the market in one trading day (market Tobin's Q)

$$Q=Total\ Market\ Value\ /\ Total\ Book\ Value \tag{2-37}$$

ROE: weighted average of return on equity in one trading day

$$ROE=Total\ annualized\ income\ /\ Total\ Book\ Value \tag{2-38}$$

PE: weighted average of PE ratio in one trading day

$$PE=Total\ market\ price\ /\ Total\ annualized\ income \quad (2\text{-}39)$$

PPP: premium payback period for the overall market

$$PPP=log(PB)/\ log(1+ROE) \quad (2\text{-}40)$$

For non-annual figures, the following methods are applied to yield annualized figures:

(i) For first quarter income data, the annualized data=income*4;

(ii) For second quarter income data, the annualized data=income*2

(iii) For third quarter income data, the annualized data=income*4/3

2.4.2.1 Tobin's Q in China's Stock Market

Figure 2-1 is drawn about the Tobin's Q ratio for the overall market. Evidently, Tobin's Q fluctuates widely around 3.5 during the period. One thing worth mentioning is that Tobin's Q has never dropped below 1 for the entire period. As discussed previously, Tobin's Q can to certain extent provide value judgment for the investment. The defect is that it does not consider the earning ability of the company.

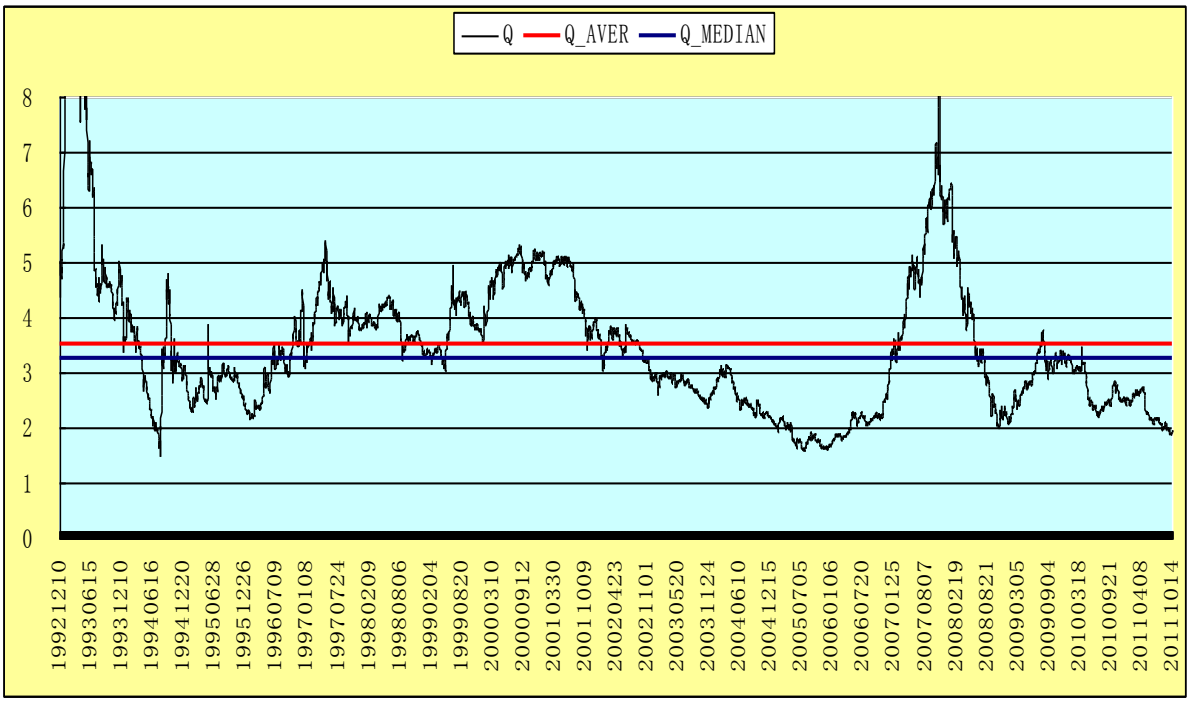

Figure 2-1: Tobin's Q in China's Stock Market

Notes: This figure shows the Tobin's Q for China's stock market from 1992 to 2011. The horizontal axis is time period from 10 December 1992 to 14 October 2011; the vertical axis is the value for Tobin's Q; the black curve is the time series plot of Tobin's Q and the red and blue lines are respective the average and the median of Tobin's Q over the entire period. Tobin's Q fluctuates widely around 3.5 during the period. One thing worth mentioning is that Tobin's Q has never dropped below 1 for the entire period.

2.4.2.2 Premium Payback Period in China's Stock Market

I construct my ideas of PPP into software called Investment Strategy System Based on PPP, which is formulated by me to guide my investment. The output of my analysis is shown in the Figure 2-2.

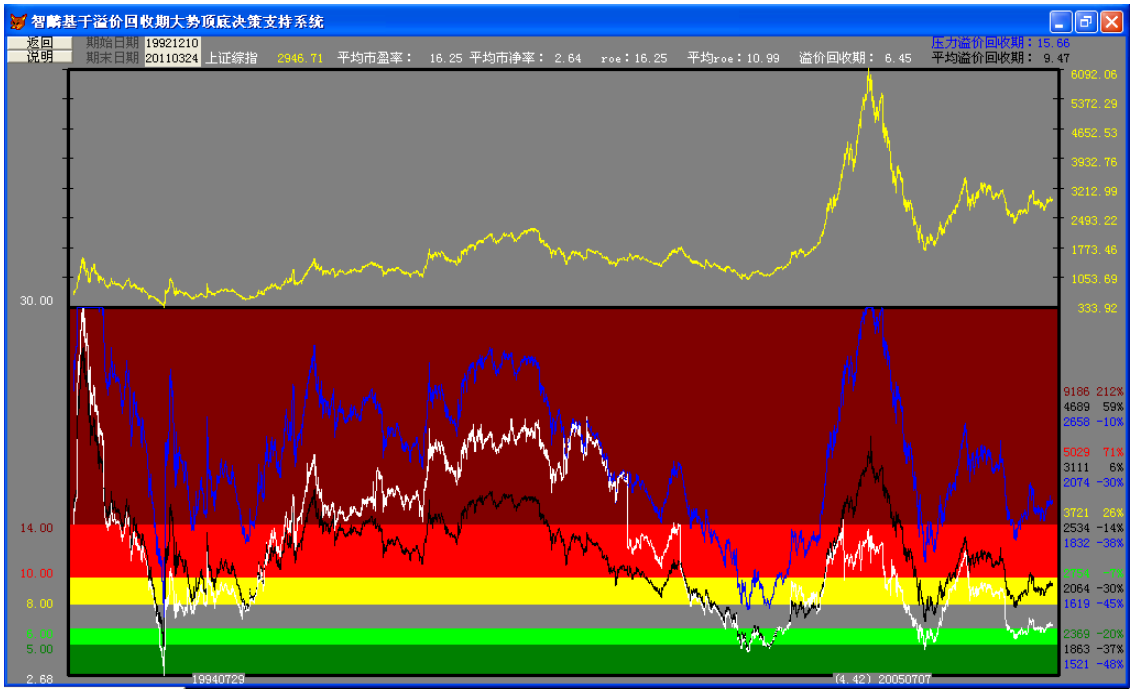

Figure 2-2: Premium Payback Period in China's Stock Market

Notes: The figure consists of two parts. The upper half provides a Yellow Curve which is the time series plot of Stock Market Index. The lower half provides three different curves for different versions of PPP and 6 bars with different colours for different investment intervals. The horizontal axis is the time period from 10 December 1992 to 24 March 2011. The left-side vertical axis is PPP value for the lower half, and the righ-side vertical axis is the market index for the upper half. The white curve is the PPP from the standard model as demonstrated. The PPP for Black Curve is a smoothed PPP and is calculated using 10 years moving average of ROE. The PPP for Blue Curve is PPP under stress testing, where the minimum ROE in 10 years is used. Horizontal Bars with different colours stand for different PPP critical values, with dark green for 2.68-5, light green for 5-6, grey for 6-8, yellow for 8-10, light red for 10-14 and dark red for 14-30.

It is obvious that when the PPP curve is in the green bar (shorter than critical value, or buy signal), the stock index is also very low and will follow with a round of increase. Investing in stock market at such time points is recommended. On the contrary, when PPP curve is on the red bars, the market is over heated and the market index is very likely to fall. Therefore, the PPP value of the stock market is one of the indicators to

predict future movement of the market index.

2.4.3 Determination of PPP Critical Value

We know that the guidance of Tobin's Q theory is to compare q and 1. For PPP model, the critical value is more complex. As discussed previously, the critical value for PPP in stock market can be mapped in the real economy. The benchmark for PPP is how long the investment in a new company (B) can be recognized by the financial market as P. This is defined as PPP in real economy and can be measured by the period from a company's establishment to going public.

In the fictitious economy, stock investment seems to be a bad decision to buy a stock valued at P but is only worth B in accounting aspects. However, the purchased asset can generate net income in the future and the gap between P and B is shrinking. Suppose no dividend and B will eventually catch up with P at the time point defined as premium payback period. This is the process of recovering the nominal loss of P-B.

Similarly such a process is also available in real economy and that is why market observation can correctly show the critical values for PPP model. Suppose an investor invests in real economy and establishes a company at the cost of B (price in real economy). A comparable company is valued at P in stock market (price in fictitious economy). Considering that P is always higher than B, the investor seems to have potential capital gain by selling the firm in the stock market. In practice, it is not so easy for a new firm to go public. The investor makes effort to establish fame of the

company and receives market recognition, resulting in the IPO of the company. This is the process of B catching up with P, a process of entrepreneurs' active practice. The duration from company's establishment to IPO can be viewed as the PPP in real economy, and which is observable from public data in real economy.

The derivation of critical values has been discussed in Section 2.3.3 in detail. It is easy to compare the PPP in stock market with the benchmark. In my own practice, the rule of thumb is that PPP < 5 is a good investment opportunity when the stock market is undervalued, while PPP > 9.5 is a dangerous signal that there is bubble in the stock market.

2.4.4 Practice of PPP Model for Investment Timing

The Figure 2-2 itself is the best evidence of the effectiveness of PPP investment strategy. Low PPP (in the green interval) sends an entry signal, when stock index is also at bottom. However, the effectiveness of PPP model is in question for high PPP. High PPP means long period to recover the premium and indicates low investment value so the decision is to exit from market. But Figure 2-2 shows that the index continues to rise before dropping as the model suggests.

PPP model can capture the overall trend of the market but fail to precisely determine market peak. This is not the fault of the model, but that of irrational investors. The model indicates the sell timing, but irrational investors continue to buy in a crazy manner, thus postponing the falling of the market. Other macro factors such as

inflation, interest rate also count.

2.4.5 A Pilot Empirical Study of PPP

In Section 2.4.2, the application of premium payback period model for the whole stock market in deciding investment timing is demonstrated. In this part, PPP model is used for selecting individual stocks to compose an investment portfolio. A pilot empirical test is performed to test the existence of excess returns.

2.4.5.1 Sample Selection for Pilot Study

As a pilot study, this section selects a typical sample according to previous discussions. I choose the date of 14 May 2004 as the start for my sample observation, and the 13 May 2005 as the end of the observation.

The purpose of the pilot study in Chapter is only to demonstrate how PPP can be used as a guide for stock selection. The result of how PPP portfolio performs is not the primary concern for this part.

The selection of sample period is a bit arbitrage in this case. The above period coincides with a bear market condition when Shanghai Security Composite Index dropped sharply from 1595 to 1108 points. I would like to reiterate that the sample is used to show how PPP is applied, not how well PPP model performs.

The duration of the sample is set to be one year can also be fully discussed. For value investment, one year seems to be a little short. It takes much time for the market to

discover the undervalued stocks.

The total sample under investigation is Shanghai Shenzhen Composite Index 300 (SSCI300) stocks. It is interesting to examine the relationship between PB and ROE for these 300 stocks at the start point for stock selection.

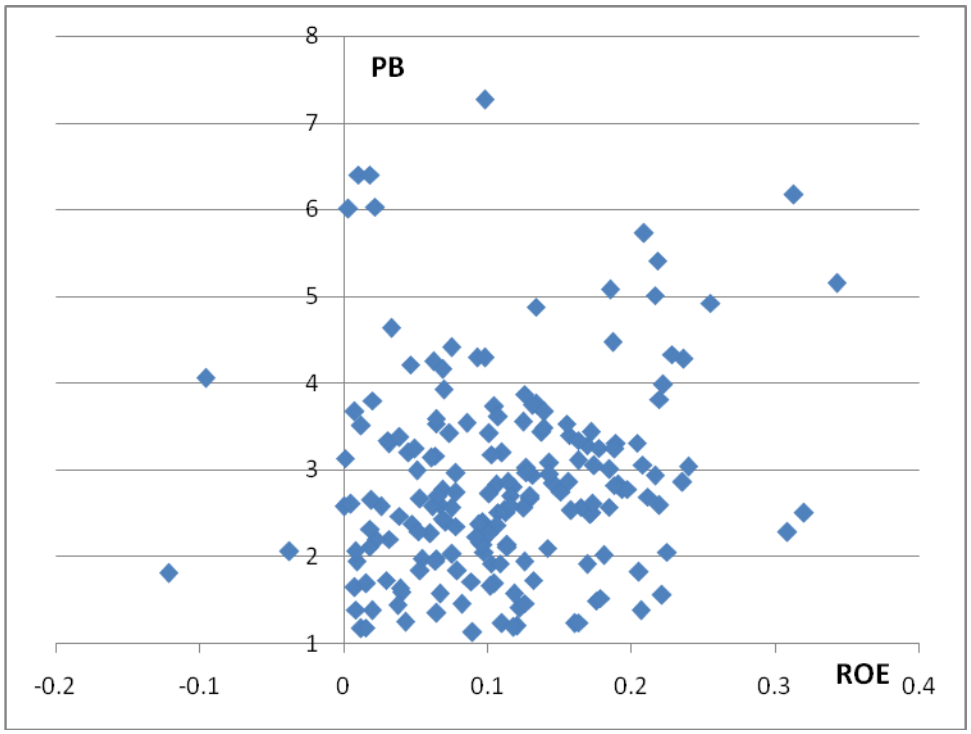

Figure 2-3: PB-ROE of Shanghai-Shenzhen Composite 300 stocks

Note: This figure presents the PB and ROE for the 300 stocks of Shanghai Shenzhen Composite Index. The horizontal axis is the ROE value for the stocks. The vertical axis is the PB value for the stocks. On the whole, stocks with higher ROE tend to have higher PB and most of the observations fall into the first quadrant. Liner regression test shows that PB is positively related to ROE. Using the Spearman rank order test for covariance test, PB and ROE are significantly and positively related and the correlation coefficient is 0.188712 with t value of 2.669635 (at 1% significance level).

2.4.5.2 Stock selection

For value investors, there are many established methods to select stocks. In this pilot study, I only demonstrate two methods for stock selection. One is the traditional DDM and the other is my PPP method.

(1) Three Stage DDM Model

This section first applies the three stage DDM model. According to the historical dividend data and future growth expectations, the intrinsic values of the stocks are computed to compare with their market prices. Unfortunately, only 4 of the 300 stocks are available for the rigorous criteria: Price < Intrinsic Value. The four stocks are BGGF(600019), YTWH(600309), GDNR(600406) and XSPC(600415).

The limited number of investment targets selected by DDM is caused by the special dividend payout policy in China. China's stock market is still in the preliminary stage. The listed companies have not formulated a stable dividend payout policy and even if they have the dividends are only paid in a small amount. On the other hand investors are more concerned about the capital gains from change in price than dividend. More precisely, China's stock market has three features in terms of dividend policy.

Firstly, Dividend Payout Ratio in China's stock market is very low. Dividend payout ratio is the percentage of earnings paid to shareholders in dividends. The dividend payout ratio is highly related to the company's level of maturity. A new, growth-oriented company that aims to expand would be expected to reinvest most or

all of its earnings and could be forgiven for having a low payout ratio. I have reviewed the dividend payout history of SSCI300 composite stocks since their IPO. Only 56 stocks (18.73%) claim to have an average dividend payout ratio above 50%. 70% of the stocks have an average dividend payout ratio below 40%.

Secondly, Dividend Yield Ratio in China's stock market is very low. Dividend yield ratio is a financial ratio that measures the amount of cash dividends distributed to common shareholders relative to the market value per share. I also studied the dividend yield ratio of the SSCI300 composite stocks and I used the lowest price in the year to calculate the dividend yield ratio. Even though this treatment may overestimate the dividend yield ratio, the overall performance is still very low. Only 30 stocks (10%) claim to have an average dividend yield ratio over 3.5%. 60% of stocks have an average dividend yield ratio below 2%. A low ratio may indicate that the stocks are overvalued.

Thirdly, dividend policy for China's listed companies is not stable. I refer to stable dividend policy as a company pays out dividend at least in 9 years (including 9 years) out of the past 10 years. I refer to unstable dividend policy as a company pays out dividend at most in 7 years (including 7 years) out of the past 10 years. The percentage of stable and unstable dividend policies in China is plotted in Figure 2-4.

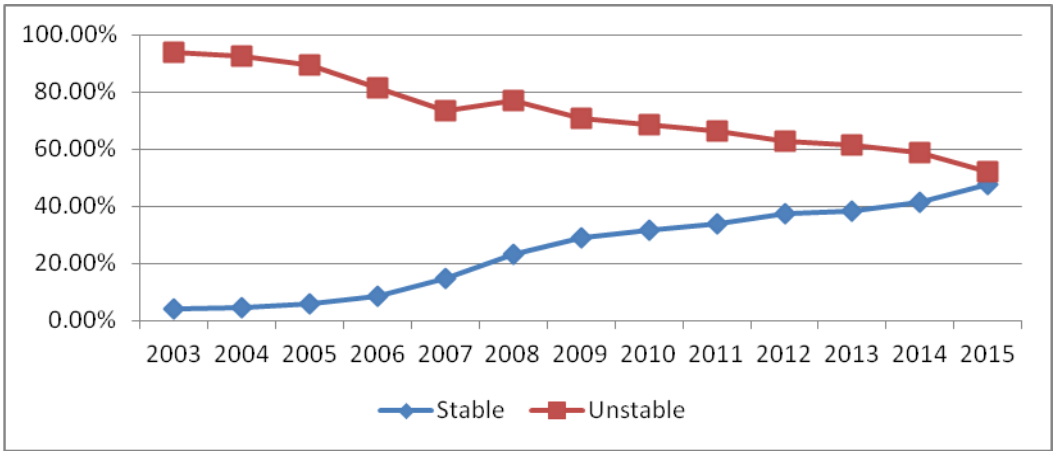

Figure 2- 4 Percentage of stable and unstable dividend policies in China

Notes: Figure 2-4 shows the percentage of listed companies which have stable (blue) and unstable (red) dividend policies. It is obvious that on the whole trend, the proportion of companies with stable dividend policy is increasing. Despite the improvement in the dividend policy, stable dividend policy only accounted for 47.83% in 2015, still at a very low level.

The above three features result in undervaluation of stocks by dividend. Therefore very few stocks can be selected by DDM.

Even though these 4 stocks can be confirmed as undervalued stocks, the insufficient numbers of stocks can be an obstacle for huge investment. Big trading volumes will easily influence the market price of the stocks. Therefore DDM model is not useful in practice.

(2) PPP method

Similarly, PB, ROE are first calculated to yield the final PPP indicators for each individual stock using the formula (2-41):

$$PPP = \log (P/B) / \log (1+ROE) \quad (2\text{-}41)$$

Table 2-3: Summary Statistics for PPP of 300 stocks

Mean	9.67
Standard Deviation	12.62
Median	7.03
Min	-43.87
Max	73.33

Notes: This table reports the summary statistics for PPP of the sample stocks of SSCI300. Statistics show that PPP values of the sample stocks have a wide range and the mean and median are 9.67 and 7.03 respectively. The wide range of PPP makes this indicator efficient to sort the sample stocks.

According to section 2.3.3, the observations in the real economy indicate that majority of companies have a PPP longer than 5 years. Therefore, the stocks with PPP shorter than 5 years are selected. The critical value of 5 years is very high standard, but still 60 stocks out of 300 are available for this criterion, providing many investment opportunities with limited market influence.

2.4.5.3 Jensen's α Test for Excess returns

Jensen's α, which was first used as a measure in the evaluation of mutual fund managers in Jensen (1968), is commonly used to determine the excess return of a an asset over the theoretical expected return. The asset could be a stock or a portfolio of stocks. The theoretical return, which is risk adjusted, is predicted by a market model and the most commonly adopted model is the capital asset pricing model (CAPM). According to an equilibrium perspective, a riskier asset should have a higher expected return than a less risky asset. When an asset's return is higher than the risk adjusted

return, then the asset is believed to have excess return or positive α.

The Jensen alpha test is the regression model:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{M,t} - R_{f,t}) + \varepsilon_{i,t} \quad (2\text{-}42)$$

where $R_{i,t}$ is the daily return for stock *i* at time *t*. *i* can also be a portfolio.

$R_{M,t}$ is the daily return of market portfolio at time *t*.

$R_{f,t}$ is the return of risk free asset, represented by current deposit rate.

α_i is the intercept to be estimated and is expected to be 0 if no excess return occurs.

β_i is the slope to be estimated and is regarded as an indicator for relative systematic risk.

$\varepsilon_{i,t}$ is the error term of unsystematic risk with the expected mean of zero.

According to CAPM,

$$R_{i,t} = R_{f,t} + \beta_i (R_{M,t} - R_{f,t}) \quad (2\text{-}43)$$

The intercept α in the regression model should be 0. If $\alpha > 0$ and is significant, excess return occurs, or stock *i* provides a return over risk-adjusted return. If $\alpha < 0$, negative excess return occurs. The pilot study focuses on the alpha value of the stocks selected by PPP model.

2.4.5.4 Empirical Results of Jensen' s α Test

(1) Excess return test for individual stocks

The market index (Shanghai Shenzhen Composite 300) fell from 1239 to 887 points

by 28.41% in the year from 14 May 2004 to 13 May 2005. In such a bear market condition, most of the 60 selected stocks also witnessed negative return. However, only 12 stocks were beaten by the market, and the other 48 stocks boasted of their returns higher than -28.41%.

To test the significance of the excess return, the Jensen's $\boldsymbol{\alpha}$ test regression model is run for all the 60 selected stocks individually to test the sign and significance of the intercept $\boldsymbol{\alpha}$. I employ the econometric package of Eviews 7.0 to obtain the regression results shown in Table 2-3. Most "α"s are positive, (49/60); only 11 "α"s are negative. Some "α"s are significantly positive at 5% level (11/60).

Table 2-4: Summary of regression for portfolio composites

No.	Stock Code	Stock Name	IPO Date	PPP	1y return	α
1	000039.SZ	ZJJT	1994-4-8	2.57	0.9015	**0.004217****
2	000059.SZ	TLHG	1997-1-30	3.48	-0.0319	0.001411
3	000063.SZ	ZXTX	1997-11-18	3.14	0.2137	0.001979
4	000527.SZ	MDDQ	1993-11-12	3.02	0.1496	0.001679
5	000623.SZ	JLAD	1996-10-28	1.08	0.0904	0.001882
6	000629.SZ	PGFT	1996-11-15	1.51	-0.2628	-8.17E-05
7	000630.SZ	TLYS	1996-11-20	4.19	-0.3035	0.000206
8	000651.SZ	GLDQ	1996-11-18	4.79	0.0138	0.001253
9	000709.SZ	HBGT	1997-4-16	1.42	-0.0823	0.000685
10	000729.SZ	YJPJ	1997-7-16	3.30	-0.1052	0.000278
11	000768.SZ	XFGJ	1997-6-26	1.24	-0.1958	0.000271
12	000778.SZ	XXZG	1997-6-6	2.82	-0.2160	0.000131
13	000807.SZ	YLGF	1998-4-8	3.64	-0.4381	-0.000929
14	000825.SZ	TGBX	1998-10-21	1.67	-0.1269	0.000713
15	000858.SZ	WLY	1998-4-27	1.21	0.0596	0.001319
16	000876.SZ	XXW	1998-3-11	2.11	-0.1754	0.000854
17	000898.SZ	AGGF	1997-12-25	1.99	-0.0340	0.001315
18	000933.SZ	SHGF	1999-8-31	4.60	-0.0340	0.00109
19	000937.SZ	JZNY	1999-9-9	3.75	0.2901	**0.002163***
20	000960.SZ	XYGF	2000-2-21	4.49	0.1525	**0.002631***
21	000961.SZ	ZNJS	2000-3-1	3.40	-0.4580	-0.000947

No.	Stock Code	Stock Name	IPO Date	PPP	1y return	α
22	000983.SZ	XSMD	2000-7-26	4.15	0.3312	**0.002573***
23	600005.SH	WGGF	1999-8-3	3.34	0.1197	0.002111
24	600009.SH	SHJC	1998-2-18	4.25	0.3350	**0.001907***
25	600010.SH	BGGF	2001-3-9	2.34	-0.1579	0.000524
26	600019.SH	BGGF	2000-12-12	3.03	-0.1851	0.000173
27	600026.SH	ZHFZ	2002-5-23	4.46	0.1359	0.001821
28	600058.SH	WGFZ	1997-5-28	4.15	-0.1103	0.001241
29	600066.SH	YTKC	1997-5-8	1.27	0.0204	0.001096
30	600068.SH	GZB	1997-5-26	1.13	-0.4517	-0.001081
31	600096.SH	YTH	1997-7-9	3.12	0.1363	0.001703
32	600098.SH	GZGG	1997-7-18	4.21	-0.2444	0.000271
33	600108.SH	YSJT	1997-8-18	1.48	-0.4133	-0.000418
34	600111.SH	BGXT	1997-9-24	4.54	-0.4085	-0.000179
35	600125.SH	TLWL	1998-5-11	4.36	0.5015	**0.002932***
36	600151.SH	HTJD	1998-6-5	4.61	-0.4708	-0.000741
37	600153.SH	JFGF	1998-6-16	3.24	-0.2588	0.000215
38	600170.SH	SHJG	1998-6-23	3.30	-0.3364	-0.000455
39	600177.SH	YGE	1998-11-19	1.00	-0.0118	0.001214
40	600188.SH	YZMY	1998-7-1	4.59	-0.1294	0.000591
41	600219.SH	NALY	1999-12-23	3.58	-0.3458	-0.000298
42	600307.SH	JGHX	2000-12-20	2.09	-0.2258	0.000324
43	600320.SH	ZHZG	2000-12-21	3.56	0.2880	**0.0028688***
44	600331.SH	HDGF	2001-12-20	0.80	0.5890	**0.003585***
45	600352.SH	ZJLS	2003-8-1	4.39	0.0068	0.001357
46	600362.SH	JXTY	2002-1-11	4.60	-0.2628	0.000415
47	600380.SH	JKY	2001-6-8	4.17	-0.1880	0.000207
48	600418.SH	JHQC	2001-8-24	4.16	-0.2800	0.000302
49	600428.SH	ZYHY	2002-4-18	3.95	0.3758	**0.00308***
50	600500.SH	ZHGJ	2000-3-1	3.58	-0.0014	0.001599
51	600508.SH	SHNY	2001-8-29	4.60	-0.0242	0.001375
52	600519.SH	GZMT	2001-8-27	3.81	0.7063	**0.002901****
53	600690.SH	QDHE	1993-11-19	2.52	-0.2530	7.33E-05
54	600694.SH	DSGF	1993-11-22	4.84	0.3114	**0.002323***
55	600795.SH	GDDL	1997-3-18	3.24	-0.2388	0.000169
56	600808.SH	MGGF	1994-1-6	2.85	-0.3225	-0.000148
57	600811.SH	DFJT	1994-1-6	4.93	-0.3097	0.000348
58	600839.SH	SCCH	1994-3-11	1.28	-0.3752	-0.000384
59	600859.SH	WFJ	1994-5-6	4.62	-0.0773	0.000899
60	600881.SH	YTJT	1995-11-15	1.97	-0.2611	0.000225

Notes: This table shows the regression results for the 60 stocks selected by PPP model. The stock name and code selected are displayed in Columns 2 and 3. Column 4 shows the IPO dates of the

60 stocks. Column 5 shows the calculated values of PPP for the stocks and it is evident that all the selected stocks have PPP values shorter than 5 years. Column 6 is the one year buy-and-hold return from 14 May 2004 to 13 May 2005, and only 21 stocks have positive return over the period of bear market environment. The last column shows the Jensen α for each regression using the software Eviews 7. The α value is the indication for excess returns. Most "α"s are positive, (49/60); only 11 "α"s are negative. Some "α"s are significantly positive at 5% level (11/60).

* indicates significant at 5% level;

** indicates significant at 1% level.

(2) Excess return test for PPP portfolio

The PPP portfolio is an average weighted portfolio of all the 60 stock selected by PPP criterion. The statistical summary of the daily return for both market index and PPP portfolio are shown in the Table 2-4 and most statistics are very similar except the mean return.

Table 2-5: Comparison of Market Index and PPP Portfolio Returns

Summary Statistics	Market Index	PPP Portfolio
Mean	-0.001195	-0.000211
Median	-0.001933	-0.001300
Maximum	0.053290	0.052300
Minimum	-0.039915	-0.046600
Std. Dev.	0.013492	0.013618
Skewness	0.866386	0.688350
Kurtosis	4.454646	4.391414

Notes: This table compares market index return with PPP portfolio return for the one year holding period from 14 May 2004 to 13 May 2005. The market index refers to SSCI300. The PPP Portfolio refers to the portfolio of 60 stocks which have a PPP <5. The PPP portfolio has a higher mean return and median return than the market index.

Considering that 49 PPP stocks beat the market for the selected investment period,

there is every reason to believe that the overall performance of the portfolio excelled the market performance. The one year return for the portfolio from 14 May 2004 to 13 May 2005 is -6.19%, much higher than market return of -28.41%.

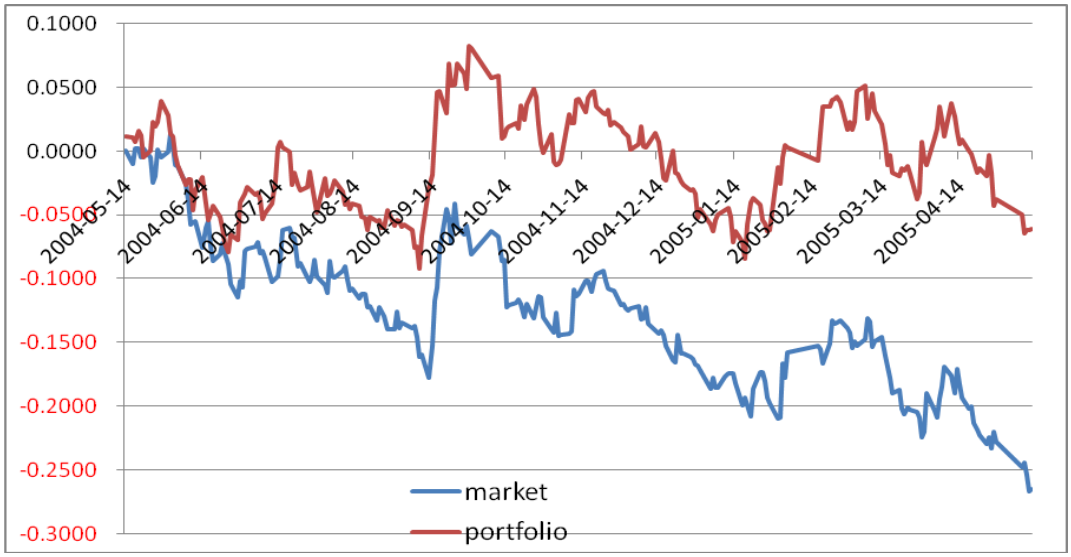

Figure 2-5: Cumulative returns for market index and PPP portfolio

Notes: This figure plots the one year cumulative returns for market index (SSCI300) and PPP portfolio starting from 14 May 2004. The horizontal axis is the time line and the vertical axis is the cumulative return. Obviously, the portfolio performance was consistently better than the market.

For a rigorous statistical test, the α test regression is also performed with the regression results of the portfolio return shown as follows:

$$R_{p,t} - R_{f,t} = 0.000965 + 0.984086(R_{M,t} - R_{f,t}) \qquad (2\text{-}44)$$

$$(4.9415) \qquad (68.11128)$$

where $R_{p,t}$ is the daily return of the PPP Portfolio at date t.

The R square is 0.9506 with F-statistic at 4639. It is evident that PPP model can help identify a portfolio that can produce a daily excess return of 0.0965%. The advantage

of PPP over DDM in stock selection is that PPP can provide more investment opportunities and more stocks are recommended. This is very crucial for huge volume trading.

2.4.5.5 Other empirical studies remaining

The pilot study for empirical research is a useful attempt. Many other tests can be attempted. First, this pilot study chooses a period of bear market, so that future empirical test can choose market data at both market highs and market lows, so that the validity of PPP model can be verified in various market conditions. Second, this pilot study examines the excess return in one year scope, so future studies can expand the investment horizon to 3 years or even 5 years to evaluate the long-term performance of PPP model. Thirdly, if long term investment is investigated, the composition of PPP portfolio should be dynamically changeable so that new qualified stocks are bought and disqualified stocks are eliminated from the portfolio. Fourthly, include other statistical tests to show whether PPP models can create excess returns. Fifthly, consider external factors which may affect the robustness of PPP and give a solid theoretical explanation why PPP can create excess return.

2.5 Conclusions

Value investing is a relatively long-term investment, searching for undervalued high-growth securities in the market. Many valuation models have been developed to determine the intrinsic value of the stock so that it is easy to tell whether it is

over-valued or under-valued. The purpose of this study is to provide a new method for the same motivation.

The Premium Payback Period model inherits the advantages of the existent models. PPP takes into consideration the book value of the stock and it also looks ahead to account for the company's value creation in terms of ROE. More importantly it is very easy for application.

Like Tobin's Q theory, PPP can also serve as a bridge between fictitious economy and real economy. Investors can decide where to invest their money and their object is to minimize payback period for safety purposes. A rational investor can judge between the PPPs in these two economies and finally decide his investment. The PPP for the fictitious economy can be easily computed by two important ratios PB and ROE which are readily available in the market. On the other hand, PPP for real economy requires experiment. Fortunately, the opening of Growth Enterprise Market provides adequate observation samples to measure the PPP in the real economy as duration from the establishment and IPO of the company. Observations in real economy and my investment experience tell that a stock with PPP < 5 years is a good opportunity for investment.

PPP model is useful in many areas. Firstly, PPP can be applied to the whole market to examine whether the overall market is bull or bear. The PPP of the whole stock market can be a signal of timing for market entry or exit. PPP model is also powerful for investors in selecting stocks for their portfolio. According to the pilot study, PPP

model picks 60 stocks out of 300 stocks and empirical test shows that 12 of the stocks can produce excess return and the averaged-weighted portfolio can also generate excess return.

Chapter 3 Practice of PPP in Stock Investment: A Perspective in Stock Selection

3.1 Introduction

Previously in Chapter 2, a new method, PPP model for valuing individual stocks was introduced to determine whether a stock is overvalued or undervalued. PPP model inherits the advantages of the existent models by taking into consideration the book value of the stock and the company's earning ability measured in terms of ROE. The concept of premium payback period is proposed to measure how soon the premium paid in purchasing stocks is compensated by company earnings. Stocks with low PPP are safer and more profitable investment target than those with high PPP. My investment experience shows that normally stocks with PPP shorter than 5 years can be viewed as value stocks and can generate excess return. This is a very useful rule of thumb to select stocks and more importantly this criterion leaves abundant stocks for investment, unlike DDM which is so strict that rules out majority of stocks. PPP model is also powerful for investors in selecting stocks for their portfolio. According to the pilot study, PPP model picks 60 stocks out of 300 stocks and the empirical test shows that 12 of the stocks can produce excess return and the average-weighted portfolio can also generate excess return. In a nutshell, PPP model assists in selecting undervalued stocks and allocates investment capital in these stocks for excess return.

The pilot study in Chapter 2 shows a great potential of applying PPP model to stock investment, but it is to some extent too simplified. The practice of PPP in stock

investment can be investigated from two aspects. First of all, how PPP model performs in different market conditions? Pilot study in Chapter 2 analyzed how PPP performed in the period from 14 May 2004 to 13 May 2005 and the result was satisfying. In this chapter, the different market conditions are to be investigated both the bull and bear markets. Secondly, how can PPP stock selection method collaborate with other methods to yield better returns? It is common sense that one foot alone cannot walk far and it is always beneficial to have two or more tools to tackle with the irrational stock market in China. The exclusive use of PPP may cause some trouble. In this chapter, the selection in terms of market capitalization is also taken into consideration. These two new progresses improve the pilot study in Chapter 2 and demonstrate the power of PPP model in stock selection.

In order to evaluate PPP under different market conditions, two periods are selected. One period is from 5 Nov 2008 to 3 Nov 2009, which is a period of bull market condition. The other period is from 5 Dec 2011 to 3 Dec 2012, which is a period of bear market. On the other development, the selection of stocks takes into account both its market capitalization and premium payback period. Past experience and theoretical studies show that stocks with smaller market capitalization tend to yield better returns than those with larger market capitalization, which is defined as size effect. According to Chapter 2, stocks with lower PPP tend outperform those with high PPPs, which can also be defined as PPP effect in this study. In this chapter, the interaction of size effect and PPP effect is studied under different market conditions.

The rest of the chapter is arranged as follows. In section 3.2, I provide a literature review on size effect and PB effect in stock returns. In section 3.3, I demonstrate the methodology for this empirical investigation. In section 3.4, I focus on the bear market condition and present how size effect and PPP effect perform in bear market. In section 3.5, I concentrate on the bull market and illustrate how size effect and PPP effect perform in bull market. Section 3.6 is the conclusion for this chapter.

3.2 Literature Review

The focus of this chapter is to identify stocks which are more likely to have better returns. There have already been several indicators for stock selection. Two of the most widely recognized indicators are the capitalization and book to market equity. Their potential to achieve excess return is called size effect and value effect respectively.

3.2.1 Size Effect

The size effect in finance literature refers to the fact that firms with smaller size have higher return than those with larger size on average over long horizons. It also describes the contribution that company size has in explaining stock returns. The size effect is first proposed by Banz (1981) in testing the Capital Asset Pricing Model. His research examines the relationship between the total market value of a company's stock and its return, using sample stocks in New York Stock Exchange from 1926 to 1975. Using regression, he observes that that stock returns are explained by its size in addition to market risk adjusted return explained by CAPM model. In one word,

market capitalization is a significant factor in explaining stock returns and there is an inverse relationship between size and returns. The plausible explanation of size effect is that smaller firms tend to be riskier than larger firms and this additional risk must be rewarded in term of stock returns. Although Reinganum (1983) and Fama and French (1992) also proved the existence of size effect, some other scholars are skeptical to size effect. Schwert (2002) pointed out that size effect is on the trend of shrinking. Dimon and Marsh (1999) also believes that size effect is fading away and in some cases reversed, i.e. larger firms have better returns. Goyal and Welch (2003) denies the so called size effect and advocates that it is the result of sample selection bias.

The empirical studies on China's stock market however present similar conclusions that size effect exists in Chinese stock markets (Wang and Zhou, 2002; Xie and Luo, 2005; Hilliard and Zhang, 2015).

3.2.2 Value Effect

The value effect in finance literature refers to the fact that firms with higher value have higher return than those with lower value on average over long horizons, where value is defined the ratio of the company's book value to price of the stock, or the inverse of PB ratio. The book to market ratio was first made popular by Ben Graham. However, it lost popularity when Efficient Market Hypothesis was developed. It gained back its position especially when Stattman (1980) and Rosenberg, Reid and Lanstein (1985) unveiled the positive relationship between stock return and book to

market ratio. Fama and French (1992) also discovered their significantly positive relation in US stock market.

The empirical studies on China's stock market however lead to different conclusions using different methods and samples. Some researchers do not find evident support for value effect (Gu and Ding, 2003）, Hilliard and Zhang, 2015) while others confirm significant evidence of value effect (Chen, Zhang and Chen, 2001)

3.2.3 PPP Effect

PPP effect is a concept proposed by me. It has similar definition as size effect in that stocks with lower PPP tend to perform better than those with higher PPP. The logic is simple and has been thoroughly discussed in Chapter 2. PPP refers to the time needed for an investor to recover the overpaid price of the stock's book value of net asset. A stock with low PPP is a safe investment because the time to earn back the premium is short and such a stock is usually undervalued. Investing in stocks with low PPP can generate considerable return, which may not be explained by CAPM model. The additional return is supposed to be caused by PPP effect.

Considering that the computation of PPP involves the factor of PB, it is well considered that PB effect is included in PPP effect. Therefore the framework of size and PPP effects are sufficient.

3.3 Methodology of Empirical Study

The empirical study of PPP effect in acquiring excess return can be segmented into the following six steps, which will be discussed respectively in this chapter.

Step 1: Determining a sample pool for investigation.

Step 2: Calculating PPP of the sample on a specific bench date.

Step 3: Classification of sample stocks in terms of market capitalization and PPP.

Step 4: Computing daily returns for the categorized portfolios for a specific period.

Step 5: Obtaining Jensen alpha for the portfolios.

Step 6: Evaluating the best performing portfolio and investment recommendation.

3.3.1 Determining a sample pool for investigation.

Since the establishment of Shanghai Securities Exchange and Shenzhen Securities Exchange in early 1990s, China's stock market has undergone a remarkable development in the past two decades. Thousands of stocks have been listed in the two stock exchanges in Shanghai and Shenzhen. It is unrealistic to evaluate all the stocks listed. The scope of interest in this chapter is focused on the 300 composite stocks for Shanghai Shenzhen Composite Index 300 (hereafter referred to as "SSCI300").

SSCI300 index was first published on 8 April 2005 jointly by the two stock exchanges to reflect the overall market situation in the China's A share stock market. The

objective to propose such an index is to show price movement and performance of the entire Chinese stock market, so that it is often used as evaluation bench market for fund performance. The composite stocks in the SSCI300 index are selected from different industries and their market capitalization account over 60% of the overall stock market. Therefore, the index can to some extent represent the overall stock market. Using the index composites as research sample is feasible and well-grounded. However, not all 300 stocks in the index can serve as qualified sample. Two additional conditions are set to screen the stocks. One condition is positive net asset, otherwise PPP is not applicable. The other condition is that the company is listed for more than five years, so that the operations and financial ratios are subject to less volatility. The final sample is thus reduced to short list of around 200 stocks. More specifically, the sample is shortlisted to 212 stocks for the bear market condition and to 188 stocks for the bull market condition.

3.3.2 Calculating PPP on a specific date

Since PPP can be used to observe whether a stock is overpriced or underpriced, it is an important and effective criterion for stock selection. The calculation of PPP is crucial and the fundamental for further analysis. PPP, by its name, means the period required for an investment in stock *i* to achieve additional return so that the price paid over its book value is earned back.

In the compounded interest form of PPP model, it is supposed that all the earning for a stock in each period is reinvested in the company and no dividend is paid out. Still,

the essential equation is the book value of equity grows up to the purchase price so that the investment is paid back.

In practice, stocks with PB < 1 are always preferable because an investor pays less price than the accounting value of the stock. However such ideal stocks are rare in the stock market. More commonly, investors buy the stock with book value of B at the price of $P > B$ with the expectation that the premium is shortened with compounded growing book value of equity at the speed of *ROE*. In the N^{th} year, the book value of equity is increased to P, where the time this process takes is called the premium payback period.

Theoretically, PPP can be calculated at any time for a stock, if we know its price, book value and the ROE. Price of a stock is frequently quoted in the stock market and it is widely available. Book value is an accounting term and can be found in the financial report of a listed company, no matter in annual report or quarterly reports. Unlike price and book value, ROE seems to be more challenging and entails more precise prediction, because in the model, ROE refers to the profitability in the future. However, statistics have shown that the ROE of a company is relatively stable so that past ROE can be used for prediction of the future ROE. So once the price, book value and ROE are determined, the index of PPP is readily available.

The index of PPP fluctuates with stock price every day. The dynamics of PPP contains the information of valuation of a stock. A stock's PPP can compare with an absolute value for a certain period. For instance, in a relatively long period, PPP lower than

five years can be observed as a good opportunity and triggers investment in the stock. A stock's PPP can also compare with other stocks on a specific date. For example, on one particular date, stocks with relatively lower PPPs may have better investment values. In the pilot study in Chapter 2, the former comparison is applied and the investment in a series of stocks with PPP lower than 5 years is proved with excess return. In this chapter, however, the latter comparison is used. The comparison date can either be random or deliberately chosen.

In this study, a specific date as a bench date to calculate PPP index will be selected for starting date for different market conditions.

3.3.3 Classification of sample stocks in terms of size and PPP

The shortlisted sample of SSCI300 composite stocks is further divided into particular portfolios in terms of size and PPP. Market capitalization is used to measure size of a stock.

According to market capitalization, all stocks are equally divided into three categories. The stocks with market capitalizations ranking for the largest trisection are labeled as large size. The stocks with market capitalizations ranking for the smallest trisection are labeled as small size. The stocks with market capitalizations ranking for the mid trisection are labeled as mid size.

On the other dimension, all the stocks are also ranked in terms of PPP. All the stocks can be divided into 2 or 3 categories according to PPP. For the 2 categories, all stocks

are divided into two equal categories of high PPP and low PPP. The stocks with PPP ranking for the higher half are labeled as high PPP. The stocks with market capitalizations ranking for the lower half are labeled as low PPP. For the 3 categories, all stocks are not equally divided. Stocks with PPP < 5 are labeled as low PPP; stocks with PPP > 9.5 are labeled as high PPP; stocks with PPP between 5 and 10 are labeled as mid PPP.

Therefore all the stocks are labeled in terms of two dimensions. Stocks which fall into the same category constitute an investment portfolio. Two scenarios may occur for different classification on PPP. A 3x2 scenario refers to 3 size ranks and 2 PPP ranks and 6 portfolios are constructed namely (1) large size and high PPP, (2) large size and low PPP, (3) mid size and high PPP, (4) mid size and low PPP, (5) small size and high PPP, (6) small size and low PPP.

Similarly, if the stocks are divided into three categories according to high PPP, mid PPP and low PPP, different stocks which are labeled in terms of size and PPP can be classified into 9 portfolios, which is the 3x3 scenario. Both the 3x2 and 3x2 scenarios will be discussed for the performance of each portfolio in later empirical analysis.

3.3.4 Computing daily returns for the categorized portfolios

For each category based on size and PPP, the daily return for every stock can be computed by the formula:

$$R_t = \ln (P_t / P_{t-1}) \qquad (3\text{-}1)$$

where R_t is the return for day t,

P_{t-} is the close price of the stock on day t,

ln is the natural logarithm with the base of e to capture the compound rate form of return.

The holding period or the duration of investment is determined to be one year for several reasons. First of all, ROE as an element in PPP is usually calculated on annual basis so that PPP tends to be relative stable within one year. For duration over one year, the PPP criteria may indicate different stocks to be included in an investment portfolio. On the other hand, shorter duration than one year is unsuitable for value investors who do not frequently buy and sell stocks. The holding period of one year is an ideal and eclectic option.

Therefore, the above R_t is calculated for a consecutive year. Suppose each portfolio is equally weighted so that the return of the portfolio is the arithmetic average of its components, i.e.

$$R_{p,t} = \frac{1}{n}\sum_{i=1}^{n} R_{i,t} \tag{3-2}$$

where $R_{p,t}$ is the daily return for the portfolio p on date t,

$R_{i,t}$ is the daily return for stock i on date t.

The daily return of the portfolio can be compared with the daily return of the market R_m, which is defined as the daily return of SSCI300 index. The statistical summary of the discrepancy ($R_p - R_m$) will be reported and tested.

3.3.5 Obtaining Jensen α for the Portfolios

Even though (R_p – R_m) is tested to be significantly different from zero, it may be caused by the risk factor. In other words, the reason why R_p is consistently larger than R_m is because R_p bears more systematic risks. Only when the return is adjusted by the bearing risks, can the final conclusions of excess return be drawn.

Unlike the event study where a potential structural change takes place before or after the specific date, the date chosen in this PPP test is arbitrage, having no relationship with any special event. In other words, no structural change occurs for the selected stocks and there is no concrete argument that the return before and after the date should be significantly different. One can choose *t*, *t*-1 or *t*+1 freely. In this regard, such event study methods are not helpful.

The more suitable analytical framework for this study is the Jensen alpha test based on CAPM equation. Constitute a regression model as:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{M,t} - R_{f,t}) + \varepsilon_{i,t} \quad (3\text{-}3)$$

$R_{i,t}$ is the daily return for stock *i* at time *t*. *i* can also be a portfolio.

$R_{M,t}$ is the daily return of market index (SSCI300).

$R_{f,t}$ is the daily return of risk free asset, represented by current deposit rate.

α_i is intercept to be estimated and is expected to be 0 if no excess return occurs.

β_i is slope to be estimated and is regarded as an indicator for relative systematic risk.

$\varepsilon_{i,t}$ is the error term of unsystematic risk with expected mean of zero.

According to standard Asset Capital Pricing Model,

$$R_{i,t} = R_{f,t} + \beta_i (R_{M,t} - R_{f,t}) \quad (3\text{-}4)$$

The intercept α in the regression model should be 0. If $\alpha > 0$ and is significant, excess return occurs, or stock *i* provides a return over risk-adjusted return. If $\alpha < 0$, excess loss occurs. Both the sign and significance of α is examined to determine the direction and magnitude of excess return.

3.3.6 Evaluating the best performing portfolio and recommendations

In both 3x2 scenario and 3x3 scenario, the performance of each portfolio is to be assessed in comparison with the market return and with each other. The comparison of portfolio performance with market performance is feasible with the model of Jensen alpha to check whether a particular portfolio can achieve excess return or not.

The performance comparison with each other is made by comparing the different Jensen α across different portfolios. Portfolios with positive and large Jensen α are more attractive for investors, indicating that investing in such portfolios is quite safe and profitable. Portfolios with Jensen α also have their value because selling short such portfolios can also achieve excess return. Another implication of comparing Jensen α is to investigate the effect of size and PPP on portfolio performance. As rule of thumb, small size stocks and low PPP size stocks are more preferable, but this hypothesis should be tested under different market conditions.

3.4 Size Effect and PPP Effect in Bear Market Conditions

3.4.1 Data Selection and Description

A bear market is defined as a condition in which securities prices fall and widespread pessimism causes the stock market's downward spiral to be self-sustaining. Investors anticipate losses as pessimism and selling increases. Although figures vary, a downturn of 20% or more from their 52-week high in a stock index is considered an entry into a bear market.

For the chosen period from 5 Dec 2011 to 3 Dec 2012, the SSCI300 index peaked at 2717.78 points and closed at its bottom of 2018.85 points. The index was fallen by 22.4% from peak to bottom and therefore this period was defined as a bear market.

In China there is no such long period of bearish and a common phenomenon is that the market is on the trend of falling with little sign of rebound. The period under investigation is characterized by gloomy global market conditions and domestic tight monetary policy environment.

Potential stocks are selected from 300 index composites. The two criteria have already been demonstrated that (1) the stock has been listed for more than five years, (2) book value of equity is positive, otherwise PPP = log (P/B) / log (1+ROE) is meaningless. By these two criteria the 300 stocks are reduced to 212 stocks available for investment. The bench date is 5 Dec 2011 for PPP calculation.

The 212 stocks exhibit a wide range of PPP from -24.6 to 151.8 years. The negative PPPs refer to the stocks with P/B<1, so that log (P/B) is negative. Low PPPs are favorable and negative PPPs are even more favorable because these stocks are sold at discount instead of premium. The mean of PPP is 10.39 years and the median of PPP is 6.34 years. A substantial proportion of the stocks are undervalued using the PPP < 5 criteria.

The size of the 212 stocks also shows a wide range of market capitalization from 7.9 billion RMB to 1494 billion RMB. The mean of size is 45.6 billion RMB and the median is 20 billion RMB. The standard deviation of size is 125 billion RMB.

It is an interesting idea to examine the relationship between size and PPP. Theoretically, there is no direct or apparent link between size and PPP. A linear regression between PPP and log (size) offers a surprising result. The size of a stock is treated with logarithm to become smoother. Regressing PPP against log (size) shows to what extent size can affect PPP or how these two factors coincide. The regression result is shown below:

$$PPP = 32.89 - 4.08 * \log(size) \qquad (3\text{-}5)$$
$$(4.23) \quad (-2.96)$$

The relationship between PPP and size is negative. The coefficients are significant at 1% level. It is directly interpreted as that the stocks with large size tend to have low PPP and small sized stocks tend to have high PPP.

The impact of size on PPP can be decomposed into PB and ROE. Large size

companies are likely to have low PB compared to small size companies. Firstly the information of large companies is more transparent, so the large size stocks are more likely to be rationally priced. Secondly, the prices of large stocks are more difficult to be manipulated. Large size companies are likely to have high ROE compared to small size companies. Firstly, large companies have economics of scale. Secondly large companies are usually SOEs who have special advantage over private companies. Referring to my sample, the median PB for the large size sample is 2.41, smaller than its counterpart of small size sample (2.65). The median ROE for the large size sample is 20.09%, larger than is counterpart of small size sample (12.17%).

It can be viewed from an equilibrium perspective. If stocks with large size have high PPP, the demand for such stocks are low, so there will be adjustments in the stock market. Therefore stocks with large size are matched with low PPP. Similarly, if small sized stocks have low PPP, the demand for such stocks is very strong and triggers the purchase of such stocks. On the other hand, low PPP stocks are desirable and the overbuying of such stocks make its size grow big.

3.4.2 Investment Portfolios based on 3x2 scenario of size and PPP

3.4.2.1 Portfolio Constituents

When all the stocks are divided into 3 equal categories by size factor and 2 equal parts by PPP factor, the stocks can fall into one of the six portfolios. Out of 212 stocks, large size, mid size and small size stocks account respectively for 70, 71 and 71

stocks. More specifically, when the size classification cointegrated with PPP classification, 6 portfolios are constructed.

Table 3-1: Sample Numbers in 3x2 Scenario in Bear Market

	High PPP	Low PPP	Total
Large size	35	35	70
Mid size	36	35	71
Small size	36	35	71
Total	107	105	212

Notes: This table shows the number of stocks in each portfolio matrix. The total sample includes 212 stocks. The sample size for each portfolio is roughly the same, around 35 stocks in each.

3.4.2.2 Average PPP for each portfolio

In order to have an initial impression of how well each portfolio would perform, the average PPP is calculated for each portfolio. Portfolios with low PPP average are more likely to have better performance than those with high PPP average. Illustrated in Table 3-2, the portfolios of the high PPP show much higher PPP indicators (over 10 years) than their low PPP counterparts (within 5 years). On the whole, the PPP value for the large size, mid size and small size are 5.74 years, 11.94 years and 13.37 years.

Table 3-2: Average PPP for Each Portfolio in 3x2 Scenario in Bear Market

	High PPP	Low PPP	Overall average
Large size	9.35	2.23	5.74
Mid size	19.32	4.43	11.94
Small size	23.71	2.73	13.37
Overall average	17.46	3.13	10.295

Notes: This table shows the average PPP for each portfolio. High PPP portfolios have a much greater

PPP value than low PPP portfolios. On the whole, PPP value is negatively related to capitalization size.

3.4.2.3 Statistics of daily returns of portfolios

In this 3x2 scenario analysis, 6 portfolios are constructed in terms of size and PPP. The summary statistics for the returns of market index and 6 portfolios are computed in this section.

Table 3-3: Summary Statistics for Market Return and Portfolio Return in Bear Market

Portfolios	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
SSCI300	-0.00074	-0.0011	0.0478	-0.0288	0.01229	0.558184	4.216362
LH	-0.00175	-0.0027	0.0563	-0.0407	0.014234	0.331771	4.389969
LL	-0.00068	-0.0008	0.0433	-0.0282	0.01152	0.648884	4.303316
MH	-0.00166	-0.0016	0.0548	-0.0395	0.014787	0.271795	3.852184
ML	-0.00105	-0.00165	0.0558	-0.0416	0.014981	0.217651	4.004931
SH	-0.00188	-0.00155	0.0608	-0.046	0.016296	0.101034	3.874513
SL	-0.00083	-0.00125	0.059	-0.0434	0.015851	0.280822	3.697976

Notes: This table displays the summary statistics for the daily returns of market index (SSCI300) and 6 portfolios. The six portfolios are named by LH for large size and high PPP, LL for large size and low PPP, MH for mid size and high PPP, ML for mid size and low PPP, SH for small size and high PPP, SL for small size and low PPP. The daily return for each portfolio is calculated and the average returns are all negative, because during this period, the overall stock market index also dropped slightly. All the average daily returns for the six portfolios except LL portfolio are lower than market return.

3.4.2.4 Test of Excess Return by Jensen α

For each of the six portfolios, the following regression is performed to test the sign and significance of the intercept α.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{M,t} - R_{f,t}) + \varepsilon_{p,t} \quad (3\text{-}6)$$

$R_{p,t}$ is the daily return for a portfolio, which can be LH, LL, MH, ML, SH or SL.

$R_{M,t}$ is the daily return of market portfolio (SSCI300).

$R_{f,t}$ is the daily return of risk free asset, represented by current deposit rate.

α_p is intercept to be estimated and is expected to be 0 if no excess return occurs.

β_p is slope to be estimated and is regarded as relative systematic risk.

$\varepsilon_{p,t}$ is the error term of unsystematic risk with the expected mean of zero.

Table 3-4: Regression Results of 6 Portfolios in 3x2 Scenario in Bear Market

No.	Portfolio	α	β
1	Large Size and High PPP (LH)	-0.000936** (-2.9609)	1.087550** (42.2846)
2	Large Size and Low PPP (LL)	-0.000018 (-0.0979)	0.905566** (57.9257)
3	Mid Size and High PPP (MH)	-0.000820** (-2.3809)	0.054452** (40.0611)
4	Mid Size and Low PPP (ML)	-0.000207 (-0.5593)	1.126166** (37.3945)
5	Small Size and High PPP (SH)	-0.000964* (-2.2994)	1.216107** (35.6454)
6	Small Size and Low PPP (SL)	0.000102 (0.3323)	1.230787** (49.4522)

Notes: This table displays the regression results for the 6 portfolios return against market return. Eviews 7.0 is applied to generate the results. The estimated α and β are shown in the table and the corresponding t values are displayed in the bracket.

* indicates significant at 5% level;

** indicates significant at 1% level.

The focus of study is Jensen alpha of the regression. Notably, the Jensen alphas for the high PPP groups regardless of size are all significantly negative; investing in high PPP portfolios may probably lead to unfavorable results regardless the size of stocks selected. For the low PPP group, Jensen alphas are all insignificant, and the only the small sized group show a positive sign. Still, it is worth noting that for either high PPP or low PPP group, portfolio with small-sized stocks tends to perform better than portfolio with large-sized stocks. In the bear market, PPP effect seems to be more eminent than size effect.

Table 3-5: Jensen alpha for Size-PPP portfolios in Bear Market

	High PPP	Low PPP
Large size	-0.000936**	-1.88E-05
Mid size	-0.000820*	-0.000207
Small size	-0.000964*	0.000102

Notes: This table reorganizes Table 3-4 into PPP-size matrix. The figures presented in the boxes are the Jensen α for the six combinations. Portfolios with high PPP all have negative excess return.

* indicates significant at 5% level;

** indicates significant at 1% level.

3.4.2.5 Investment Recommendations

Based on the Jensen alpha test for excess return, there are two investment recommendations of the bear market period. The first recommendation is to strongly avoid investing in high PPP stocks. The second recommendation is to invest in the small capitalization stocks with low PPP.

Considering the fact that PPP effect is more influential than size effect in bear market, a new portfolio can be constructed solely based on PPP criterion regardless of their size. The new portfolio consists of buying the low PPP portfolios and selling the high PPP portfolios. The initial investment amount for the new portfolio is zero because the long and short positions offset each other. The return of the new portfolios, which can be defined as Low Minus High portfolio (hereafter LMH), can be computed below:

$$R_{LMH} = R_{LowPPP} - R_{HighPPP} \quad (3\text{-}7)$$

where R_{LowPPP} is the average daily return for all the 105 stocks which are labeled as low PPP, and $R_{HighPPP}$ is the average daily return for all the 107 stocks which are labeled as high PPP.

Jensen alpha model can also be applied to test the performance of the LMH portfolio against market return.

$$\text{LMH: } R_{LMH} - R_f = 0.000765 - 0.054452^{*} (R_M - R_f) \quad (3\text{-}8)$$

$$(2.2603) \qquad (-1.9767)$$

Jensen alpha is significantly positive at 5% level. It is evident that the LMH portfolio can obtain excess return and is thus an effective investment.

The above LMH portfolio can be further improved by taking into consideration the size effect. Since the performance of a stock is negatively related to its size, it is advisable to buy the stocks of small size and low PPP (long SL portfolio) and sell the stocks of large size and high PPP (short LH portfolio). The SL portfolio and LN

portfolio are on the diagonal of Table 3-1, therefore I name this new portfolio diagonal portfolio, donated as D.

$$R_D = R_{SL} - R_{LH} \quad (3\text{-}9)$$

Jensen alpha model can also be applied to test the performance of the diagonal portfolio against market return.

$$\text{D Portfolio: } R_D - R_f = 0.000938 + 0.143236^* (R_M - R_f) \quad (3\text{-}10)$$
$$(2.3007) \quad (4.31967)$$

Jensen alpha for D portfolio is 0.000938, which significantly positive at 5% level and it is also larger than the Jensen alpha in LMH portfolio (0.000765). It is evident that the diagonal portfolio can obtain excess return and also improves LMH portfolio.

3.4.3 Investment Portfolios based on 3x3 scenario of size and PPP

3.4.3.1 Portfolio Constituents

When all the stocks are divided into 3 categories by size factor and 3 categories by PPP factor, the stocks can fall into one of the nine portfolios. When the size classification co integrated with PPP classification, 9 portfolios are constructed, and the number of stocks in each portfolio is shown in the Table 3-6.

Table 3-6: Sample Numbers in 3x3 Scenario in Bear Market

	High PPP	Mid PPP	Low PPP	Total
Large size	10	25	35	70

Mid size	22	29	20	71
Small size	26	18	27	71
Total	58	72	82	212

Notes: This table shows the number of stocks in each 3x3 portfolio matrix. For instance, the number of stocks with large size and high PPP is 10.

3.4.3.2 Average PPP for each portfolio

In order to have an initial impression of how well each portfolio would perform, the average PPP is calculated for each portfolio. Portfolios with low PPP average are more likely to have better performance than those with high PPP average, which is consistent with the findings in 3x2 scenario.

Table 3-7: Average PPP for Each Portfolio in 3x3 Scenario in Bear Market

	High PPP	Mid PPP	Low PPP	Overall average
Large size	16.98	7.09	2.30	8.79
Mid size	20.25	7.28	2.97	10.17
Small size	25.14	7.77	1.68	11.53
Overall average	20.79	7.38	2.32	10.16

Notes: This table shows the average PPP for each portfolio. The portfolios of the high PPP show much higher PPP indicators (almost 20 years) than their mid PPP and low PPP counterparts (7.38 years and 2.32 years respectively). On the whole, the PPP value for the large size, mid size and small size are 8.79 years, 10.17 years and 11.53 years, showing a negative relationship as well.

3.4.3.3 Statistics of daily returns of portfolios

In this 3x3 scenario analysis, 9 portfolios are constructed in terms of size and PPP. The summary statistics for the returns of market index and 9 portfolios are computed in this section.

Table 3-8: Summary Statistics for Market Return and Portfolio Return in Bear Market

Portfolios	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
SSCI300	-0.00074	-0.0011	0.0478	-0.0288	0.01229	0.558184	4.216362
LH	-0.00144	-0.00215	0.0574	-0.0396	0.014072	0.469273	4.527958
LM	-0.00144	-0.00215	0.0574	-0.0396	0.014072	0.469273	4.527958
LL	-0.00074	-0.0009	0.0448	-0.0285	0.011791	0.666219	4.381685
MH	-0.00131	-0.0013	0.0537	-0.0407	0.015054	0.179144	3.662154
MM	-0.00137	-0.00145	0.0617	-0.052	0.015845	0.35171	4.379365
ML	-0.00104	-0.0017	0.0551	-0.0427	0.014917	0.215319	3.930187
SH	-0.00179	-0.00095	0.0608	-0.0519	0.016322	0.080576	3.962602
SM	-0.00179	-0.00145	0.0627	-0.0499	0.017438	0.094434	3.591933
SL	-0.00067	-0.00135	0.0573	-0.0432	0.015573	0.250414	3.762716

Notes: This table displays the summary statistics for the returns of market index (SSCI300) and 9 portfolios. The nine portfolios are named by LH for large size and high PPP, LM for large size and mid PPP, LL for large size and low PPP, MH for mid size and high PPP, MM for mid size and mid PPP, ML for mid size and low PPP, SH for small size and high PPP, SM for small size and mid PPP, SL for small size and low PPP. The daily return for each portfolio is calculated and the average returns are all negative, because during this period, the overall stock market index also dropped slightly. Almost the average daily returns for the nine portfolios are lower than market return.

3.4.3.4 Test of Excess Return by Jensen α

For each of the nine portfolios, the following regression is made to test the sign and significance of the intercept.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{M,t} - R_{f,t}) + \varepsilon_{p,t} \quad (3\text{-}11)$$

$R_{p,t}$ is the daily return of portfolio LH, LM, LL, MH, MM, ML, SH, SM or SL.

$R_{M,t}$ is the daily return of market index SSCI300.

$R_{f,t}$ is the daily return of risk free asset, represented by current deposit rate.

α_p is the intercept to be estimated and is expected to be 0 if no excess return occurs.

β_p is slope and is regarded as an indicator for relative systematic risk.

$\varepsilon_{p,t}$ is the error term of unsystematic risk with an expected mean of zero.

Table 3-9: Regression Results of 9 Portfolios in 3x3 Scenario in Bear Market

No.	Portfolios	α	β
1	Large Size and High PPP (LH)	-0.000650 (-1.9688)	1.066741 (39.7027)
2	Large Size and Mid PPP (LM)	-0.000650 (-1.9688)	0.905566 (39.7027)
3	Large Size and Low PPP (LL)	-0.000027 (-0.1418)	0.930640 (60.7356)
4	Mid Size and High PPP (MH)	-0.000465 (-1.2599)	1.133264 (37.7665)
5	Mid Size and Mid PPP (MM)	-0.000427 (-1.501023)	1.238439 (53.5104)
6	Mid Size and Low PPP (ML)	-0.000195 (-0.5399)	1.124732 (38.1885)
7	Small Size and High PPP (SH)	-0.000874 (-2.0275)	1.211854 (34.5536)
8	Small Size and Mid PPP (SM)	-0.000823 (-1.6625)	1.274499 (31.6543)
9	Small Size and Low PPP (SL)	0.000232 (0.7214)	1.200556 (45.8665)

Notes: This table displays the regression results for the 9 portfolios return against market return.

The estimated α and β are shown in the table and the corresponding t values are displayed in the bracket.

* indicates significant at 5% level;

** indicates significant at 1% level.

Notably, the Jensen alphas for the high PPP groups are significantly negative; therefore investing in high PPP portfolios is very likely to lead to unfavorable results regardless the size of stocks selected. For the low PPP group, Jensen alphas are all insignificant, and the only the small size portfolio show a positive sign. Table 3-10 shows the Jensen alphas for the nine portfolios.

Table 3-10: Jensen alpha for Size-PPP portfolios in Bear Market

	High PPP	Mid PPP	Low PPP
Large size	-0.000650*	-0.000650*	-2.67E-05
Mid size	-0.000465	-0.000427	-0.000195
Small size	-0.000874*	-0.000823	0.000232

Notes: This table reorganizes Table 3-9 into PPP-size matrix. The figures presented in the boxes are the Jensen alphas for the 9 combinations.

* indicates significant at 5% level;

** indicates significant at 1% level.

3.4.3.5 Investment Recommendations

Based on the Jensen alpha test of excess return, there are two investment recommendations of the bear market period. The first recommendation is to strongly avoid investing in high PPP stocks. The second recommendation is to invest in the small capitalization stocks with low PPP. There is no material difference from the

recommendations in 3x2 scenario.

Following the same method in 3.4.2.5, a new portfolio can be constructed from the available portfolios by buying the low PPP portfolios and selling the high PPP portfolios. The initial input of the new portfolio is zero because the long and short positions offset each other. The return of the new portfolios, which can be called low minus high portfolio (LMH), can be computed below:

$$R_{LMH} = R_{LowPPP} - R_{HighPPP} \quad (3\text{-}12)$$

where R_{LowPPP} is the average daily return for all the 82 stocks which are labeled as low PPP, and $R_{HighPPP}$ is the average daily return for all the 58 stocks which are labeled as high PPP.

Jensen alpha model can also be applied to test the performance of the LMH portfolio against market return.

$$\text{LMH: } R_{LMH\_} R_f = 0.000566 - 0.051977^{*} (R_M - R_f) \quad (3\text{-}13)$$

$$(1.6622) \qquad (-1.8752)$$

Jensen's α is positive but not significantly positive. In this case the LMH portfolio cannot obtain excess return.

Similarly, the diagonal portfolio can be constructed by buying SL portfolio and selling LH portfolio.

$$R_D = R_{SL} - R_{LH} \quad (3\text{-}14)$$

Jensen's α model can also be applied to test the performance of the diagonal portfolio

against market return.

$$\text{D Portfolio: } R_D - R_f = 0.000782 + 0.122815^{*} (R_M - R_f) \qquad (3\text{-}15)$$
$$(1.6365) \quad (3.4407)$$

Jensen's α in D portfolio is improved compared with that in LMH portfolio, but it is only significant at 10% level. It cannot conclude excess return for D portfolio at 5% significance level. It can be explained that stock selection alone cannot ensure excess return for bear market condition.

In the empirical investigation of the bear market from 5 Dec 2011 to 3 Dec 2012, 212 sample stocks from Shanghai Shenzhen Composite 300 Index are examined in terms of size and PPP. An inverse relationship between PPP and log(size) is discovered. The inverse relationship can be explained from an equilibrium perspective. Large size stocks tend to have lower PPP and small size stocks tend to have higher PPP. Two scenarios of size-PPP combinations (i.e. 3x2 and 3x3) are respectively investigated, and both scenarios conclude similar statistical results. In bear market, PPP effect is more dominant than size effect in that portfolios with different PPPs show sharp contrast return result but the returns across different size categories show no significant difference. Therefore, in bear market, an investor should be more keen to selecting stocks by means of PPP as a priority criteria. An investor should avoid stocks with high PPPs and is advised to invest in small firms with low PPP. A good recommendation of effective investment is LMH portfolio (buying low PPP stocks and selling high PPP stocks) or D portfolio (buying SL portfolio and selling LH

portfolio).

3.5 Size Effect and PPP Effect in Bull Market Conditions

3.5.1 Data Selection and Description

A bull market is defined as a condition in which securities prices rise and widespread optimism causes the stock market's upward spiral to be self-sustaining. Investors anticipate gains as optimism and buying increases. Although figures vary, an upturn of 20% or more from their 52-week low in a stock index is considered an entry into a bull market.

For the chosen period from 5 Nov 2008 to 3 Nov 2009, the SSCI300 index started at bottom of 1627.76 points and climbed to the peak of 3787.03 points during the sample period. The index rose by 32.6% from bottom to peak and therefore this period was defined as a bull market.

This period is characterized by bullish market conditions in domestic stock market as well other assets market such as real estate market.

Again, potential stocks are selected from 300 index composites. Because of different timing, the 300 composites are not completely identical to the index in Section 3.4. The two criteria have already been demonstrated. The first criterion is that the stock has been listed for more than five years. The second criterion is that book value of equity is positive, otherwise PPP = log (P/B) / log (1+ROE) is not computable. By these two criteria the 300 stocks are shortlisted to 188 stocks available for investment.

The bench date is 5 Nov 2008.

The 188 stocks exhibit a wide range of PPP from -152.7 to 160.8 years. The negative PPPs refer to the stocks with P/B<1, so that log (P/B) is negative. Low PPPs are favorable and negative PPPs are even more favorable because these stocks are sold at discount instead of premium. During the selected bullish market period, 29 stocks exhibit negative PPP, indicating high investment value. The mean of PPP is 6.78 years and the median of PPP is 4.78 years. A substantial proportion of the stocks are undervalued using the PPP < 5 criteria. From the first glance of the PPP of the stocks, this period is very likely to be bull market.

The size of the 188 stocks also show a wide range from 0.3 billion RMB to 587 billion RMB. The mean of size is 18.5 billion RMB and the median is 7.5 billion RMB. The standard deviation of size is 48.1 billion RMB.

It is an interesting idea to examine the relationship between size and PPP. Theoretically, there is no direct or apparent link between size and PPP. A linear regression between PPP and log (size) offers a surprising result again. The size of a stock is treated with logarithm to become more smooth. Regressing PPP against log (size) shows to what extent size can affect PPP or how these two factors coincide. The regression result is shown below:

$$PPP = 16.7488 - 2.2591 * \log(size) \qquad (3\text{-}16)$$
$$(2.7332) \quad (2.6816)$$

The relationship between PPP and size is negative. The coefficients are significant. It

is directed interpreted as that the stocks with large size also tend to have low PPP and small sized stocks tend to have high PPP in bull market. It can be viewed from an equilibrium perspective. If large sized stocks have high PPP, the demand for such stocks are low, so there will be adjustments in the stock market. Therefore large sized stocks are matched with low PPP. Similarly, if small sized stocks have low PPP, the demand for such stocks is very strong and triggers the purchase of such stocks. On the other hand, low PPP stocks are desirable, and the overbuying of stocks with low PPP pushes up its price and makes its size grow big.

3.5.2 Investment Portfolios based on 3x2 scenario of size and PPP

3.5.2.1 Portfolio Constituents

When all the stocks are divided into 3 equal parts by size factor and 2 equal parts by PPP factor, the stocks can fall into one of the six portfolios. Table 3-11 shows the number of stocks in each portfolio matrix.

Table 3-11: Sample Numbers in 3x2 Scenario in Bull Market

	High PPP	Low PPP	Total
Large size	33	31	64
Mid size	30	33	63
Small size	29	32	61
Total	92	96	188

Notes: This table shows the number of stocks in each portfolio matrix. The total sample includes 188 stocks. The sample size for each portfolio is roughly the same.

3.5.2.2 Average PPP for Each Portfolio

In order to have an initial impression of how well each portfolio would perform, the average PPP is calculated for each portfolio. Portfolios with low PPP average are more likely to have better performance than those with high PPP average. Illustrated in the Table 3-12, the portfolios of the high PPP show much higher PPP indicators (over 10 years) than their low PPP counterparts (within 2 years). On the whole, the PPP value for the large size, mid size and small size are 5.51 years, 6.38 years and 8.12 years, showing a negative relationship between PPP and capitalization.

Table 3-12: Average PPP for Each Portfolio in 3x2 Scenario in Bull Market

	High PPP	Low PPP	Overall average
Large size	10.79	0.22	5.51
Mid size	11.09	1.66	6.38
Small size	15.64	0.60	8.12
Overall average	12.51	0.83	6.67

Notes: This table shows the average PPP for each portfolio. High PPP portfolios have a much greater PPP value than low PPP portfolios. On the whole, PPP value is negatively related to capitalization size.

3.5.2.3 Statistics of daily returns of portfolios

In this 3x2 scenario analysis, 6 portfolios are constructed in terms of size and PPP. The summary statistics for the returns of market index and 6 portfolios are computed in this section.

Table 3-13: Summary statistics for market return and portfolio returns in Bull Market

Portfolios	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
SSCI300	0.003075	0.0044	0.0712	-0.0771	0.022926	-0.490111	4.164834
LH	0.001855	0.0036	0.0579	-0.066	0.019659	-0.549731	4.09533
LL	0.003168	0.0045	0.0773	-0.0852	0.024179	-0.425163	4.157312
MH	0.003109	0.0064	0.0609	-0.076	0.02263	-0.667203	4.25831
ML	0.004103	0.0063	0.0809	-0.0863	0.026695	-0.530965	4.077175
SH	0.004524	0.007	0.0684	-0.0743	0.023974	-0.616198	4.102336
SL	0.004703	0.0074	0.0759	-0.0789	0.026318	-0.602781	4.227612

Notes: This table displays the summary statistics for the returns of market index and 6 portfolios. The six portfolios are named by LH for large size and high PPP, LL for large size and low PPP, MH for mid size and high PPP, ML for mid size and low PPP, SH for small size and high PPP, SL for small size and low PPP. The daily return for each portfolio is calculated and the average returns are all positive, because during this period, the overall stock market index also surged rapidly. All the average daily returns for the six portfolios are higher than market return except the LH portfolio.

3.5.2.4 Test of Excess Return by Jensen α

For each of the six portfolios, the following regression is made to test the sign and significance of the intercept.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{M,t} - R_{f,t}) + \varepsilon_{p,t} \quad (3\text{-}17)$$

$R_{p,t}$ is the daily return for a portfolio, which can be LH, LL, MH, ML, SH or SL.

$R_{M,t}$ is the daily return of market portfolio (SSCI300).

$R_{f,t}$ is the daily return of risk free asset, represented by current deposit rate.

α_p is the intercept to be estimated and is expected to be 0 if no excess return occurs.

β_p is the slope to be estimated and is regarded as an indicator for relative systematic risk.

$\varepsilon_{p,t}$ is the error term of unsystematic risk with expected mean of zero.

Table 3-14: Regression Results of 6 Portfolios in 3x2 Scenario in Bull Market

No.	Portfolio	α	β
1	Large Size and High PPP (LH)	-0.000645 (-1.49)	0.806629 (43.05)
2	Large Size and Low PPP (LL)	-0.000002 (-0.0069)	1.031878 (73.48)
3	Mid Size and High PPP (MH)	0.000277 (0.514)	0.918348 (39.39)
4	Mid Size and Low PPP (ML)	0.000706 (1.329)	1.108106 (48.10)
5	Small Size and High PPP (SH)	0.001445* (2.2242)	0.945347 (32.83318)
6	Small Size and Low PPP (SL)	0.001611* (2. 4254)	1.061509 (37.709)

Notes: This table displays the regression results for the 6 portfolios return against market return. Eviews 7 is applied to generate the results. The estimated α and β are shown in the table and the corresponding t values are displayed in the bracket.

* indicates significant at 5% level;

** indicates significant at 1% level.

Notably, the Jensen's α for the large size groups are negative, investing in large size portfolios may probably lead to unfavorable results regardless their PPP values. For the mid size group, Jensen's αs are positive but not significant, because in this bull market, the market index has already in a quick increase, it is less likely for common stocks to beat the entire bull market significantly. Still, it is worth noting that for the small size group, both high PPP and low PPP portfolios perform better than portfolio with large-sized stocks. Size effect is more dominant than PPP effect. For the small sized group, portfolio with low PPP seems to slightly out beat high PPP, although both

can generate excess return over the entire market. Table 3-15 shows the Jensen alphas for the six portfolios. Portfolios with small sizes all have positive excess return.

Table 3-15: Jensen alpha for size-PPP portfolios in Bull Market

	High PPP	Low PPP
Large size	-0.000645	-2.25E-06
Mid size	0.000277	0.000706
Small size	0.001445*	0.001611*

Notes: This table reorganizes Table 3-14 into PPP-size matrix. The figures presented in the boxes are the Jensen alphas for the six combinations. Portfolios with small sizes have positive excess return.

* indicates significant at 5% level;

** indicates significant at 1% level.

3.5.2.5 Investment Recommendations

Based on the Jensen alpha test of excess return, there are two investment recommendations of the bull market period. The first recommendation is to strongly avoid investing in large capitalization stocks. The second recommendation is to invest in the small capitalization stocks with low PPP.

Considering the fact that size effect is more influential than PPP effect in bull market, a new portfolio can be constructed solely based on size criterion regardless of their PPP value. The new portfolio consists of buying the small sized portfolios and selling the large size portfolios. The initial investment amount for the new portfolio is zero because the long and short positions offset each other. The return of the new portfolios, which can be called Small Minus Large portfolio (hereafter SML), can be computed

below:

$$R_{SML} = R_{SmallSize} - R_{LargeSize} \quad (3\text{-}18)$$

where $R_{SmallSize}$ is the average daily return for all the 61 stocks which are labeled as small size, and $R_{LargeSize}$ is the average daily return for all the 64 stocks which are labeled as large size.

Jensen alpha model can also be applied to test the performance of the SML portfolio against market return.

$$\text{SML: } R_{SML} - R_f = 0.001751 + 0.084175^* (R_M - R_f) \quad (3\text{-}19)$$
$$(3.2025) \quad (3.5511)$$

Jensen alpha is significantly positive at 1% level. It is evident that the SML portfolio can obtain excess return and is thus an effective investment.

The above SML portfolio can be further improved by taking into consideration the PPP effect. Since the performance of a stock is negatively related to its size, it is advisable to buy the stocks of small size and low PPP (long SL portfolio) and sell the stocks of large size and high PPP (short LH portfolio). For consistency, this new portfolio is also called diagonal portfolio, donated as D.

$$R_D = R_{SL} - R_{LH} \quad (3\text{-}20)$$

Jensen alpha model can also be applied to test the performance of the diagonal portfolio against market return.

$$\text{D Portfolio: } R_D - R_f = 0.001989 + 0.25488^* (R_M - R_f) \quad (3\text{-}21)$$
$$(2.9020) \quad (8.5782)$$

Jensen alpha for D portfolio is 0.001989, which significantly positive at 1% level and it is also larger than the Jensen alpha in SML portfolio (0.001751). It is evident that the diagonal portfolio can obtain excess return and also improves SML portfolio.

3.5.3 Constructing Investment Portfolios based on 3x3 scenario of size and PPP

3.5.3.1 Portfolio Constituents

When all the stocks are divided into 3 categories by size factor and 3 categories by PPP factor, the stocks can fall into one of the nine portfolios. When the size classification co integrated with PPP classification, 9 portfolios are constructed, and the number of stocks in each portfolio is shown in Table 3-16.

Table 3-16: Sample Numbers in 3x3 Scenario in Bull Market

	High PPP	Mid PPP	Low PPP	Total
Large size	11	22	30	63
Mid size	9	20	34	63
Small size	15	15	32	62
Total	35	57	96	188

Notes: This table shows the number of stocks in each portfolio matrix. For instance, the portfolio with large size and high PPP stocks has 11 samples.

3.5.3.2 Average PPP for each portfolio

In order to have an initial impression of how well each portfolio would perform, the average PPP is calculated for each portfolio. Portfolios with low PPP average are more likely to have better performance than those with high PPP average, which is

consistent with the findings in 3x2 scenario.

Table 3-17: Average PPP for Each Portfolio in 3x3 Scenario in Bull Market

	High PPP	Mid PPP	Low PPP	Overall average
Large size	13.85	6.98	1.02	7.28
Mid size	20.50	7.16	1.76	9.81
Small size	25.42	6.56	0.60	10.86
Overall average	19.92	6.90	1.13	9.32

Notes: This table shows the average PPP for each portfolio. The portfolios of the high PPP show much higher PPP indicators (almost 20 years) than their mid PPP and low PPP counterparts (6.90 years and 1.13 years respectively). On the whole, the PPP value for the large size, mid size and small size are 7.28 years, 9.81 years and 10.86 years, showing a negative relationship between PPP and market capitalization as well.

3.5.3.3 Statistics of daily returns of portfolios

In this 3x3 scenario analysis, 9 portfolios are constructed in terms of size and PPP. The summary statistics for the returns of market index and 9 portfolios are computed in this section.

Table 3-18: Summary Statistics for Market and Portfolio Return in Bull Market

Portfolios	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
SSCI300	0.003075	0.0044	0.0712	-0.0771	0.022926	-0.49011	4.164834
LH	0.001784	0.0039	0.0581	-0.0715	0.020433	-0.67958	3.992118
LM	0.002025	0.0039	0.0594	-0.0637	0.02022	-0.44922	4.102722
LL	0.003111	0.0043	0.0767	-0.0851	0.024131	-0.43898	4.158221

MH	0.003242	0.0063	0.072	-0.0876	0.024119	-0.66968	4.209024
MM	0.00291	0.0056	0.0616	-0.074	0.023371	-0.6796	4.147927
ML	0.004092	0.0062	0.0804	-0.0868	0.026674	-0.54668	4.091061
SH	0.004189	0.006	0.0705	-0.0882	0.025291	-0.72196	4.441954
SM	0.004703	0.0074	0.0759	-0.0789	0.026318	-0.60278	4.227612
SL	0.004842	0.0069	0.0664	-0.0702	0.023967	-0.51447	3.78631

Notes: This table displays the summary statistics for the returns of market index and 9 portfolios. The nine portfolios are named by LH for large size and high PPP, LM for large size and mid PPP, LL for large size and low PPP, MH for mid size and high PPP, MM for mid size and mid PPP, ML for mid size and low PPP, SH for small size and high PPP, SM for small size and mid PPP, SL for small size and low PPP. The daily return for each portfolio is calculated and the average returns are all negative, because during this period, the overall stock market index also dropped slightly. Generally speaking, the performance of large size portfolios is lower than the market return and small sized portfolios beat the entire bull market.

3.5.3.4 Test of Excess Return by Jensen's α

For each of the nine portfolios, the following regression is made to test the sign and significance of the intercept.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{M,t} - R_{f,t}) + \varepsilon_{p,t} \quad (3\text{-}22)$$

$R_{p,t}$ is the daily return for a portfolio, which can be LH, LM, LL, MH, MM, ML, SH, SM or SL.

$R_{M,t}$ is the daily return of market index SSCI300.

$R_{f,t}$ is the daily return of risk free asset, represented by current deposit rate.

α_p is the intercept to be estimated and is expected to be 0 if no excess return occurs.

β_p is the slope to be estimated and is regarded as an indicator for relative systematic risk.

$\varepsilon_{p,t}$ is the error term of unsystematic risk with expected mean of zero.

Table 3-19: Regression Results of 9 Portfolios in 3x3 Scenario in Bull Market

No.	Portfolio	α	β
1	Large Size and High PPP (LH)	-0.000754 (-1.4469)	0.819371 (36.2813)
2	Large Size and Mid PPP (LM)	-0.000489 (-0.95)	0.811260 (36.41)
3	Large Size and Low PPP (LL)	-0.000057 (-0.1853)	1.031445 (76.35)
4	Mid Size and High PPP (MH)	0.000464 (0.57349)	0.8999 (25.6435)
5	Mid Size and Mid PPP (MM)	0.000011 (0.018898)	0.9408 (37.21719)
6	Mid Size and Low PPP (ML)	0.000712 (1.2863)	1.102183 (45.911)
7	Small Size and High PPP (SH)	0.001191 (1.5469)	0.973854 (29.1747)
8	Small Size and Mid PPP (SM)	0.001445 (2.2242)	1.061509 (37.7094)
9	Small Size and Low PPP (SL)	0.002008 (2.7119)	0.919049 (28.6385)

Notes: This table displays the regression results for the 9 portfolios return against market return. The estimated α and β are shown in the table and the corresponding t values are displayed in the bracket.

* indicates significant at 5% level;

** indicates significant at 1% level.

Notably, the Jensen alphas for the large size groups are negative, investing in large size portfolios may probably lead unfavorable results regardless the PPP of stocks selected. For the small size group, Jensen alphas are all positive and in particular, Jensen alphas are significantly positive in mid PPP and low PPP cases. For the mid

sized group, no significant excess return is detected. Still, it is worth noting that for large size, mid size or small size group, portfolios with low PPP stocks tend to perform better than portfolios with high PPP stocks and mid PPP stocks.

Table 3-20: Jensen alpha for Size-PPP portfolios in Bull Market

	High PPP	Mid PPP	Low PPP
Large size	-0.000754	-0.000489	-5.78E-05
Mid size	0.000464	1.10E-05	0.000712
Small size	0. 001191	0. 001445*	0.002008**

Notes: This table reorganizes Table 3-19 into PPP-size matrix. The figures presented in the boxes are the Jensen alphas for the 9 combinations.

* indicates significant at 5% level;

** indicates significant at 1% level.

3.5.3.5 Investment Recommendations

Based on the Jensen alpha test of excess return, there are two investment recommendations of the bull market period. One recommendation is to strongly avoid investing in large capitalization stocks. And the other recommendation is to invest in the small capitalization stocks with low PPP.

Following the same method in 3.5.2.5, a new portfolio can be constructed from the available portfolios by buying the small size portfolios and selling the large size portfolios. The initial input of the new portfolio is zero because the long and short positions offset each other. The return of the new portfolios, which can be called Small Minus Large portfolio (SML), can be computed below:

$$R_{SML} = R_{SmallSize} - R_{LargeSize} \quad (3\text{-}23)$$

where $R_{SmallSize}$ is the average daily return for all the 62 stocks which are labeled as small size, and $R_{LargeSize}$ is the average daily return for all the 63 stocks which are labeled as large size.

Jensen alpha model can also be applied to test the performance of the SML portfolio against market return.

$$\text{SML: } R_{SML} - R_f = 0.001882 + 0.098445^* (R_M - R_f) \quad (3\text{-}24)$$
$$(3.3391) \quad (3.9899)$$

Jensen alpha is significantly positive at 1% level. It is evident that the SML portfolio can obtain excess return.

Similarly, the diagonal portfolio can be constructed by buying SL portfolio and selling LH portfolio.

$$R_D = R_{SL} - R_{LH} \quad (3\text{-}25)$$

Jensen alpha model can also be applied to test the performance of the diagonal portfolio against market return.

$$\text{D Portfolio: } R_D - R_f = 0.002662 + 0.099678^* (R_M - R_f) \quad (3\text{-}26)$$
$$(3.08567) \quad (2.66590)$$

Jensen alpha for D portfolio is 0.002662, which significantly positive at 1% level and it is also larger than the Jensen alpha in SML portfolio (0.001882). It is evident that the diagonal portfolio can obtain excess return and also improves SML portfolio.

In the empirical investigation of the bull market from 5 Nov 2008 to 3 Nov 2009, 188 sample stocks of Shanghai Shenzhen Composite 300 Index are examined in terms of size and PPP. An inverse relationship between PPP and size is also discovered. In bull market, large size stocks tend to have lower PPP and small size stocks tend to have higher PPP. Two scenarios of size-PPP combinations (i.e. 3x2 and 3x3) are respectively investigated, both scenarios lead similar statistical results. In bull market, size effect is more dominant than PPP effect in that portfolios with different sizes show sharp contrast return result but the returns across different PPP categories show no significant difference. Therefore, in bull market, an investor should be more keen to selecting stocks by means of size as a priority criteria. An investor should avoid stocks of large size and is advised to invest in small firms with low PPP. A good recommendation of effective investment is SML portfolio, buying small size stocks and selling large size stocks. Empirical study shows significant excess return in such a portfolio. The diagonal portfolio which longs the best possible portfolio and shorts the worst possible portfolio provides even better result of excess return.

3.6 Conclusion

This chapter is an extension of Chapter 2 in the application of Premium Payback Period method in stock investment activities with implications for stock selection in different market conditions and with other stock selection methods. The major empirical work in this chapter combines the two special factors of a stock, i.e. market capitalization (size) and PPP, as guidance for stock selection. Size effect refers to the

fact that smaller firms are more likely to get higher returns than larger firms. PPP effect refers to the fact that firms with lower PPP are more likely to get higher returns than those with higher PPP. When stocks fall into the category of small firm with low PPP, it is a good investment opportunity. A stock or portfolio's excess return refers to difference of its actual return and the risk-adjusted return suggested in CAPM. The excess return is measured in terms of Jensen alpha, which is the result of potentially influential factors, which are size effect and PPP effect in this study. However, there is not always an ideal investment; in some cases size effect contradicts PPP effect. The interaction of size effect and PPP effect in different market conditions is the major research target in this chapter.

In the empirical investigation of the bear market from 5 Dec 2011 to 3 Dec 2012, 212 sample stocks of Shanghai Shenzhen Composite 300 Index are examined in terms of size and PPP. An inverse relationship between PPP and size is discovered. The inverse relationship can be explained from an equilibrium perspective. Large size stocks tend to have higher PPP and small size stocks tend to have lower PPP. Two scenarios of size-PPP combinations (i.e. 3x2 and 3x3) are respectively investigated, both scenarios lead to similar statistical results. In bear market, PPP effect is more dominant than size effect in that portfolios with different PPPs show sharp contrast return result but the returns across different size categories show no significant difference. Therefore, in bear market, an investor should be more concerning to select stocks by means of PPP as a priority criteria. An investor should avoid stocks with high PPPs and is advised to invest in small firms with low PPP. A good recommendation of stock investment is

LMH portfolio, buying low PPP stocks and selling high PPP stocks. A more considerate case is to buy stocks with small size and low PPP (SL portfolio) and sell stocks with large size and high PPP (LH portfolio).

In the empirical investigation of the bull market from 5 Nov 2008 to 3 Nov 2009, 188 sample stocks of Shanghai Shenzhen Composite 300 Index are examined in terms of size and PPP. An inverse relationship between PPP and size is also discovered. In bull market, large size stocks tend to have higher PPP and small size stocks tend to have lower PPP. Two scenarios of size-PPP combinations (i.e. 3x2 and 3x3) are respectively investigated, both scenarios lead similar statistical results. In bull market, size effect seems to be more dominant than PPP effect in that portfolios with different sizes show sharp contrast return result but the returns across different PPP categories show no significant difference. Therefore, in bull market, an investor should be more keen to selecting stocks by means of size as a priority criteria. An investor should avoid stocks of large size and is advised to invest in small firms with low PPP. A good recommendation for investment is SML portfolio, buying small size stocks and selling large size stocks. Empirical study shows significant excess return in such a portfolio. A more considerate case is to buy stocks with small size and low PPP (SL portfolio) and sell stocks with large size and high PPP (LH portfolio).

In the empirical investigation in this chapter, both size effect and PPP effect are observed in stock returns although the influences of these two effects are different according to various market conditions. On the whole, it is recommended to invest in

small size firms with low PPP and sell short large size with high PPP. When the investment recommendation by the two factors of size and PPP are conflicted, PPP effect should be put in priority in bear market whereas size effect should be first considered in bull market condition.

Chapter 4 Practice of PPP in Stock Investment: A Perspective in Market Timing

4.1 Introduction

In the previous two chapters, a new method for valuing individual stocks was introduced to determine whether a stock is overvalued or undervalued. Many valuation models have already been developed to determine the intrinsic value of the stock so that it is easy to tell whether it is overvalued or undervalued. The new method introduced in this series of study is the Premium Payback Period model (PPP model), which is measured by the time required to pay back the premium (price minus book value) in stock investment, whose market price is usually higher than its book value.

PPP model inherits the advantages of the existent models by taking into consideration the book value of the stock and the company's earning ability measured in terms of ROE. The concept of premium payback period is proposed to measure how soon the premium paid to buy stocks is rewarded by company earnings. Stocks with low PPP are safer and profitable investment. The critical value for PPP can be obtained by observation in real economy. Normally stocks with PPP shorter than 5 years can be viewed as value stocks. PPP model is also powerful for investors in selecting stocks for their portfolio. PPP model assists in selecting undervalued stocks and allocates investment capital in these stocks for excess return.

In practice, investors do not only care about which stocks to invest, but also when to invest. Fund managers are supposed to be professional investors. The investment strategies adopted by fund managers can be borrowed by normal individual investors. There are numerous factors influencing the fund performance and the factors have been investigated. Fama (1972) advocated that fund performance can be decomposed into two abilities, i.e. micro forecasting and macro forecasting ability. Micro forecasting ability refers to the prediction of individual stock price movement, which directs fund managers to select individual stocks. Macro forecasting ability refers to the prediction of total stock market movement as a whole, which directs fund managers to decide when to enter or exit the stock market. Therefore, a fund manager should first decide the capital allocation on stock asset and non-stock asset (e.g. cash, bond, etc) and then decide the allocation of stock asset on different stocks. In other words, a fund manager should first judge whether the overall stock market is overvalued or undervalued as the most important foundation for investment strategy and then identify the undervalued stocks in the market.

Micro forecasting involves the identification of individual stocks which are undervalued or overvalued relative to equities generally. Undervalued stocks generate excess return other than indicated by Capital Asset Pricing Model. Micro forecaster attempts to identify individual stocks whose expected returns lie significantly above or below the Security Market Line. Macro forecasting, or "market timing," attempts to identify when equity market in general are undervalued or overvalued relative to the fixed-income securities. A macro forecaster or "market timer," tries to forecast

whether stock market outperforms bonds that is, $R_m > R_f$. If a fund manager believes that stock market is undervalued and will outperform bond market, he will intentionally increase investment proportion on stock market, otherwise he will reduce investment in stock market. The contingent shift between high risk assets and low risk asset enables the fund managers to excel the overall stock market.

The stock selection methods using PPP model have been thoroughly discussed in previous chapters. The most traditional model is the discount dividend model to calculate the intrinsic value of individual stocks. However, in most cases, the intrinsic value is lower than the stock price. In this regard, few stocks have investment value. Using the original PPP model, more valuable stocks are identified and the constituted portfolio is proved to generate excess return.

Investment timing strategies is then to be discussed in this chapter. Market timing investment strategies also assume that the stock market is not efficient, and the overall stock market is normally either overvalued or undervalued. Such assumption gives market timers good opportunity to obtain excess return. The most used market timing indicators adopted by practitioners include PE, Tobin's Q, Market value relative to GDP, AAII sentiment, etc. Despite the many market timing tools, empirical studies show that most fund managers perform poor market timing abilities. This chapter intends to empirically test Chinese fund performance in market timing and propose the premium payback period for the overall stock market. This is the extension of PPP application. The PPP of the whole stock market can be a signal of timing for market

entry or exit.

The rest of the chapter is arranged as follows. Section 4.2 conducts a review of related literature of market timing models and practice results. Section 4.3 provides an empirical investigation on how well fund managers in China can capture good investment opportunities in different market conditions. Section 4.4 proposes the Premium Payback Period model for the overall market exhibits the practice of PPP in stock market timing in China and demonstrates to improve market timing ability of funds. Section 4.5 is the conclusion of this chapter.

4.2 Literature Review

The focus of this chapter is to offer a new model to measure market valuation and provide investment timing suggestions. Chapters 2 and 3 have provided a good answer to the question whether an individual stock is worth investing. For this chapter, another question to be answered is whether the overall stock market is worth investing at a specific time, or put it in another way, when the stock market as a whole is worth investing.

Whether stock market performance deviates from its fundamental values is crucial to this research. Only when the deviation occurs, can various investment strategies including PPP be practicable. Whether the overvalued or undervalued stock market reverts to its fundamental is equally important. Only when the stock market reverts to fundamental, can the various investment strategies have the power of prediction. The

relation between stock market performance and its fundamental values is essentially the Market Efficiency Hypothesis.

There is always endless debate on whether stock market is efficient even in the well-developed stock markets in US and European countries. The result is important but not the focus of this study. It is a widely acceptable assumption that the stock market is not perfectly efficient and thus the investors can apply some specific methods to achieve excess return at least within a certain period. Stock selectivity and market timing are the two approaches to achieve excess return. Stock selectivity methods have been discussed already. Market timing methods include PE, PB, moving average, Tobin's Q, market value relative to GDP but the real practice is hard to observe and typically for fund managers because market timing is an expertise secret. Market timing decisions are like in the black box, as a result, literature is mainly focused on the result of market timing ability instead of the procedure of market timing, neglecting how the market timing decisions are made.

4.2.1 Market Timing Models

The previous section has discussed various methods for market timing, but the overall validity requires empirical test. If empirical results show that the current market timing ability is weak, it is necessary to introduce new methods or models, e.g. PPP. Otherwise, extra effort is not necessary.

Compared with individual investors, fund managers are assumed to be more able in

market timing. This section intends to evaluate the market timing ability of managed funds in China. Empirical models include: T-M Model (Treynor and Mazuy, 1966) and H-M Model (Henriksson and Menton, 1981)

4.2.1.1 T-M Model

Treynor and Mazuy (1966) is the pioneer in the research of fund manager's market timing ability in stock investment. The presumption of this model is that if the fund can forecast market return and when it believes that market return is to rise, it will naturally increase the position of market portfolio particularly with volatile securities, otherwise reduce the position of market portfolio. In other words, fund managers can adjust investment portfolio according to their judgment of future market trend, in such a manner that fund return is non-linearly connected with market return; to be more precisely the fund's return bears a convex relation to the market factor. Treynor and Mazuy added a quadratic term in the traditional CAPM to gauge fund managers' market timing ability. The T-M model is written as:

$$R_i - R_f = \alpha + \beta(R_m - R_f) + \gamma(R_m - R_f)^2 + \varepsilon \qquad (4\text{-}1)$$

where R_i is return of fund,

R_f is risk free rate,

R_m is return of market portfolio.

α is Jensen alpha, and $\alpha > 0$ means the fund manager has good ability in stock selection. $\gamma > 0$ means the fund manager has good ability in market timing and can generate return in various conditions, because when $\gamma > 0$, R_i is larger than risk

adjusted return indicated by CAPM.

Treynor and Mazuy (1966) selected 57 open end funds and examined their annual return. The empirical result is that only one fund exhibits significant market timing ability and most fund managers show no evidence of market timing ability.

4.2.1.2 H-M Model

Henriksson and Merton (1981) proposed another model to evaluate fund performance in terms of security selectivity and market timing, with the following form:

$$R_i - R_f = \alpha + \beta(R_m - R_f) + \gamma(R_m - R_f)D + \varepsilon \qquad (4\text{-}2)$$

where R_i is return of fund,

R_f is risk free rate,

R_m is return of market portfolio.

D is a dummy variable which equals to 1 when R_m is larger than R_f and equals to 0 otherwise. The other parameters are the same as in TM model: α is Jensen alpha, and $\alpha > 0$ means the fund manager has good ability in stock selection. $\gamma > 0$ means the fund manager has good ability in market timing and can generate return in various conditions, because when $\gamma > 0$, R_i is larger than risk adjusted return indicated by CAPM.

The HM model applies the theory of option pricing to the test of market timing of funds. HM model investigated the monthly return of 116 funds from 1968 to 1980. The empirical research found that most funds show negative market timing ability,

although insignificant by 5%. There is no evidence that fund managers have either market timing ability or security selectivity ability.

4.2.1.3 Other Model Specifications and Empirical Results

Both TM and HM models are based on CAPM. Fama and Frenche (1993), among others, TM found that CAPM does not include all potential risk factors. Later, scholars started to use Famma and French three factor model (FF3) to modify TM and HM into regression method.

Chang and Lewellen (1984) built their research on the basis of Arbitrage Pricing Theory in order to avoid the unrealistic assumptions of CAPM. They investigated both the bull market and bear market conditions and conducted regressions in the respective scenarios, concluding that the sample exhibit neither significant stock selectivity ability nor significant market timing ability.

Jeffrey A. Busse (1999) introduced volatility into the evaluation of fund's market timing ability for the following two reasons. First volatility is more convenient to observe and predict because of its cluster and persistency. Second, fund managers should normally reduce market exposure when market volatility increases. Busse applied the new model to the empirical study of 230 funds using daily data from January 1985 to January 1995, finding that fund managers actively restructure market exposure of the portfolio in different market volatility conditions and achieved good fund performance. Significant market timing is observed.

Goetzmann, Ingersoll and Ivkovic (GII, 2000) posited that regressing HM model with monthly data may underestimate fund managers' market timing ability, because for most fund managers, the frequency of making investment decision is less than 1 month and fund managers trade more frequently than investment return is measured so that monthly data does not incorporate fund managers' frequent decisions according to market dynamics and can very likely underestimate their market timing ability. They composed a put option function on the daily return of stock index and accumulate the value of the put option within each month, expressed as:

$$P_{m,t} = \{[\prod_{\tau \in month(t)}^{t} Max(1+R_{m,\tau}, 1+R_{f,\tau})]-1\} - R_{m,t} \quad (4\text{-}3)$$

where $P_{m,t}$ is the added value for the fund by daily market timing activity,

t denotes a specific month, and τ denotes trading days.

The function is based on the assumption that fund managers make daily trading and investment decisions according to market conditions. An extreme case is that if a fund manager predicts that the stock market will produce positive excess return, he will invest all the position in stock market, otherwise in risk free asset, so that he can always achieve good return but reduce risk. The model developed by GII expresses:

$$Z_{p,t} = \alpha + \beta Z_{m,t} + \gamma P_{m,t} + \varepsilon_t \quad (4\text{-}4)$$

where $Z_{p,t} = r_{p,t} - r_{f,t}$ $Z_{p,t} = r_{p,t} - r_{f,t}$ is the excess return for the fund portfolio;

$Z_{m,t} = r_{m,t} - r_{f,t}$ is the excess return for the market portfolio.

GII (2000) selected 123 funds from January 1988 to March 1998 and applied HM、GII and Fama French 3 factors specifications, concluding that few funds exhibit

statistically significant market timing ability.

Merton (1981) developed a non-parametric model to evaluate market timing ability. It is supposed that a fund manager only predicts whether market return is larger or smaller than risk free rate and does not consider the real difference between them in terms of quantity. A fund manager will make relevant investment decision according to his prediction. The fund manager's market timing ability is based on the conditional probability of the fact that market return is higher than risk free rate. The limitation of this model is that it is difficult for the researcher to observe the prediction process and result of the fund managers.

4.2.2 Empirical Results for Fund Performance in China

China's stock market and fund market took a late start, and the research on the market timing of fund performance mainly based on the mature theories and models established by foreign researchers. The most commonly used models by Chinese researchers for empirical research are the classical models including TM model, HM model, etc. Following the well established models, Chinese researchers also decompose fund performance into stock selectivity and market timing, to investigate whether fund managers can beat the market.

Zhang and Li (2000) evaluated the first five funds performance using data from 9 October 1998 to 30 June 1999, finding that all funds achieve positive excess return as a result of good stock selectivity rather than market timing.

Adopting the same method, Liu, et al (2001) investigated 14 funds from 1 September 1999 to 31 March 2001, finding that the sample funds exhibit no significant stock selectivity and market timing and that the abnormal performance of the funds is not persistent.

Wang (2002) adopted TM, HM and GII with both CAPM and Fama-French 3 factors specifications and his empirical research showed that the 33 funds displayed no significant market timing ability. The stock selectivity ability, however, only marginally contributed to the performance of the funds, which was on the whole unstable.

Wei et al (2003) adopted a new model of Andrew Partial GMM method to test and discover the significant change of fund value at stock market turns. Their empirical research led to opposite conclusion to the traditional models. Most Chinese fund managers perform good market timing at the critical turning point of the stock market. Their empirical results showed that with the development of fund market, more funds were issued to intensify competition. Investment opinions may vary so that the stock market would be more efficient, so that market timing ability may disappear after 2005.

Xiao and Yang (2005) examined 57 open-end equity investment funds from 2003 to 2004 by means of TM, HM and TM-3F, HM-3F, concluding that the stock selectivity was not persistent and market timing was not significant.

Shen and Dang (2005) constructs the skewness adjustment conditional quadratic model based on the TM model. The empirical analysis of Chinese equity investment fund proves that this model is more effective and erases the bias of negative market timing ability. The result is that none of the funds show any significant market timing.

Other Chinese scholars including Zhou (2001), Zhou and Shi (2004), Lu (2004) lead to similar conclusions. The major reason for the poor performance may be due to the fact that the history of open-end fund was short and few funds were traded before 2005, so that the limited number of funds and observations may undermine the empirical results.

Later researchers with more recent and large samples also lead to similar conclusions. Wu and Chen (2008) empirically studied 17 funds from 2004 to 2006 by means of TM, HM and CL model, discovering that open-ended equity investment funds in China have certain market timing ability but this ability is not persistent under all market conditions.

Yang (2008) investigated open-end equity investment fund and hybrid fund from January 2003 to April 2008 with Jensen alpha, TM model and HM model, and the empirical research was conducted to both bull and bear market conditions. Empirical results showed that more than half of the funds beat market performance, and that strong market timing was indentified in bear market and stock selectivity in bull market.

Based on T-M model, Wei (2010) investigates the market timing and security selecting ability of 41 open-end funds from 1st January 2006 to 31st March 2009 (weekly data). The result shows that the excess return of the open-end funds is mainly gained by bearing the systematic risk of stock market; although an individual fund demonstrates a significant security selecting ability, the funds market as a whole is lack of significant market timing ability.

Zheng and Chen (2009) reviewed the performance of 35 open-end equity investment funds from May 2005 to April 2008 using monthly returns. They find that most funds show positive but insignificant stock selectivity ability and show no market timing ability. Their empirical research also includes a few funds that show negative market timing ability.

To sum up, almost all empirical research lead to the similar conclusion that China's fund may exhibit positive stock selectivity but poor market timing ability. Fund managers usually emphasize the selection of stocks but neglect the market timing for the overall stock market, so that the investment risk increases. It is understandable that China's fund market has a short history and the fund managers' investment behaviour is on an improving process. The poor performance of China's funds may be caused by the volatility of stock market, lack of risk hedging tools and inadequate fund assessment system. Most of the above empirical research have examined the fund market before 2007, it is therefore necessary to evaluate fund performance with most recent data to check whether fund performance especially market timing has

improved recently. One other motivation to update the research is that China's stock market has changed substantially after 2007.

4.3 Empirical Study of Investment Timing of Funds in China

The main purpose of this chapter is to provide a sound method to determine appropriate investment timing and discover investment opportunities. It is therefore necessary to comment on how current practitioners perform in investment timing. Considering that it is extremely difficult to research individual investor's behaviour in stock investment, it would be a good alternative to study the fund managers' behaviour for two reasons. First, fund managers are commonly believed to be rational investor with qualified expertise. If fund managers are found to be unable to control satisfactory investment timing, it is convincing that current investment methods are not effective in investment timing. Second, the data for fund operation, especially open-end fund, is available for empirical research. As of the end of 2012, the number of all traded funds in China was 1174, with total 3156 billion shares accounting for 2797 billion RMB of total net asset value under management.

In this section, the overall development of China' fund market is to be introduced first. Secondly, typical stock-type fund is to be selected and investigated by TM Model and HM Model respectively. Different market environments will also be taken into consideration. Finally, the investment timing ability of Chinese fund managers is concluded and commented.

4.3.1 The Development of Fund Market in China

The development of China's fund industry is divided into three historic phases.

4.3.1.1 Phase I from 1991 to 1997: Slow development with exploration

China's fund industry was initiated in 1991 with the development of China's stock market. Zhuxin Fund, Wuhan Securities Investment Fund, and Shenzhen Nanshan Venture Capital Fund were established in 1991 as the first cohort of investment funds. By the end of 1997, there were 78 investment funds, which were all closed fund. During this period, there were only a few fund companies with small scale and substandard operation. The relevant policies and regulations were not in place, and fund investment lacked liquidity.

4.3.1.2 Phase II from 1997 to 2001: Orderly development with normalization

The start of Phase II was marked by the introduction of <Interim Measures of Securities Investment Fund Management > in November 1997. The Interim Measures set up legal norms for the fund establishment and management, clarifying that the major investment tools for fund investment to be securities investment. The existent funds were reshuffled in 1999 by means of M&A and asset restructuring, so that these funds were renewed. During this golden period, the fund market was still dominated by closed fund, however, the break issue problem began to be outstanding after 2000 and the discounted trade brought fund market to gloom.

4.3.1.3 Phase III from 2002 to present: Rapid development with innovation

The establishment of Huaan innovation securities investment fund (040001) in 2001 preluded the new era of open-end fund. Since 2002, China's fund market entered into a period of high speed development with accelerating pace of innovation. During this period, various types of funds were introduced, including bond fund, index fund, fund of fund, money market fund, etc. China's fund market has made marvelous achievement in terms of asset scale and product structure and has already become an ineligible part of China's security market.

As of the end of 2012, the number of all traded funds was 1174, with total 3156 billion shares accounting for 2797 billion RMB of total net asset value under management. The purpose for fund operation is to yield maximum return for the investors. Considering the huge number of existent funds, the competition of the fund market is fierce. The fund managers are strictly selected and believed to be rational investors. The most used criteria to judge a fund manager's performance is his ability in selecting stocks and deciding investment timing.

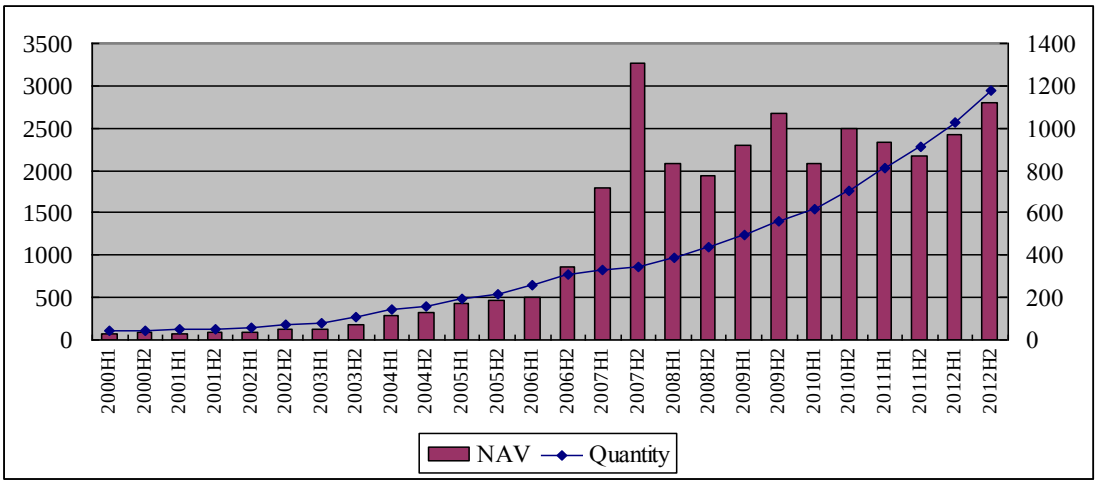

Figure 4-1: Development of China's Fund Market in Quantity and NAV

Notes: This figure shows the quantity and net asset value of funds in China's capital market. The horizontal axis is the period from 2000 to 2012. The left side vertical axis is the value for net asset value of all funds in billion RMB. The right side vertical axis is the quantity of funds. The data source is WIND Database

Although China's open-end fund took a late start in 2001, it has already become the most important and mainstream player in the fund market because of its numerous advantages of market selectivity, liquidity, information disclosure. In terms of different investment target, China's open ended fund can be categorized into equity style, bond, money market and hybrid. According to the classification standards formulated by China Security Regulatory Committee, equity style fund refers to the open-end fund which allocates more than 60% of the asset on stock investment. The net asset value (NAV) of the fund fluctuates with the stock prices.

According to the information provided by WIND, equity style fund takes the biggest market share, by 44.36% in terms of quantity and 35.42% in terms of NAV.

Table 4-1: Composition of China's Fund Market by 2013

Fund Type	Quantity	Percentage	Net Asset Value (billion RMB)	Percentage
Equity style	554	44.36	1031	35.42
Hybrid Fund	195	15.61	529	18.20
Bond	236	18.90	284	9.75
Money market	113	9.05	780	26.80
Others	220	17.61	294	10.10
Total	1249	100.00	2911	100.00

Notes: This table presents the general composition of China's fund market. There are totally 5 types of funds operated in China, with total number of 1249 and net asset value of 2911 billion RMB. Equity style fund is the major fund type in China.

Data Source: WIND.

4.3.2 Model Construction

In this empirical study, the existent mature models are borrowed from Treynor and Mazuy (1966) as well as Henriksson and Merton (1981).

4.3.2.1 Treynor and Mazuy Model

Treynor and Mazuy (1966) is one of the earliest and most frequently adopted models to evaluate market timing ability. The model proposes that if the fund can predict market return, it will increase the proportion of market portfolio. It will also accordingly reduce the proportion of market portfolio when market return is predicted to cline. Therefore, if the fund manager has perfect market timing ability, portfolio return and market return shows a non-linear relationship. A quadratic item is incorporated in TM model, which writes:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + \gamma_i (R_{m,t} - R_{f,t})^2 + \varepsilon_{i,t} \quad (4\text{-}5)$$

where R_i is the weekly return of fund *i*,

R_f is risk free rate in terms of current deposit rate,

R_m is the weekly return of market portfolio (Shanghai Security Composite Index).

α is Jensen alpha, and $\alpha > 0$ means the fund manager has good ability in stock selection.

β is CAPM beta, and stands for systematic risk.

γ is the coefficient to measure market timing ability. Positive γ means the fund manager has good ability in market timing and can generate return in various conditions.

The most important part of this analysis is to find the sign of γ. If γ is significantly larger than 0, TM model shows that such fund portfolio can generate return higher than its risk adjusted return as suggested by CAPM model. A direct explanation is that the investor increases the beta value when stock market is on the rise.

4.3.2.2 Henriksson and Merton Model

Henriksson and Merton (1981) continue with the TM idea, but provides a different regression format as follows:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + \gamma_i (R_{m,t} - R_{f,t}) D_{i,t} + \varepsilon_{i,t} \quad (4\text{-}6)$$

where R_i is the weekly return of fund *i*,

R_f is risk free rate in terms of current deposit rate,

R_m is the weekly return of market portfolio (Shanghai Security Composite Index).

$D_{i,t}$ is a dummy variable, which equals to 1 when $R_{m,t}$ is larger than $R_{f,t}$ and equals to 0 otherwise.

α is Jensen alpha, and $\alpha > 0$ means the fund manager has good ability in stock selection.

β is CAPM beta, and stands for systematic risk.

γ is the coefficient to measure market timing ability. Positive gamma means the fund manager has good ability in market timing and can generate return in various conditions.

The difference between TM model and HM model is the former has a quadratic item whereas the latter introduces a dummy variable. All other parameters and indications are comparable. The core consideration of this model is also the sign of γ. If the fund manager observes that market return is over risk free return, he or she should consciously raise the beta of his portfolio, so $\beta + \gamma > \beta$, i.e. $\gamma > 0$.

4.3.3 Sample and Data Collection

4.3.3.1 Sample Period

Most of current researches which evaluate fund performance investigate a sample period over 3 years for a robust and reliable conclusion. For this study, I investigate a sample period from 5 January 2007 to 28 January 2013 for three reasons.

One reason is that existent studies on the market timing ability of China's fund have already examined the sample period before 2007 and the conclusion is that most China's funds show no evidence of market timing ability. Therefore, it is necessary to examine the sample period after 2007 to evaluate whether China's fund have made any progress in this field for the new period.

The second reason is that the sample period is of research interest because China's stock market experienced different market conditions during this period. The sample can be used to investigate how fund managers perform in different market conditions. The market conditions can be classified according to Shanghai Securities Composite Index (SSCI). The sample period can be divided into three sub-periods.

The third reason is the sample period was before the implementation of the new policy for equity fund. The requirement of equity fund with minimum 80% position on stock asset was announced in the "Regulation for the Public Offering of Fund" put forward by China Securities Supervision Committee in 2014. The requirement was put into execution until August 2015. This requirement certainly has a negative impact on the marketing ability of the fund managers. Especially when the market is on the downturn, the fund manager will have fewer measures to avoid loss. Due to this effect, over 200 equity funds changed their names and became hybrid funds in an effort for more flexibility on position adjustment. The sample period is not influenced by this policy.

Table 4-2: Definition of Sub-samples

Sample Period	Sample Range	Stock Market Condition
Period I	5-1-2007 ~ 25-1-2008	Bull Market
Period II	1-2-2008 ~ 30-1-2009	Bear Market
Period III	6-2-2009 ~ 28-1-2013	Stable Volatility

Notes: This table presents the three periods of sub-sample for observation. Each sub-sample represents a typical market condition.

During Period I from 5-1-2007 to 25-1-2008, SSCI rose from 2641 to historic peak 6124 and then remained above 5000, so this period is labeled bull market. During Period II from 1-2-2008 to 30-1-2009, SSCI fell from 5000 to 1729 and remained below 2000, so this period is labeled bear market. During Period III, from 6-2-2009 to 28-1-2013, SSCI is relative stable and fluctuate between 2000 and 3000, so this period is labeled as market correction.

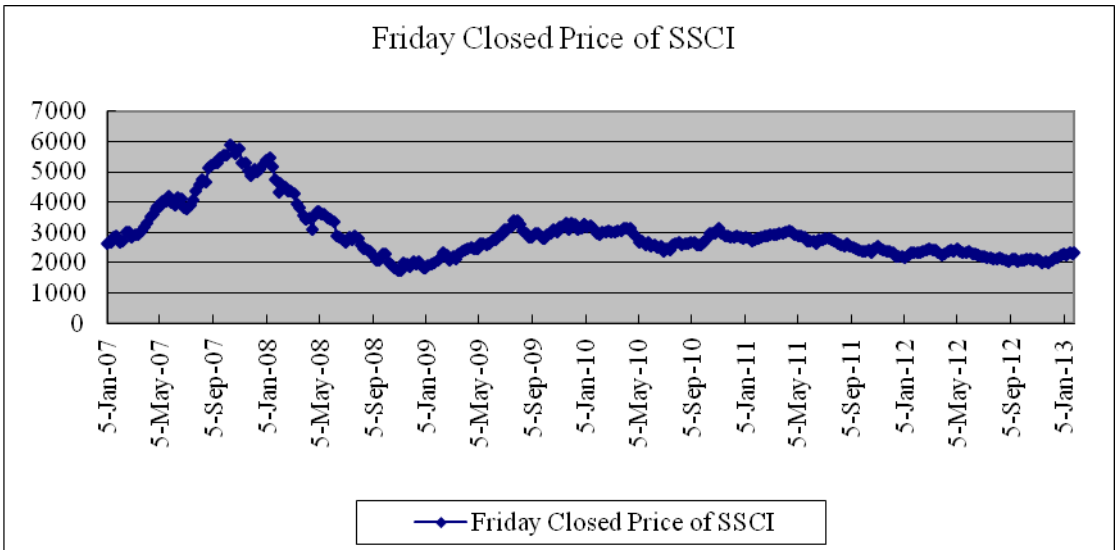

Figure 4-2: Shanghai Security Composite Index from 2007 to 2013

Notes: This figure presents the weekly dynamics of Shanghai Security Composite Index from 5 January 2007 to 5 January 2013. The three periods of bull, bear and market correction are easy to identify. Data source is WIND database.

4.3.3.2 Sample Funds

The target for research is how well the funds in China can exhibit stock selection and market timing ability. For the many funds in China's market, this study mainly focuses on the performance of equity style fund which is more linked with the performance of the stock market, so that experienced fund managers' market timing ability can be evaluated.

From the many funds which are actively traded in the market, 10 typical funds are selected by the following criteria. First of all, 10 most prestigious fund companies in China's fund market are selected according to their market share in terms of net asset value of managed funds. Then I choose one typical fund from each of the ten fund companies, by the criteria that the fund is an equity style fund and covers the sample period from 5 January 2007 to 28 January 2013. The 10 sample funds and their managing companies are summarized in Table 4-3. It is commonly believed that big fund companies can have better research and resource support and their fund managers are more capable in stock selectivity and market timing than their counterparts in small fund companies. Therefore, these 10 sample funds are chosen.

Table 4-3: Ten Sample Funds Selected for Empirical Study

Fund Company	Date of Est.	Funds Managed	Total Fund NAV (Billion)	Market share by NAV	Name of Sample Funds	Code of Sample Funds	Date of Fund Issuance
HUAXIA	1998/4/9	32	235	8.21%	Intense Selection	000011	2004/8/11
YIFANGDA	2001/4/17	40	199	6.96%	Strategic Growth	110002	2003/12/9
BOSHI	1998/7/13	35	138	4.82%	Intense Selection	050004	2004/6/22
GUANGFA	2003/8/5	28	113	3.95%	Growth	162703	2005/2/2
GONGYINRUIXIN	2005/6/21	28	108	3.77%	Core Value	481001	2005/8/31
ZHONGYIN	2004/8/12	23	100	3.49%	Continuous Growth	163803	2006/3/17
JIANXIAN	2005/9/19	28	95	3.32%	Perpetual Value	530001	2005/12/1
SHANGTOUMOGEN	2004/5/12	20	60	2.11%	Alpha	377010	2005/10/11
JIAOYINGSHILUODE	2005/8/4	24	57	2.00%	Intense Selection	519688	2005/9/29
ZHAOSHANG	2002/12/27	28	55	1.93%	Antai	217001	2003/4/28

Notes: This table shows how the select the ten sample funds in China. First, I introduce the ten biggest fund companies in China. The table also shows the number of funds and total net asset value managed by the ten fund companies. For each fund company, a typical fund is chosen for empirical study. The typical fund must be an equity style fund and cover the sample period from 5 January 2007 to 28 January 2013.

Data Source: WIND.

4.3.3.3 Data Collection

Like other empirical studies on China's fund market, this study chooses data frequency of weekly data. Daily data is too frequent and few fund managers make investment strategies on a daily basis. Although monthly data is more commonly used

in empirical research in US and Europe, this study still adopts weekly data in order to obtain enough observations for regression.

All the data of fund performance, market return, and risk free rate are collected from WIND Database. The SSCI points and NAV of the 10 sample funds are collected for every Friday during the sample period. Logarithm function is adopted to generate weekly return. Current deposit rate is selected as risk free rate, and certainly the risk free rate is also adjusted into weekly basis.

4.3.4 Empirical Results

Recall the TM and HM model as follows:

TM model: $R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + \gamma_i (R_{m,t} - R_{f,t})^2 + \varepsilon_{i,t}$ (4-7)

HM model: $R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + \gamma_i (R_{m,t} - R_{f,t}) D_{i,t} + \varepsilon_{i,t}$ (4-8)

where R_i is the weekly return of fund *i*,

R_f is is risk free rate in terms of current deposit rate,

R_m is the weekly return of market portfolio (SSCI).

α is Jensen's α.

β is CAPM beta, and stands for systematic risk.

γ is the coefficient to measure market timing ability.

The coefficients of α and γ are of research interest. Comparing TM and HM with traditional CAPM which writes:

$$R_{i,t} - R_{f,t} = \beta_i (R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \quad (4\text{-}9)$$

α and γ are two additional terms on the CAPM. If α and γ show positive signs, the fund portfolio can generate excess return other than risk adjusted return suggested by CAPM. In such cases, fund managers are proved to beat the market. $\alpha > 0$ means that the fund manager has good ability in stock selection. $\gamma > 0$ means that the fund manager has good market timing ability. The software Eviews 7.0 is applied to generate the regression results.

4.3.4.1 Empirical Results for the Whole Sample

The regression results for the whole sample period for each fund are displayed in the Table 4-4. Unfortunately, neither stock selectivity nor market timing is found to contribute significantly positive contribution to fund return. For the TM Model, four "α"s are larger than 0 and five "γ"s are larger than 0, but none of them is significant. For the HM model, four "α"s are larger than 0 and four "γ"s are larger than 0.

Table 4-4: Empirical Result of China's Fund Performance

Fund Code		Trenyor and Mazuy Model			Henriksson and Merton Model		
		α	β	γ	α	β	γ
000011	Coefficient	0.0026	0.8365**	0.2122	0.0029	0.8303**	0.0016
	t-Statistic	1.4151	19.0360	0.3632	1.1411	12.7854	0.0121
110002	Coefficient	0.0004	0.7670**	-0.5752	0.0014	0.8272**	-0.1181
	t-Statistic	0.3786	27.7332	-1.5647	0.8480	20.2294	-1.4155
050004	Coefficient	0.0003	0.9091**	-1.6259	0.0045	1.1212**	-0.4445
	t-Statistic	0.0974	10.8756	-1.4633	0.9363	9.0957	-1.7670
162703	Coefficient	0.0013	0.9851**	0.1739	0.0005	0.9529**	0.0726
	t-Statistic	1.0902	33.4589	0.4402	0.3217	21.8492	0.8162
481001	Coefficient	-0.0107	0.7850**	1.6526	-0.0149	0.5724**	0.4438
	t-Statistic	-1.7922	5.5325	0.8762	-1.8167	2.7323	1.0379
163803	Coefficient	-0.0037	0.6029**	-1.2667	0.0006	0.7960**	-0.4197
	t-Statistic	-0.9077	6.3155	-0.9982	0.1154	5.6561	-1.4614
530001	Coefficient	-0.0055	0.6719**	-0.2709	-0.0031	0.7499**	-0.1864

	t-Statistic	-1.7100	8.9117	-0.2703	-0.7238	6.7394	-0.8207
377010	Coefficient	-0.0022	0.8154**	0.0779	-0.0010	0.8434**	-0.0793
	t-Statistic	-0.9929	15.4222	0.1109	-0.3197	10.8025	-0.4979
519688	Coefficient	-0.0074*	0.7150**	0.7844	-0.0101*	0.5940**	0.2637
	t-Statistic	-2.0013	8.1940	0.6763	-2.0072	4.6121	1.0033
217001	Coefficient	-0.0091*	0.5673**	-0.0933	-0.0071	0.6244**	-0.1439
	t-Statistic	-1.9466	5.1466	-0.0637	-1.1218	3.8356	-0.4331

Notes: This table shows the empirical result for the ten sample funds using both TM and HM models for the whole sample.

* indicates significant at 5% level;

** indicates significant at 1% level.

4.3.4.2 Empirical Results for the Sub-Samples

The empirical result for the whole sample is disappointing that the fund managers are proved to be incapable of selecting good stocks and choosing proper investment opportunities. It may be caused by the structural change in the overall market, from bull market to bear market and then market correction. The coefficients may differ in different periods so investigating the coefficients in the whole sample may be not significant. It is necessary to examine each sub period to see how fund managers perform in bull market, bear market and market correction periods respectively. The regression results for each fund under three conditions with two models are shown in detail in the Table 4-5.

Table 4-5: Empirical Results for Sub-period Samples

Fund Code	Market Condition	Trenyor and Mazuy Model			Henriksson and Merton Model		
		α	β	γ	α	β	γ
000011	Bull	0.0088*	0.8744**	1.2420	0.0084	0.7852**	0.1524
	Bear	0.0029	0.6516**	-0.6083	0.0043	0.7270**	-0.1448
	Correction	0.0020	0.9736**	-0.6115	0.0035	1.0524**	-0.1725
110002	Bull	0.0009	0.9235**	1.5565	-0.0013	0.7677**	0.3037

	Bear	-0.0012	0.6419**	-0.9800	0.0012	0.7642**	-0.2354
	Correction	0.0009	0.8037**	-1.8537*	0.0025	0.9387**	-0.2708*
050004	Bull	0.0158	1.2878**	-16.218*	0.0264	2.5831**	-2.3257
	Bear	-0.0051	0.7003**	0.1327	-0.0059	0.6760**	0.0510
	Correction	0.0003	0.8784**	-1.5945*	0.0021	1.0098**	-0.2700*
162703	Bull	0.0032	1.0567**	1.6869	0.0027	0.9364**	0.2051
	Bear	-0.0023	0.9734**	0.0859	-0.0025	0.9627**	0.0207
	Correction	0.0003	0.9557**	0.8255	-0.0012	0.8684**	0.1865
481001	Bull	-0.0431	1.2467	12.3402	-0.0594	0.0568	2.2913
	Bear	-0.0027	0.6074**	-0.1993	-0.0027	0.6261**	-0.0327
	Correction	-0.0059	0.8514**	0.4348	-0.0060	0.8281**	0.0433
163803	Bull	-0.0025	-0.1958	-8.7488	0.0128	0.7425	-1.8664
	Bear	-0.0006	0.7243**	-0.3216	-0.0005	0.7547**	-0.0531
	Correction	0.0003	0.8518**	-1.3961	0.0018	0.9634**	-0.2280
530001	Bull	-0.0156	0.6068	3.1314	-0.0159	0.4024	0.3323
	Bear	-0.0087	0.7396**	0.4523	-0.0094	0.6890**	0.0943
	Correction	0.0001	0.6392**	-4.5057	0.0037	0.9565**	-0.6318**
377010	Bull	0.0012	0.7947**	2.4717	-0.0027	0.5403**	0.4999*
	Bear	-0.0017	0.6996**	-0.2229	-0.0015	0.7217**	-0.0395
	Correction	0.0000	0.9059**	-4.0903*	0.0046	1.2389**	-0.6826*
519688	Bull	-0.0313	0.8160	7.5713	-0.0509	-0.1545	2.0197
	Bear	-0.0085*	0.5611**	0.0396	-0.0092*	0.5473**	0.0314
	Correction	-0.0008	0.8741**	-1.0604	0.0005	0.9651**	-0.1882
217001	Bull	-0.0260	0.1467	-0.6224	-0.0164	0.4268	-0.6774
	Bear	-0.0050	0.6029**	0.0566	-0.0057	0.5870**	0.0354
	Correction	-0.0026	0.7777**	-1.0805	-0.0024	0.8308**	-0.0956

Notes: This table shows the empirical result for the ten sample funds using both TM and HM models under three different market conditions.

* indicates significant at 5% level;

** indicates significant at 1% level.

The result of fund mangers' ability of stock selectivity and market timing is summarized in the Table 4-5. The conclusions of TM and HM results are very similar.

In bull market, fund managers show normal stock selectivity ability, but their timing ability is proved to be strong, because in a bull market, it is very simple for market timing decision, just enter stock market and buy.

In bear market, fund managers' stock selectivity ability is proved to be rather poor, with overwhelmingly more negative α than positive α. Stock selectivity in bear market is more important than in bull market, because the overall condition is poor, the fund manager must observe and pick out those stocks whose price is still rising. Market timing ability in bear market is normal: 5 funds do well whereas the other 5 funds do poorly.

In market correction period, however, the market trend is difficult for the fund managers to forecast. In either bull or bear market, even inexperienced individual investor can tell it is time to buy or sell. In market correction period, the market timing ability plays an important role in fund return. It is rather disappointing that overwhelmingly majority of the 10 funds show poor market timing ability, and several of the funds show significantly poor market timing ability.

In a nutshell, regarding only market timing ability, fund managers show good market timing ability in bull market, but very poor market timing ability in market correction period.

Table 4-6: Summary of Stock Selectivity and Market Timing of China's Fund

Model Specification / Market Conditions	Trenyor and Mazuy Model				Henriksson and Merton Model			
	Selectivity (α)		Timing (γ)		Selectivity (α)		Timing (γ)	
	+	-	+	-	+	-	+	-
Total Sample	4	6(2)	5	5	4	6(1)	4	6
Bull Market	5（1）	5	7	3（1）	4	6	7（1）	3
Bear Market	1	9（1）	5	5	2	8（1）	5	5

Market Correction	6	4	2	8（3）	4	6（1）	2	8（4）

Notes: This table summarizes the empirical results for the ten funds using both TM and HM models under three market conditions. The figures indicate the number of positive or negative signs of coefficient in each market condition for bot TM and HM models. The figure in the bracket indicates the number of significant coefficients.

4.3.5 Summary and Comments

This section evaluates China's fund managers' performance in stock selectivity and market timing. The methodology is not new, and the only difference from the previous empirical studies in China's fund market is the updated data from 2007 to 2013 and different market conditions are thoroughly discussed. The findings are no different from the previous research, that even China's top fund managers do not show convincingly good market timing ability, let alone average individual investors. It is disappointing for the investment market, but very encouraging for my research.

The poor fund performance may be caused by various factors, including the market operation environment, fund performance evaluation system and the personal quality of fund managers. China's security market is still under-developed with few risk protection tools and speculation is very common, which is not advantageous for the healthy development of fund market. The evaluation system of fund performance lays too much weight on the short-term rankings, as a result, fund managers pursue short-term effect for personal reputation and do not allocate optimum asset. Fund managers' education background, working experience, personal network, and risk preference can also influence fund performance.

Despite the above reasonable explanations, the most important explanation is that China's fund managers consider stock selectivity more than market timing. In the fund managers' report, how assets are allocated is more discussed than when to buy or sell stocks. One reason is that market timing is the investment know-how and core competence for the fund managers. They do not reveal their secret. But empirical findings show that in fact they do not do well in market timing. So it must be the other reason that even experienced fund managers have not acquired solid market timing tools to guide their investment. Therefore, such a market timing method is not only a research gap, but also a practice gap in stock investment.

4.4 PPP Model in Market Timing

Chapter 2 has demonstrated how to apply Premium Payback Period model in individual stock investment that is to find undervalued stocks with lower PPP than the critical value. This is in fact a stock selection method. Similarly, PPP can also be applied to valuation of the overall stock market to find whether the overall market is overvalued or undervalued, and indicate whether to enter the market or exit, this is what has been discussed as market timing.

4.4.1 Practicing PPP on Individual Stocks

The practice of PPP in individual stock selection has demonstrated in Chapter 2 in detail. Below is a brief summary of the main ideas and the practice.

Value investing is a relatively long-term investment, searching for undervalued

high-growth securities in the market. Many valuation models have been developed to determine the intrinsic value of the stock so that it is easy to tell whether it is overvalued or undervalued. PPP is only a new method for the same motivation. PPP inherits the advantages of the existent models. PPP takes into consideration the book value of the stock and it also looks ahead to account for the company's value creation in terms of ROE. More importantly it is very easy for application, by a simple formula.

$$PPP = \frac{\log(P/B)}{\log(1+ROE)} \tag{4-10}$$

Calculating PPP is not enough for investment decision. It must be compared with some benchmarks to determine whether the stock is overvalued or undervalued. PPP calculated is the premium payback period of the asset in the stock market, or fictitious economy. The benchmark can thus be only found in the real economy, i.e. how fast overpaid premium can be retained in the real economy. In this way, the fictitious economy and the real economy is linked with the concept of PPP. An investor's decision of investing in fictitious or real economy indicates the valuation of the stock. When the PPP in the fictitious economy is longer than that in the real economy, it is safer to invest in real economy; when the PPP in the fictitious economy is shorter than that in the real economy, capital investment will flow back to the stock market. PPP in the fictitious market can be calculated with the formula described previously. PPP in the real economy can only be observed from the market. PPP in the real economy can be viewed as the timed needed for a company from establishment to being listed in

Growth Enterprise Market (GEM). A survey over 200 companies shows that the longest duration is 23.67 years, shortest is 4.38 years and the average is 9.87 years. The threshold PPP can be selected according to personal preference. If the PPP is set too low, the investment is certainly safe but many good investment opportunities will be passed. Personally, I select 5 years as a buy PPP threshold and 9.5 years as a sell PPP threshold in practice.

4.4.2 Derivation of PPP Model to Overall Stock Market

4.4.2.1 PPP from individual stock to overall stock market

The practice of PPP model in individual stock selection can also be borrowed into overall stock market. The essence of PPP model is to measure whether the investment can quickly earn back the premium paid. The comparison between PPP and the critical value derived from real economy can suggest whether a stock is undervalued or overvalued and provide investment advice accordingly.

Similarly, it would be perfect that the PPP of the overall stock market can be computed and compared with the same critical value, in an effort to judge whether the stock market as a whole is undervalued or overvalued. If it is demonstrated to be undervalued by PPP, it is suggested to buy the stock market (portfolio), otherwise, sell it. In this regard, the stock market portfolio can be treated like an individual stock as stock index code of 000001. Buying stock market (portfolio) can also be understood that to increase the stock proportion in the asset basket of stocks, bonds, cash, etc.

Selling stock market portfolio can be understood as to decrease the stock proportion in the asset basket. In terminology for fund managers, it is related to the so called stock position.

Since PPP model can suggest either increase or decrease stock position, the suggestions can be made on a daily basis. Except for the extreme events, investment suggestions are identical within a small period, so that the PPP suggestions would be a series of buy followed by a series of sell and so on. Buying market portfolio as discussed refers to convert other assets into stock assets, which also means to enter the stock market. Selling market portfolio refers to convert stock assets into other forms of asset, which also means to exit market. In this regard, PPP can be applied in the overall stock market as a market timing indicator or signal.

In other words, stock market with high PPP is bull market, and with low PPP is bear market. High PPP is not safe for investors and they will exit from the market, causing the stock index to fall. Before it falls, it is wise to sell the stock assets. This is how PPP really functions in the market timing practice.

4.4.2.2 Computation of PPP for the overall stock market

The Premium Payback Period for the overall stock market is similar to that of the individual stocks, which can also be written as:

$$PPP = \frac{\log(P / B)}{\log(1 + ROE)} \tag{4-11}$$

where P is the total market value of all listed stocks divided total stock shares

B is the total book value of all listed stocks divided total stock shares

ROE = E/B = PB/PE, (*E* is the total earning for all the listed stocks divided total stock shares)

For robustness, different PE ratios are used to yield PPP data in different scenarios. The benchmark PPP uses the TTM PE ratio (trailing twelve months). Since PE ratio can be volatile, the 10 years moving average ROE is also adopted to yield a more reliable PPP. For stress test, minimum ROE in past 10 years is also used to see how long PPP is using the lowest ROE.

Table 4-7: Definition of Various PPP Types

PPP Type	Adoption of ROE
PPP BM (benchmark)	Trailing twelve months
PPP MA (moving average)	10 years moving average
PPP ST (stress testing)	Lowest in past 10 years

Notes: This table matches the different types of PPP to the adoption of ROE. Since PPP=logPB/log(1+ROE), different ROE specifications result in different PPPs. PPP BM is the most common type of PPP. PPP MA takes into consideration of cyclical movements and the moving average treatment makes PPP smooth. PPP ST is the PPP value for the worst possible case for stress test.

I have developed an automatic system that reports the various PPP data for the entire stock market on a daily basis so that the stock investment timing is closely monitored.

4.4.3 Practice of PPP for the Overall Stock Market

Once the PPP data for the overall stock market is collected, it is necessary to make

evaluations and judgment to guide the investment strategy.

PPP can be calculated on a daily basis from 01-07-1992 to 21-01-2013 and plotted in a time series graph. PPP can be compared with critical value so determine whether the entire market is overvalued or undervalued.

If PPP > critical value, the overall stock market is overvalued, sell market portfolio and exit the stock market;

If PPP < critical value, the overall stock market is undervalued, enter the stock market and buy the market portfolio.

In such a manner, PPP is practiced to judge the market trend and make investment timing decisions accordingly. The key point here is also how to determine the critical values. Like the investment practice in selecting individual stocks, PPP < 5 is a signal of undervaluation and PPP > 9.5 is a signal of overvaluation. However, in real practice, the selection of critical value is flexible with many other factors taken into consideration.

The practice of PPP in the overall stock market can be vividly summarized in the following graph, which provides a convincing evidence for the effectiveness of the PPP method.

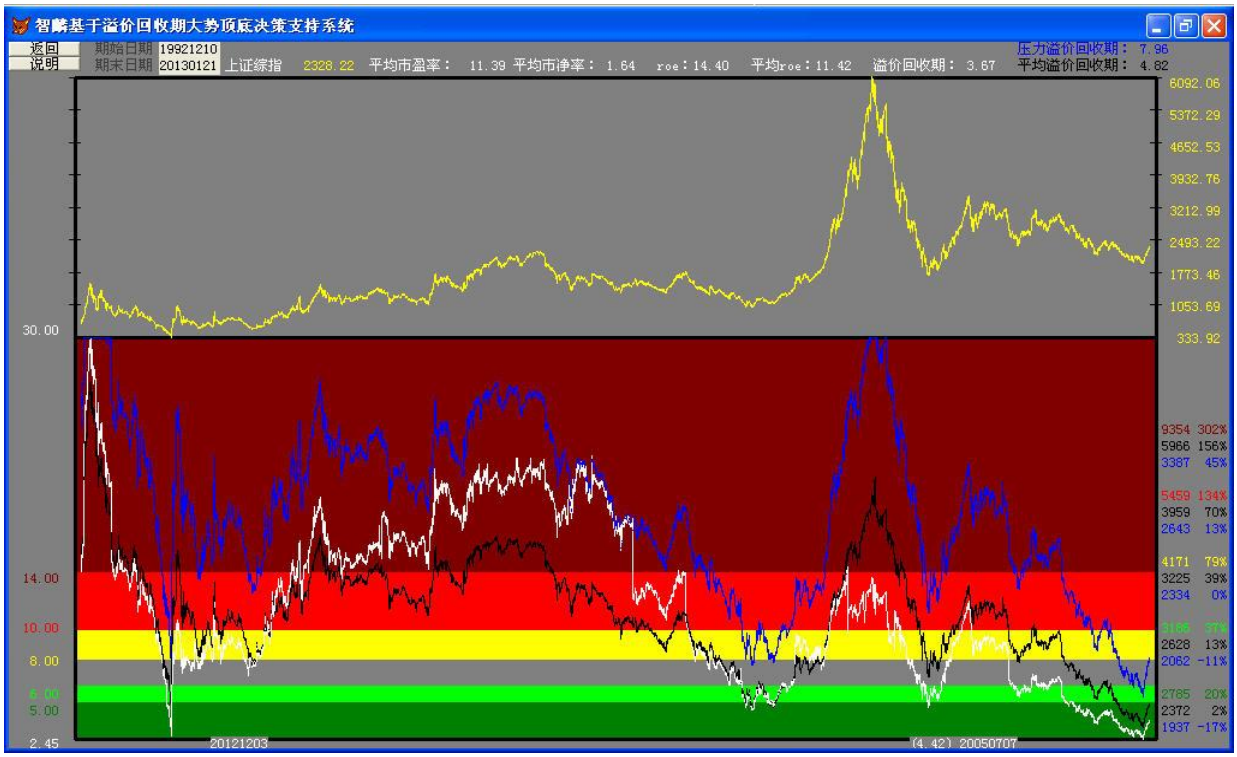

Figure 4-3: SSCI and PPP in China's Stock Market

Notes: The figure consists of two parts. The upper half provides a Yellow Curve which is the time series plot of Stock Market Index. The lower half provides three different curves for different versions of PPP and 6 bars with different colours for different investment intervals. The horizontal axis is the time period from 10 December 1992 to 21 January 2013. The left-side vertical axis is PPP value for the lower half, and the righ-side vertical axis is the market index for the upper half. The white curve is the PPP from the standard model as demonstrated. The PPP for Black Curve is a smoothed PPP and is calculated using 10 years moving average of ROE. The PPP for Blue Curve is PPP under stress testing, where the minimum ROE in 10 years is used. Horizontal Bars with different colors are different PPP critical values defined in Table 4-8.

Table 4-8: Different Critical Values for PPP

Colours	PPP Range	Market Valuation	Investment Suggestion
Dark Red	14 ~ 30	Extremely overvalued	strong sell
Light Red	10 ~ 14	Overvalued	sell
Yellow	8 ~ 10	Moderately overvalued	stop selling
Grey	6 ~ 8	Moderately undervalued	stop buying

Colours	PPP Range	Market Valuation	Investment Suggestion
Light Green	5 ~ 6	Undervalued,	buy
Deep Green	0 ~ 5	Extremely undervalued	strong buy

Notes: This table explains the colour bars in Figure 4-3 in details. Each colour bar represents an interval of PPP. The market valuation is dependent on the value of PPP. The high value of PPP indicates overvaluation and the investment strategy is to sell. The low value of PPP indicates undervaluation and the investment strategy is to buy.

The Figure 4-3 illustrates how to apply PPP in market timing. SSCI underwent a mild growth from 1992 to 2006, followed by a sky-rocketing growth in 2007, peaking at 6124 points on 16 October 2007. In 2008, SSCI witnessed a landslide from above 6000 to below 2000. SSCI has then been fluctuating between 1800 and 3600 points ever since. The graph itself is the best evidence of the effectiveness of PPP investment strategy. Low PPP (when the PPP curve falls into the green interval) gives an entry signal and it is recommended to buy when stock index is also at bottom. It is also found that low PPP appeared a few weeks earlier than the stock index began to rebound as shown in the picture.

According to the PPP graph, there are four cases when PPP falls into the green interval in the history of China's stock market. It is interesting and instructive to review how PPP and SSCI performed in these four cases respectively.

Case I took place in the early years of China's stock market, when the market is still underdeveloped, however even in such conditions, PPP method shows its power as well. The PPP fell below 5 for the first time on 4 July 1994, when SSCI called only

439 points. This is an entry signal, and the SSCI was later proved to be a relative historic low and started to climb. As the SSCI grew up to 1005 points, PPP took the measure of 10.37, the first time above 10. This is a exit signal. The fact is that after the exit from the market, SSCI started to fall again. Therefore in Case I, the investment period was from 4 July 1994 to 6 September 1994 and SSCI increased more than doubled during the two months.

Case II took place almost ten years later after Case I as China's stock market developed and matured. The second time in SSCI history when its PPP fell below 5 happed on 1 June 2005, when SSCI was 1039 and its PPP was 4.86. Applying the principle, the investor should enter the market on 1 July 2005 and exit on 25 December 2006 when PPP first exceeded 10. During this period, SSCI also more than doubled and called at 2436 points. However, later development China's stock market amazed all investors that the craziest bull market ever in China approached. The highest close price of SSCI was 6092 on 16 October 2007 and the relevant PPP is 13.5 years. In Case II PPP method did bring good investment profit, but it also missed the biggest growth ever in China. Maybe the criteria of 10 years is too low for extreme bull market.

Case III showed up after a sharp drop in China's stock market. The crazy bull market in Case II was short-lived and was followed by a more surprising downturn till the stock index was merely one third of its peak. Bear market can also provide investment opportunity. The PPP again fell below 5 on 30 October 2008, when SSCI was at 1764

points. It is safe to invest under such low market conditions. With the market turned warm and the PPP exceeded 10 on 18 July 2009, it would be a good idea to exit at 2854 points of SSCI and claim handsome return. However, from Case II, the investor has learned that the criteria for PPP in bull market should be more than years and therefore the investor should hold the stock asset for two more months, when PPP was close to 12 and SSCI rose more up to 3471. Exit under this condition was perfect investment.

Case IV is not a complete investment period but an ongoing process. However, something interesting can be discussed. After a small scale rebound in Case III, SSCI fluctuated and there was no good sign of proper investment until 19 July 2011 when PPP fell to 4.94 and SSCI was 2797. Standard PPP model indicated it is high time to invest in stock market. However, the following market trend is difficult to understand. Because of the investors' low investment mood, SSCI continued to fall with PPP also falling to 3.99 on 23 October 2011 and to 2.97 on 23 July 2012. Such extremely PPP are rare in history (lowest at 2.45 on 3 December 2012), providing safe and lucrative investment chances. Current PPP is still on a very low level. Whether the stock index will strongly rebound is to be tested in future observation.

The four cases of investment periods are summarized in Table 4-9. In a nutshell, PPP is a perfect investment tool in the early years of China's stock market. It predicted market lows and highs precisely in Case I. However, things are different in 21st century.

Table 4-9: Case Study of PPP in China's Stock Market

	Observation	**PPP**	**SSCI**	**Comments**
Case I	19940704	4.71	439	Perfect investment with PPP
	19940906	10.37	1005	
Case II	20050601	4.86	1039	PPP can generate high return, but not highest. Criteria should be renewed for bull market.
	20061225	10.16	2436	
	20071016	13.5	6092	
Case III	20081030	4.99	1764	Similar performance with Case II. Lessons from Case II are useful.
	20090618	10.1	2854	
	20090804	11.85	3471	
Case IV	20110719	4.94	2797	PPP keeps falling with SSCI because of investors' fear. The current low PPP is a good investment chance.
	20111023	3.99	2317	
	20120723	2.97	2141	

Notes: This table reviews four periods in China's stock market. On each selected observation date, the data of SSCI and its PPP value are collected. The objective is to examine whether PPP is a good ex ante indicator for the movement of market index.

In the first decade of 21st century, PPP still precisely predicted the market lows, but the effectiveness of PPP model was in question for high PPP. High PPP means long period to recover the premium and indicates low investment value so the decision is to exit from market. But the graph shows that the index continues to rise before dropping as the model suggests. PPP model can capture the overall trend of the market but fail to precisely determine market peak. This is not the fault of the model, but that of

irrational investors. The model indicates the sell timing, but irrational investors continue to buy in a crazy manner, thus postponing the falling of the market. One of the suggested adjustments to PPP model is to revise its critical value for the bull market.

During the second decade of 21st century, PPP shows that its ability in predicting market lows has been weakened. Even when PPP is rather low, the stock index continues to fall, which can be explained as a result of disappointed investors. Other macro factors such as inflation, interest rate may also count. Rationally, it is good investment chance to enter the stock market at the current conditions.

Two major issues remain to be carefully solved. The first concern is the selection of critical values. Should the critical value for entire market be identical to that for individual stocks? It is normally believed that individual can be undervalued or overvalued to a greater extent than the overall stock market. Should the critical value for different market conditions be the same? If the critical value for the overall market is too strict, available investment opportunities will be very few so that PPP model is meaningless. The other issue refers to the fact that PPP model can only help in forecasting the moving trend of the stock market and it is not very precise in predicting market peak and valley. This is not the fault of the model, but the irrational investors who push the overvalued market to a new high. The problem can be partly solved with revised critical value in different market scenarios.

4.4.4 An Empirical Test on Market Timing Ability of PPP Model

Section 4.4.3 provided the theoretical foundation and practical implication of PPP model in investment timing. The empirical significance of PPP timing method remains to be examined.

4.4.4.1 Market Timing measured by Stock Position

Market timing refers to the purchase and sell of stocks at specific time point. The behaviour of timing is rather difficult to quantify. One of the few attempts is to measure investment timing by stock position, which refers to the percentage of stock assets in the total investment assets. A higher stock position indicates that the investor allocates more assets on the riskier asset of stocks than other less risky assets such as current deposit. Assume that the stock assets are highly related to the overall stock market, the stock position adjusts the correlation between the investment and the overall stock market. If the stock market index is rising, it is wise to increase stock position to share the welfare of the bull market. If the stock market index is falling, it is wise to downsize stock position to avoid potential loss. The timely modification of stock position contingent on stock market index demonstrates the timing ability of the investor. An ideal scenario is that the stock position is 0 when stock index drops and 1 when stock index increases so that the investment take full advantage of stock market growth and avoids all possible losses. A perfect scenario, where short selling is permitted, is that the stock position is -100% when stock index drops so as to take advantage even in bear market.

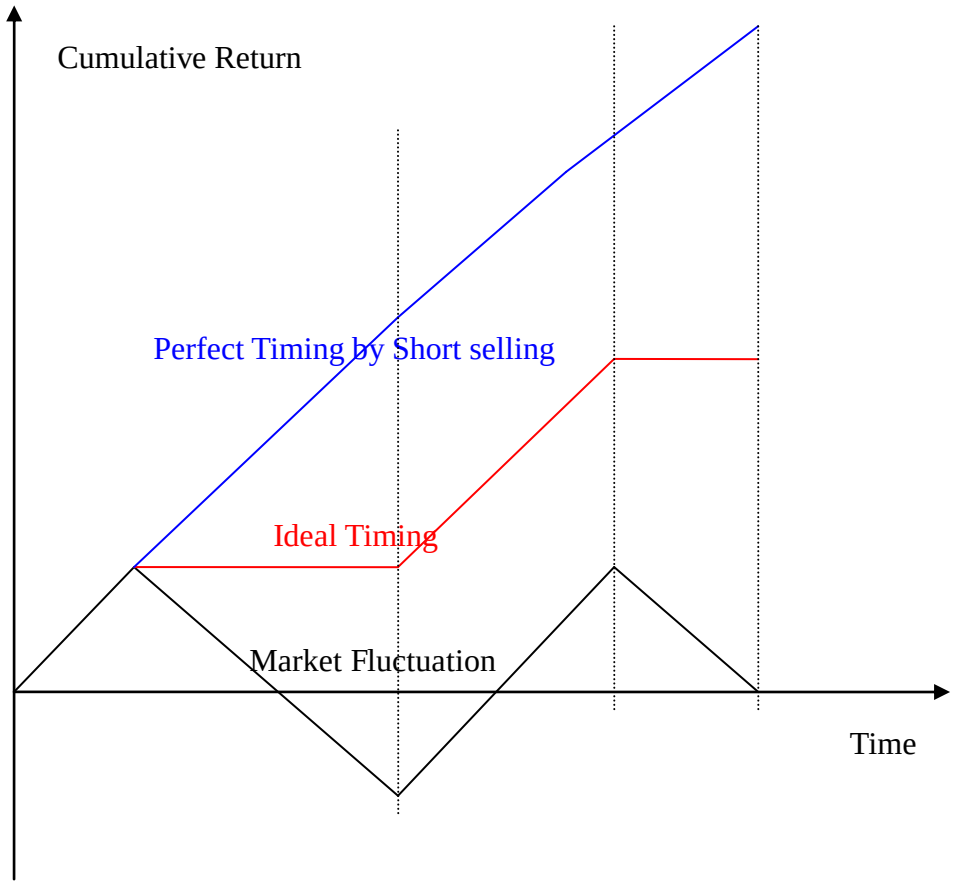

Figure 4-4: Market Timing and Cumulative Return

Notes: This figure depicts the different investment strategies. The horizontal axis is the time line and the vertical axis is the accumulative return of investment across time. The black curve is the normal market fluctuation. If an investor can forecast precisely the downturn of market and adjust the asset allocation on stocks and cash to avoid the negative influence of the market so that investment return rise with the market but not fall with the market as shown in the red line of ideal timing. The blue line shows the case that short selling is allowed so that investors can also obtain profit when market is going down.

4.4.4.2 The Implication of PPP in Determining Stock Position and Timing

The power of PPP in stock selection has been soundly demonstrated in previous projects therefore this section exclusively focuses on PPP's timing ability. Assume a portfolio is constructed with n stocks and the components and structure remains

unchanged during the investment. The only independent variable for excess return is the stock position, denoted as ω_t .

The return rate of a portfolio which consists of n stocks can be expressed as:

$$R_{p,t} = \frac{1}{n}\sum_{i=1}^{n} R_{i,t} = \frac{1}{n}\sum_{i=1}^{n} (\ln P_{i,t} - \ln P_{i,t-1}) \tag{4-12}$$

where $R_{p,t}$ is the weekly return rate of the portfolio *p* at time *t*,

$R_{i,t}$ is the weekly return rate of the stock *i* at time *t*,

$P_{i,t}$ is the price of the stock *i* at time *t*.

Suppose the position on the stock portfolio at time *t* is ω_t , e.g. the investor allocates ω_t of investment assets on the stock portfolio and (1-ω_t) of investment assets on risk free assets (current deposit) which yields at $R_{f,t}$. Therefore, the overall return on the investment expressed as $R_{K,t}$ is a weighted average return of stock investment and current deposit.

$$R_{K,t} = \omega_t R_{p,t} + (1-\omega_t) R_{f,t} \tag{4-13}$$

The risk premium return of the investment relative to risk free rate is written as:

$$AR_{K,t} = R_{K,t} - R_{f,t} = \omega_t (R_{p,t} - R_{f,t}) \tag{4-14}$$

The risk premium return of the investment is dependent on $R_{p,t}$, the return of the stock portfolio (stock selection) and ω_t the position on stock portfolio (market timing). The main focus of discussion for this chapter is how to achieve better market timing. ω_t is the primary independent variable. The empirical test is to demonstrate how ω_t can enhance market timing ability for a given set of stock portfolio.

Different investment managers may have different methods to modify ω_t in accordance to specific environment or conditions. In the PPP framework, the value of stock position ω_t is determined by the following rule:

Rule 1: the stock position is adapted only either when PPP falls below 5 or when PPP jumps over 9.5, i.e. 5 and 9.5 are the trigger points of PPP;

Rule 2: when PPP is below 5, stock position ω_t is set to be 100%;

Rule 3: when PPP is above 9.5, stock position ω_t is set to be 20%;

Rule 4: when PPP is between 5 and 9.5, stock position ω_t remains unchanged.

This thesis adopts the same PPP thresholds for individual stocks as well as the overall market. The logic is simply that investors have the preference for investment gains and investment risks. No matter what sector for investment, the investor gauges the safety of his investment by means of premium payback period and compares it with the PPP in real economy. The ratio between the two provides investment recommendation. The P value is defined as the ratio of PPP in fictitious economy over in real economy as follows:

$$P = \frac{PPP\ in\ Fictitious\ Economy}{PPP\ in\ Real\ Economy} \tag{4-15}$$

The PPP in fictitious economy is calculated by my model and can refer to either individual stocks or the entire market. The PPP in the real economy is obtained from market observation. When P<1, it means the investment in fictitious economy is more favorable than real economy and capital will rush into the stock market so that the

undervalued stock price will rise. Contrary, when P>1, investment in real economy is more attractive so that capital will flow out of stock market. This is the comparison between fictitious economy and real economy, and there is no difference between individual stocks and the stock market.

The rule can be written mathematically as:

$$\text{for } t \geq 1: \ \omega_t = \begin{cases} 100\%, & PPP_t \leq 5 \\ \omega_{t-1}, & 5 < PPP_t \leq 9.5 \\ 20\%, & PPP_t > 9.5 \end{cases} \tag{4-16}$$

$$\text{for } t = 0: \ \omega_0 = \begin{cases} 100\%, & PPP_0 \leq 5 \\ 20\%, & PPP_0 > 9.5 \end{cases} \tag{4-17}$$

if $5 < PPP_0 \leq 9.5$, find the most recent PPP which is out of this range.

where PPP refers to the premium payback period of the Shanghai Security Composite Index, based on the following computation:

$$PPP = \frac{\log(P/B)}{\log(1+ROE)} \tag{4-18}$$

4.4.4.3 An Empirical Test on Market Timing Ability of PPP Model

The stock selection power of PPP model has already demonstrated in Chapters 2 and 3. It is natural to further investigate how the return of portfolio constructed with PPP principle can be improved with PPP timing intervention. An empirical test of PPP model in market timing is required in terms of the same time period and with the same HM and TM model.

The period under investigation is identical to that in the examination of the ten funds. The start date is chosen at 5 February 2010, when the PPP index for all the listed stocks is calculated. Only those stocks with PPP lower than five years can be selected totaled in 64 stocks. These 64 stocks construct a stock portfolio *p*.

The weighted average return of stock investment and current deposit $R_{K,t}$ is calculated as of in formula (4-13). The decomposition of $R_{K,t}$ is obtained in both TM and HM models as follows.

TM Model: $R_{K,t} - R_{f,t} = \alpha_K + \beta_K (R_{m,t} - R_{f,t}) + \gamma_K (R_{m,t} - R_{f,t})^2 + \varepsilon_{K,t}$ (4-19)

HM Model: $R_{K,t} - R_{f,t} = \alpha_K + \beta_K (R_{m,t} - R_{f,t}) + \gamma_K (R_{m,t} - R_{f,t}) D_{K,t} + \varepsilon_{K,t}$ (4-20)

Table 4-10: Regression Results of TM and HM models

Model	Variable	Coefficient	Std. Error	t-Statistic	Prob.
TM	γ_K	1.742775**	0.454810	3.831872	0.0002
HM	γ_K	0.287775**	0.106408	2.704449	0.0072

Notes: This table shows the regression result of γ_K which is the indicator for market timing ability.

** indicates significance at 1% level.

Table 4-10 shows that both TM and HM models achieve the same empirical result that γ_K is significantly positive at 1% level. The apparent conclusion is that the investment based on PPP has significantly positive market timing ability.

4.4.4.4 Timing Improvement with PPP Intervention: Based on Sample Funds

The market timing ability of PPP method is to be tested on a benchmark investment to show how the introduction of PPP method contribute to avoid loss in bear market and achieve positive return in bull market, maintaining the composition of stock portfolio unchanged so that the stock selection cannot influence the investment return in the pairwise comparison. Considering that the market timing ability of 10 fund from 5 Jan 2007 to 28 Jan 2013 have been investigated in Section 4.3 and the conclusion is unsatisfactory on the fund managers' market timing ability. A natural hypothesis is that with the introduction of PPP method on the funds, market timing ability may improve to certain extent.

The return of the adjusted funds based on PPP market timing is regressed against the same independent variables in both TM model and HM model. The attention is paid to the change of the market timing coefficient γ in the original and adjusted cases.

Table 4-11: Comparison between Original Fund and Adjusted Investment

Fund Name		Trenyor and Mazuy Model			Henriksson and Merton Model		
		α	β	γ	α	β	γ
000011	Original	0.0026	0.8365	0.2122	0.0029	0.8303	0.0016
	Adjusted	-0.0027	0.3053	0.7065	-0.0027	0.2612	0.0664
110002	Original	0.0004	0.7670	-0.5752	0.0014	0.8272	-0.1181
	Adjusted	-0.0021	0.2408	0.2991	-0.0019	0.2266	0.0165
050004	Original	0.0003	0.9091	-1.6259	0.0045	1.1212	-0.4445
	Adjusted	-0.0021	0.3019	0.1559	-0.0011	0.3194	-0.0571
162703	Original	0.0013	0.9851	0.1739	0.0005	0.9529	0.0726
	Adjusted	-0.0018	0.3183	0.5382	-0.0021	0.2761	0.0736
481001	Original	-0.0107	0.7850	1.6526	-0.0149	0.5724	0.4438
	Adjusted	-0.0044	0.2841	0.8666	-0.0051	0.2085	0.1382
163803	Original	-0.0037	0.6029	-1.2667	0.0006	0.7960	-0.4197

	Adjusted	-0.0028	0.2189	0.1701	-0.0018	0.2340	-0.0517
530001	Original	-0.0055	0.6719	-0.2709	-0.0031	0.7499	-0.1864
	Adjusted	-0.0041	0.1921	0.0516	-0.0025	0.2306	-0.1050
377010	Original	-0.0022	0.8154	0.0779	-0.0010	0.8434	-0.0793
	Adjusted	-0.0032	0.2782	0.5178	-0.0028	0.2563	0.0212
519688	Original	-0.0074	0.7150	0.7844	-0.0101	0.5940	0.2637
	Adjusted	-0.0036	0.2429	0.6033	-0.0041	0.1909	0.0945
217001	Original	-0.0091	0.5673	-0.0933	-0.0071	0.6244	-0.1439
	Adjusted	-0.0042	0.2258	0.4750	-0.0037	0.2074	0.0149

Notes: This table shows the regression results and compares the original and adjusted investment. The "Original" refers to the original fund return and the regression results are from Table 4-4. The "Adjusted" refers to the fund return whose investment position can be adjusted by PPP criteria. The adjusted return is $R_{K,t}$ defined in equation (4-14).

In the original case, 5 "γ"s have positive signs and 5 "γ"s have negative signs in TM model whereas 4 "γ"s have positive signs and 6 "γ"s have negative signs in HM model. Contrarily in the adjusted case, 10 "γ"s have positive signs and 0 "γ"s have negative signs in TM model whereas 7 "γ"s have positive signs and 3 "γ"s have negative signs in HM model. In terms of absolute value, 8 "γ"s increase and 2 "γ"s decrease in the adjusted case than in the original case for both TM model and HM model. It can be comfortably concluded that with the application of PPP based position adjustment, market timing ability is improved for the 10 selected funds.

4.4.4.5 Timing Improvement with PPP Intervention: Based on Individual Stocks

Although timing methods normally refer to the portfolio investment, it is still worthy to test how the model applies to the investment in individual stocks. PPP timing adjustment for an individual stock is similar:

$$R_{K,t} = \omega_t R_{i,t} + (1-\omega_t) R_{f,t} \tag{4-21}$$

where *i* is for an individual stock.

TM Model: $R_{K,t} - R_{f,t} = \alpha_K + \beta_K (R_{m,t} - R_{f,t}) + \gamma_K (R_{m,t} - R_{f,t})^2 + \varepsilon_{K,t}$ (4-22)

HM Model: $R_{K,t} - R_{f,t} = \alpha_K + \beta_K (R_{m,t} - R_{f,t}) + \gamma_K (R_{m,t} - R_{f,t}) D_{K,t} + \varepsilon_{K,t}$ (4-23)

The test for an individual stock, as I understand it, is to test whether in this case "γ"s are significant or not. My response of "PPP timing effect on individual stocks is heavily dependent on the selection of the stock" means the significance of γ is dependent on the selection of stock i. For some stocks, γ is significantly positive, whereas for others not. For a poorly performed stock, it is difficult assure that the stock even after being treated with PPP timing can beat the market in the absence of short selling mechanism. So it is difficult to assure that γ is significant. Nevertheless, I still investigated the current 50 composite stocks of Shanghai Securities 50 Index, 30 of these stocks were traded during the period from 05-01-2007 to 25-01-2013.

(1) Market Timing Ability of Buy-and-Hold strategy

I first examine timing ability of buy-and-hold strategy for 30 individual stocks. This investment strategy is analyzed with TM and HM models, which exhibit poor market timing ability.

Table 4-12: Market Timing Effect of Buy-and-Hold Strategy

Stocks	Trenyor and Mazuy Model			Henriksson and Merton Model		
	α	β	γ	α	β	γ
600000.SH	0.00263	1.1880**	-0.15928	0.001361	1.1899**	0.033593
600010.SH	0.002614	1.0997**	-0.25575	0.005534	1.0978**	-0.10928

600015.SH	0.001323	1.0806**	0.695898	-0.00255	1.0818**	0.163291
600016.SH	0.003108	1.0009**	-0.16209	0.001736	1.0029**	0.036835
600028.SH	0.000292	1.0122**	-0.31144	0.000305	1.0135**	-0.01642
600030.SH	-0.00053	1.5363**	**1.97149***	-0.00156	1.5295**	0.135272
600036.SH	0.001806	1.1207**	-0.15493	-0.00086	1.1239**	0.079647
600050.SH	-0.00242	0.8088**	1.309663	-0.00478	0.8060**	0.145061
600089.SH	0.001819	0.8618**	0.908319	0.00122	0.8587**	0.066379
600104.SH	0.00336	1.2440**	0.23437	0.000996	1.2455**	0.089862
600109.SH	0.003536	1.4664**	1.092359	0.003564	1.4620**	0.055205
600111.SH	0.011149	1.4106**	-0.5994	0.011804	1.4123**	-0.05233
600150.SH	0.002643	1.2264**	-0.19223	0.000165	1.2297**	0.071736
600196.SH	0.00488	0.8538**	-0.21938	0.008159	0.8514**	-0.11921
600256.SH	0.010846	1.1603**	-1.34333	0.011628*	1.1648**	-0.09475
600332.SH	0.004405	0.9581**	-0.20179	0.008555	0.9548**	-0.14701
600372.SH	0.014642	0.7344**	**-4.26207***	0.023554	0.7424**	**-0.5123***
600406.SH	0.009403*	0.6729**	-2.24832	0.01283	0.6784**	-0.22834
600518.SH	0.008308*	0.7495**	-0.45721	0.010248*	0.7494**	-0.08739
600519.SH	0.003645	0.5477**	-0.19152	0.00378	0.5483**	-0.01428
600585.SH	0.001911	1.1835**	0.844265	0.003311	1.1788**	-0.00274
600637.SH	0.007328	0.8753**	-1.15616	0.010067	0.8772**	-0.14956
600690.SH	0.007664*	1.0326**	**-2.2885***	0.010642*	1.0387**	-0.21562
600703.SH	0.010572	0.8478**	1.031612	0.009122	0.8451**	0.100738
600832.SH	0.000386	0.9910**	-0.33327	0.003026	0.9897**	-0.10406
600837.SH	-0.00163	1.4575**	**3.9230****	-0.00488	1.4452**	0.308458
600887.SH	0.008305*	0.7498**	**-3.1391***	0.01366**	0.7569**	**-0.3376****
600048.SH	0.003449	1.3417**	0.651325	-0.00031	1.3428**	0.157195
601006.SH	0.001622	0.8268**	-0.70634	0.001799	0.829433	-0.04211
601398.SH	-0.00078	0.7236**	0.675927	-0.00348	0.723684	0.123469*

Notes: This table shows the regression results in TM and HM models for the buy-and-hold strategy. The regression results show that only 3 stocks show significantly positive timing ability in TM model and only 1 stock does in HM model. In some cases, the passive investment shows significantly negative timing ability.

* indicates significant at 5% level;

** indicates significant at 1% level.

(2) Market Timing Ability of PPP strategy

I also treat the 30 stocks individually and tested them each with both HM and TM

models.

Table 4-13: Market Timing Effect of PPP Strategy

Stocks	Trenyor and Mazuy Model			Henriksson and Merton Model		
	α	β	γ	α	β	γ
600000.SH	0.000808	0.467735**	1.314427*	-0.00188	0.465208**	0.155944**
600010.SH	-0.001133	0.519797**	1.151728	-0.00094	0.515037**	0.05284
600015.SH	-0.001076	0.433906**	1.555167**	-0.00439	0.431052**	0.188981**
600016.SH	0.002155	0.393362**	0.869511*	0.000252	0.391816**	0.107307*
600028.SH	-0.000751	0.387029**	0.689899	-0.00128	0.384822**	0.052865
600030.SH	-0.000881	0.628475**	1.782865**	-0.00319	0.623709**	0.167452**
600036.SH	-0.000292	0.449808**	1.241578**	-0.00312	0.447713**	0.156899**
600050.SH	-0.002409	0.345041**	1.145117*	-0.0037	0.341787**	0.101227*
600089.SH	-0.001504	0.395079**	1.3217*	-0.00301	0.391337**	0.117288
600104.SH	0.001048	0.569699**	1.50409*	-0.00216	0.56694**	0.182789*
600109.SH	-0.000319	0.641602**	1.930423*	-0.00362	0.637242**	0.207674*
600111.SH	0.001927	0.663925**	1.608783	-0.00488	0.659502**	0.147081
600150.SH	-0.001367	0.549192**	1.625095*	-0.00388	0.545258**	0.16614*
600196.SH	0.001172	0.405458*	0.889016	0.001816	0.401288**	0.024464
600256.SH	0.003237	0.50598**	1.382028	0.000279	0.503458**	0.168403*
600332.SH	0.000884	0.46557**	1.0562	0.001077	0.461189**	0.047918
600372.SH	0.002668	0.405239**	0.091936	0.003776	0.403765**	-0.03178
600406.SH	0.000946	0.32577**	0.681243	-0.00041	0.324421**	0.079528
600518.SH	0.002566	0.374203**	0.860987	0.001808	0.371546**	0.06918
600519.SH	0.000121	0.269361**	0.953032	-0.00048	0.266178**	0.068598
600585.SH	-0.000189	0.520087**	1.814377*	-0.00238	0.515079**	0.165214
600637.SH	0.002158	0.484145**	0.839191	2.51E-03	0.480465**	0.031529
600690.SH	0.00123	0.450118**	0.659498	0.000695	0.448037**	0.051485
600703.SH	0.003285	0.451764**	1.306322	0.002004	0.447865**	0.109302
600832.SH	-0.001729	0.466559**	1.364584**	-0.00275	0.462171**	0.103794
600837.SH	-0.002504	0.641239**	2.100098*	-0.00509	0.635499**	0.193106
600887.SH	0.002718	0.370235**	0.638775	0.001899	0.368521**	0.059798
600048.SH	0.001471	0.590157**	1.742877*	-0.00227	0.586989**	0.212787*
601006.SH	-0.001274	0.348289**	0.41323	-0.00175	0.347121**	0.036736
601398.SH	-0.000457	0.267858**	0.82995**	-0.00191	0.26602**	0.09048**

Notes: This table shows the regression results in TM and HM models for PPP strategy. Empirical test shows that after being treated by PPP timing method, the individual stocks show good timing ability. 30 stocks in TM model have a positive γ and 29 stocks in HM model have a positive γ.

* indicates significant at 5% level;

** indicates significant at 1% level.

Table 4-14: Summary of Test for Individual Stocks

	TM Model	HM Model
Number of γ>0	30 (11)	29 (14)
Significant at 10% level	19	16
Significant at 5% level	15 (2)	12 (1)
Significant at 1% level	5 (1)	5 (0)

Notes: This table shows the signs of "γ"s in regression of both TM and HM models. This table also presents the number of positive γs under different significance level.

Table 4-14 shows that the numbers of stocks of significance at 5% level are 15 and 12 respectively in TM and HM models in PPP method, in comparison to 2 and 1 in buy-and-hold method. I still emphasize that the good empirical result is not only the good power of PPP model but also the "luck" that the individual stocks selected are highly correlated to the market. Generally speaking, a portfolio has better chance to be correlated to market than an individual does.

In order to show to what extent PPP timing method improves the performance of individual stocks, the concept of cumulative return is adopted because it is the prime concern for investors. The cumulative return measures the aggregate amount that an investment has gained or lost over time. The observation period is identical as in the above test, i.e. from 05-01-2007 to 25-01-2013. The individual stocks under investigation are the 10 selected components for the portfolio.

The cumulative return for the individual stock *i* is

$$CR_{i,T} = \prod_{t=1}^{T}(1+R_{i,t}) \tag{4-24}$$

where $R_{i,t} = \ln P_{i,t} - \ln P_{i,t-1}$ indicates the return of stock *i* at time *t*.

I have computed both Buy and Hold Cumulative Return and PPP Timing Cumulative Return for the ten stocks respectively for the period. The results in Table 4-15 demonstrate the latter's overwhelming advantage over the former. Nine of the ten selected stocks exhibit better cumulative returns after being applied with PPP timing method in investment position. It is evident that PPP timing can also help improve performance of individual stocks.

Table 4-15: Cumulative Returns of Buy and Hold vs PPP Timing

Stocks	**Buy and Hold**	**PPP Timing**	**Improvement**
PFYH	0.8585	1.9684	129.28%
HXYH	0.9566	1.2561	31.31%
ZXZQ	0.7278	1.3578	86.56%
ZSYH	0.7794	1.3976	79.32%
SQJT	1.2084	2.0777	71.94%
GJZQ	1.1505	1.5113	31.36%
ZGCB	0.6621	1.0540	59.19%
HLSN	1.0214	1.6158	58.19%
HTZQ	0.8221	0.7417	-9.78%
BLDC	1.1830	2.5400	114.71%
Portfolio	1.3592	1.6389	20.58%

Note: This table compares the cumulative returns for the ten stocks using buy-and-hold strategy and PPP timing strategy. Suppose the initial stock price is 1, then the cumulative return represents the final price. Improvement refers to the change in cumulative return with position adjustment according to PPP.

The value of improvement is equal to cumulative return by PPP Timing divided by cumulative return with Buy and Hold strategy minus 1.

4.5 Conclusion

For an equity investor, the two most important issues for investment decision are what to invest and when to invest. Therefore the abilities of stock selectivity and market timing are the core competency for an investor, in some cases fund managers. Both these factors, if managed properly, can positively contribute to the excess return of the portfolio. Due to the fact that the behaviour and performance of common individual investors is hard to observe and collect, most of the researches focus on funds which are managed by expert investors. Many models have been established to assess fund performance in terms of stock selectivity and market timing and the most widely used models include Treynor and Mazuy (1966) and Henriksson and Merton (1981). Most of empirical studies show that fund managers show positive but insignificant stock selectivity but little market timing ability. The same empirical finds are reached with data from China's fund market.

This chapter follows the mature methodology of TM model and HM model to examine whether stock selectivity and market timing abilities of China's fund managers have improved since 2007. This study selects in total 10 open-end equity investment funds, each from 10 biggest fund companies in China. I choose the weekly data from January 2007 to January 2013. The empirical result for the total period is that even China's top fund managers do not show convincingly good stock selectivity

and market timing ability. This study also investigates the sub-sample periods of bull market, bear market and market correction periods within the total sample. In bull market, fund managers show good market timing ability, because in bull market, any time is a good investment opportunity. In bear market, the selected funds show negative stock selectivity ability but no market timing ability. It is interesting that under such conditions, choosing undervalued stocks is particularly important, but fund performance is disappointing. In the period of market correction, negative market timing ability is observed, because during this period, few fund managers can predict précised the future market trend. The overall findings are disappointing that fund managers cannot capture good market timing; however, it is very encouraging for my research to provide a new method to improve market timing ability.

On the basis of Premium Payback Period model for individual stocks, this chapter adjusts the PPP model for the entire market. Low PPP means the overall stock market is undervalued and it is good time to invest and increase stock market position in the portfolio. When PPP is too high, the overall stock market is overvalued and decreasing stock market position is safe. Therefore another important factor besides calculation is the determination of critical value. According to my logical reasoning and practice, invest when PPP is shorter than 5 and di-invest when PPP is over 10. According to this rule of thumb, this chapter reviews the four cases in China's stock market history when PPP falls below 5. In the early years of China's stock market, the PPP practice is perfect to predict both the bottom and top of the stock market. In later years, although PPP in general can predict the major trend of stock market, it may

miss good investment opportunities in some extreme cases when other investors become irrational and push the stock market far from its fundamental value. Despite the imperfection, PPP model is still believed to be a powerful tool for market timing as well as for stock selectivity demonstrated in Chapter 2. One of the possible improvements is to establish a set of critical values for different market conditions based on market history and study of investor behaviour. In order to show the market timing ability of PPP, the stock selection factor is controlled and the stock position of the fund is adjusted contingent on the PPP value of the entire stock market. Empirical results show that the intervention of PPP timing method improves timing ability for both funds and individual stocks.

Chapter 5 Conclusions, Implications and Limitations

5.1 Conclusions

This thesis introduces for the first time the model of premium payback period which can be used as an effective investment strategy in terms of stock selection as well as market timing. Chapter 2 proposes the concept of PPP, derives the mathematical model and underlines its economic interpretation. Chapter 3 attempts to demonstrate the power of PPP model in selecting undervalued stocks, while Chapter 4 endeavors to extend the application of PPP model to market timing. This research provides strong evidence that the well grounded PPP model performs as an effective investment strategy by selecting undervalued stocks and entering or exiting the stock market at appropriate timing.

In Chapter 2, I demonstrate how PPP model is constructed, explaining the mathematical and economic indication behind it. First, I review the stock valuation models including discount cash flow models, residual income models, relative valuation rations and PB-ROE model. The valuation model which is solely dependent on future cash flow is theoretically correct but practically flawed. A proper valuation model should incorporate the factors of future cash flow and current accounting information. Therefore I propose the PPP model using this logic and the result coincides with the PB-ROE model in the form of equation. PB is price to book value, which includes the current accounting value of the stock. ROE is return on equity,

which projects future earning ability. It is argued that stocks with low PB and high ROE are good investment targets. However, in investment practice, ROE is often negatively related to PB. PPP model, which includes PB and ROE in one framework, is a good tool to balance the two factors. Literally, PPP means the time required to earn back the premium paid for a stock, therefore, stocks with lower PPP is preferable to those with higher PPP in terms of safety margin. In the real economy, a company's PPP can be observed from the date of establishment to IPO, which can be engaged to determine the critical value for PPP in the stock market. Like Tobin's Q theory, PPP can also serve as a bridge between fictitious economy and real economy. Investors can decide where to invest their money and their object is to minimize payback period for safety purposes. A rational investor can judge between the PPPs in these two economies and finally decide his investment. Based on the observations in real economy, stocks with PPP < 5 years are undervalued and worth buying; stocks with PPP > 9.5 years are overvalued and should be sold. The threshold PPP is obtained from observations of hundreds of samples in real economy. According to the pilot study, PPP model selects 60 stocks with PPP<5 out of Shanghai Shenzhen Composite Index 300 and empirical test shows that 11 of the 60 stocks can produce excess return and the averaged-weighted portfolio of the 60 stocks can also generate excess return.

Chapter 3 extends Chapter 2 in the application of Premium Payback Period model in stock investment activities with implications for identifying undervalued stocks in an effort to achieve excess return. The major empirical work in this chapter combines the two factors of a stock, i.e. market capitalization (size) and PPP, as guidance for

selection. Size effect refers to the fact that firms with smaller capitalization are more likely to get higher returns than firms with larger capitalization. PPP effect refers to the fact that firms with lower PPP are more likely to get higher returns than those with higher PPP. When a stock falls into the category of small capitalization and with low PPP, it is a good investment opportunity. In this chapter, size effect and PPP effect are employed to explain the excess returns over what is implied in CAPM. This chapter investigates the size effect and PPP effect under two market conditions. The bear market sample is from 5 December 2011 to 3 December 2012, and the bull market sample is from 5 November 2008 to 3 November 2009 for the composite stocks in the Shanghai Shenzhen Composite 300 Index. An inverse relationship between PPP and log (size) is also discovered. Two scenarios of size-PPP combinations (i.e. 3x2 and 3x3) are respectively investigated. In bear market, PPP effect is more dominant than size effect in that portfolios with different PPPs show contrast return results but the returns across different size categories show no significant difference. However, in bull market, size effect is dominant than PPP effect in that portfolios with different sizes show contrast return results but the returns across different PPP categories show no significant difference. The application of PPP model to select stocks performs better in bear market than in bull market. For investment recommendations, PPP criterion is the priority in the bear market and size criterion is the priority in the bull market. A zero investment portfolio which longs stocks with small capitalization and low PPP and sells short stocks with large capitalization and high PPP is recommended.

Chapter 4 endeavors to extend the application of PPP model to market timing. What to invest and when to invest are equally important for investment decisions and these two abilities of stock selectivity and market timing are the core competency for an investor. Due to the fact that the behaviour and performance of common individual investors is hard to observe and collect, most of the researches focus on funds which are managed by expert investors. Both Treynor and Mazuy model and Henriksson and Merton model confirm show positive (but insignificant) stock selectivity but little (even negative in certain cases) market timing ability for China's 10 renowned open-end equity investment funds from 2007 to 2013 using weekly data. In bull market, fund managers show good market timing ability, only because in bull market, any time is a good investment opportunity. In bear market, fund managers show negative stock selectivity ability but no market timing ability. In the period of market correction, negative market timing ability is observed, because during this period, few fund managers can predict precisely the future market trend. PPP model is employed to improve market timing. Premium Payback Period Model, which is developed for valuation of individual stocks, is adjusted for the overall market to assess whether the overall stock market is overvalued or undervalued. In order to show the market timing ability of PPP, the stock selection factor is controlled and the stock position of the fund is adjusted contingent on the PPP value of the entire stock market. Empirical results show that the intervention of PPP timing method improves timing ability for both funds and individual stocks.

This research thus provides strong evidence that the PPP model performs as a good

investment strategy by selecting undervalued stocks and entering or exiting the stock market at appropriate timing.

5.2 Implications

A simple and effective investment strategy has always been the pursuit of both academicians and practitioners. Investors will be more confident and comfortable if such an investment strategy has a solid theoretical foundation. The PPP model inherits the advantages of the existent models. PPP takes into consideration the current book value of the stock and it also looks ahead to account for the company's value creation in terms of ROE. More importantly it is very easy for application. And the simplicity of PPP model does not undermine its economic intuition. Another superiority of PPP model is that it is a good market timing tool as well as a stock selection mechanism.

First of all, stocks with lower PPP is preferable to those with higher PPP, because the former require less time to reclaim the initial investment, indicating wider margin of safety. A portfolio which buys low PPP stocks and short sells high PPP stocks are likely to achieve satisfactory result.

Secondly, except the above relative comparison among stocks, there are also benchmarks for PPP value which are derived from observation in real economy. Stocks with PPP lower than 5 years are undervalued and those with PPP higher than 9.5 years are overvalued. Buying undervalued stocks and selling overvalued stocks are recommended.

Thirdly, PPP is not only applicable to individual stocks but also to the overall stock market. The PPP index for stock markets can be compared across countries to see which market is better worth investing. The PPP index for one stock market can also be plotted through time to see when the stock market is undervalued or overvalued. The valuation of a stock market is a signal for entry or exit, in other words, a signal to allocate assets between stock asset and risk free asset. Again, as rule of thumb, when the PPP index of stock market is below 5 years, it is recommended to increase the position of stock assets. When the PPP index of stock market is over 9.5 years, it is recommended to reduce the position of stock assets.

Finally, the power of PPP model in either stock selection or market timing seems to perform better in bear market conditions than in bull market conditions. Therefore, the combination of PPP model and other methods is conducive for a better investment return.

5.3 Limitations

Despite the excellent performance of PPP model in the fields of stock selection and market timing, there are a few limitations in this model which should be addressed in future studies.

First of all, one of the major assumptions is that PPP is only applicable to stocks or companies which have stable ROE. PPP takes into account current accounting information and future earning ability, where the latter is exhibited in future ROE.

However, the model itself cannot predict future ROE and it only uses past ROE as a proxy for the future. For specific companies or industries, ROE is not stable. If future ROE is not stable, the analysis of PPP model is not reliable. For instance, a growth company in IT sector may have bright future and any innovation will increase ROE significantly. Even though the current PPP is too high to be safe, such a company is still a good investment target. An opposite example is a mining company with good operation in the past but poor remaining resources. Low PPP value for such a company does not interpret a good investment.

Secondly, PPP model is a method with rigorous economic logic and does not take into account investors' behaviour or psychology. Like other value investment strategies, PPP model sticks to the philosophy that the deviation of stock price from its intrinsic value will be corrected. However, different investors have different opinions on when this correction takes place and how far deviation is sufficient to trigger reverting. Although PPP model can predict the general movement trend of a stock price or market index, it is definitely incapable in forecasting the precise peak and bottom of the price. In extreme bull or bear market, investors become irrational and unpredictable. In this thesis, it has already been noticed that PPP model performs poorer in bull market than in bear market. In bull market, investors tend to become crazy and push the overvalued market to a new high.

Thirdly, the benchmark for PPP is a crucial element for the successful performance of PPP model in stock investment. In this study, the benchmark values are derived from

observations in the real economy. However, the real economy does not present a unified benchmark, because different samples have different PPP values. This study only takes a rule of thumb according to my own investment experience. The benchmark setting of 5 years or 9.5 years is somehow arbitrage. PPP benchmark may be variable to many factors. The conditions in real economy can influence the benchmark, so that the benchmark in 9.5 years later cannot be the same with that in 9.5 years ago. Should the critical value for entire stock market be identical to that for individual stocks? It is normally believed that individual can be undervalued or overvalued to a greater extent than the overall stock market, so that the same rigorous criterion for the stock market index may leave out investment opportunities.

It is natural that a new model may have several limitations and it is unlikely that one researcher can solve all the problems. Therefore, future researches can develop PPP model in various directions. One of the most possible and fruitful directions is to include the investor behaviour into the analytical framework of PPP model. Investors' potential behaviour can be mapped to different levels of PPP benchmarks. For example, investors may have higher tolerance of PPP value in bull market so that investors can still hold at PPP > 9.5 and achieve better returns.

This study is merely a small step forward to provide investors a new perspective on the stock investment and hopefully can inspire academicians or practitioners compelling for continued research in this field

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